04-264074
Information Handout

Table of Contents

1. CA Department of Fish and Game 1602 Agreement
2. US Army Corp 404 Permit
3. San Francisco Bay RWQCB 401 Permit
4. USFWS Biological Opinion (BO)
5. Structures Foundation Report
6. Geotechnical Design and Materials Report
7. Geotechnical Investigation Report – North Marin Water District Aqueduct Relocation
8. Hydraulics Report
9. Storm Water Information Handout
10. "Asbestos and Lead-Containing Paint Survey Report, Redwood Landfill Overcrossing (Bridge 27-0115, Marin County, California." – December 2009
11. "Preliminary Site Investigation Report, US 101 Marin-Sonoma Narrows Segment B1 – Southerly Interchange, Marin County, California." - January 2010
12. "Supplemental Private Property Investigation Report, US-101 Marin-Sonoma Narrows Segment B1 Project, Marin County, California." – February 2011

1. CA Department of Fish and Game 1602 Agreement

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5520
www.dfg.ca.gov

EDMUND G. BROWN JR., *Governor*
CHARLTON H. BONHAM, *Director*

April 25, 2012

Betcy Joseph
California Department of Transportation
111 Grand Avenue
Oakland, CA 94623

Subject: Final Lake or Streambed Alteration Agreement
Notification No. 1600-2011-0363-R3
Marin-Sonoma Narrows, Segment B1

Dear Ms. Joseph:

Enclosed is the final Streambed Alteration Agreement ("Agreement") for the Marin-Sonoma Narrows, Segment B1 ("Project"). Before the Department may issue an Agreement, it must comply with the California Environmental Quality Act ("CEQA"). In this case, the Department, acting as a responsible agency, filed a notice of determination ("NOD") on April 25, 2012, based on information contained in the Marin-Sonoma Narrows HOV Widening Project, Final Environmental Impact Report/Statement the lead agency prepared for the Project.

Under CEQA, filing a NOD starts a 30-day period within which a party may challenge the filing agency's approval of the project. You may begin your project before the 30-day period expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this matter, please contact Timothy S. Dodson, Environmental Scientist, at (707) 944-5513 or tdodson@dfg.ca.gov.

Sincerely,

CJ Weightman

Craig J. Weightman
Acting Environmental Program Manager
Bay Delta Region

cc: W. Stuart Kirkham
Lieutenant Jones
Warden Thiem
Warden Swaney
Timothy S. Dodson

CALIFORNIA DEPARTMENT OF FISH AND GAME
BAY DELTA REGION
7329 SILVERADO TRAIL
NAPA, CALIFORNIA 94558
(707) 944-5520
www.DFG.CA.GOV

STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2011-0363-R3

CALIFORNIA DEPARTMENT OF TRANSPORTATION
MARIN-SONOMA NARROWS, SEGMENT B1

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Game (DFG) and the California Department of Transportation (Permittee) as represented by Betcy Joseph.

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified DFG on October 7 2011, that Permittee intends to complete the project described herein.

WHEREAS, pursuant to FGC section 1603, DFG has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement

PROJECT LOCATION

This Agreement covers Segment B1 of the larger Marin-Sonoma Narrows high occupancy vehicle lane project along Highway 101. The southern end of Segment B1 is located approximately one mile north of the North Novato Overhead (latitude 38°08'05"N, longitude -122°33'50"W) and the northern end of Segment B1 is located near San Antonio Road (latitude 38°10'39"N, longitude -122°35'48"W). Segment B1 covers approximately four miles of Highway 101. The project will impact seven DFG jurisdictional locations:

38°8'51"N, -122°33'58"W; 38°9'0"N, -122°34'2"W; 38°9'13"N, 122°34'6"W; 38°9'24"N, 122°34'10"W; 38°9'25"N, 122°34'6"W; 38°9'46"N, 122°34'37"W; and 38°10'19"N, 122°35'19"W. See Exhibit A for a project location map.

PROJECT DESCRIPTION

The Marin-Sonoma Narrows high occupancy vehicle Segment B1 project will relocate, improve, and create new infrastructure in preparation for the high occupancy vehicle roadway widening project. In doing so, the DFG jurisdictional locations 1 through 7 as shown on Exhibit A will be impacted by the proposed project. The project will install new culverts within drainage channels and riparian vegetation will be removed. Headwalls and rock armoring will be constructed and installed at the ends of the new culverts. New concrete line ditches will be installed at location #6. The project will also install a new bike path that will cross locations #3 and #4, frontage roads will cross locations #1, #2, #5, #6, and #7, and underground utility relocation activities will also impact location #7.

Approximately 54 feet of new culvert will be installed within DFG jurisdictional location #1 on the west side of Highway 101. A new rectangular culvert that will be four feet wide and two feet tall will be installed.

Approximately six feet of DFG jurisdictional location #2 will be temporarily impacted during grading activities. The staging area width for the bike path crosses into this jurisdictional location. Impacts to the channel banks will occur. Impacts to this feature will be repaired after construction.

Approximately 31 feet of new culvert will be installed within Olompali Creek at DFG jurisdictional location #3, on the west side of Highway 101. Two new rectangular culverts that will be seven feet wide and four feet tall will be installed side-by-side within the creek channel.

DFG jurisdictional location #4 and #5 are located on the same drainage channel. Impacts will occur on both the east and west side of Highway 101. Location #4 will be impacted by installation of approximately 25 feet of new culvert and location #5 will be impacted by the installation of approximately 128 feet of new culvert. Two new rectangular culverts that are eight feet wide and four feet tall will be installed side-by-side within the channel on the west side of highway (location #4). Two new rectangular culverts that are eight feet wide and four feet tall will be installed side-by-side within the channel on the east side of highway (location #5).

Approximately 43 feet of DFG jurisdictional location #6 will be impacted. Two new parallel concrete lined ditches (CLD) will be installed to intercept overland flows. The CLDs will be approximately 27 feet apart. The CLD located higher on the slope will be one foot deep, have 2:1 side slopes, and will be four feet wide across the top. The CLD

located lower on the slope will be one half of a foot deep, have 1:1 side slopes, and will be one foot wide across the top.

Approximately 173 feet of new culvert will be installed within DFG jurisdictional location #7. Two new rectangular culverts that are seven feet wide and four feet tall will be installed side-by-side within the channel on the west side of Highway 101. This culvert configuration will be about 69 feet long, then connect to junction structure which will convey the water in a different direction through a new ten foot wide by five-foot tall culvert that is about 111 feet long, and then connect to another junction structure which will convey the water in a different direction through an existing six feet wide by five feet tall culvert.

Riparian vegetation will be removed and temporary creek channel impacts will occur at location #7 as a result of the municipal water line relocation. The water line will be installed to the west of the highway and the new culvert. An open cut trench will be dug across this location and the pipe will be installed about eight feet below the channel bed. The creek bed contours and substrate will be reconfigured and replaced after the pipe is buried.

No other additional temporary or permanent impacts will occur from the relocation of the waterline at DFG jurisdictional locations. The utility company, AT&T, will be relocating their overhead telephone lines and all overhead lines will span jurisdictional creeks and new poles will be installed outside of the riparian corridors.

Table 1 below summarizes the length and area of creek impacts and new culvert dimensions.

Table 1
Summary of Channel Impacts

DFG Jurisdiction Area #	Approximate Impact Length		Approximate Impact Length		New Culvert Installation Length
	Temporary	Permanent	Temporary	Permanent	
	(feet)		(acres)		(feet)
1	18	60	0.0019	0.0079	53.4
2	6	0	0.0003	0	0
3	15	53	0.0081	0.0252	31.4
4	46	57	0.0272	0.0203	25.1
5	41	202	0.0037	0.0187	128.8
6	18	43	0.0158	0.0283	0*
7	55 (176**)	220	0.1082 (.02**)	0.1902	173.3
Total	**375.0**	**635.0**	**0.22**	**0.3**	**412.0**

*concrete lined ditches will be installed, no culvert.
**municipal water line installation

PROJECT IMPACTS

Existing fish or wildlife resources the project could substantially adversely affect include:

- riparian habitat
- wetland impacts
- aquatic vertebrates
- aquatic invertebrates
- nesting birds
- bats
- rare plants
- western pond turtle

The adverse effects the project could have on the fish or wildlife resources identified above include:

- permanent and temporary loss of natural bed and bank
- change in contour of bed, channel and bank
- debris transport impedance
- loss of natural bed substrate
- loss of connection to hyporheic zone
- change in stream flow
- loss of habitat
- water quality degradation
- short-term release of contaminants
- disruption to nesting birds and other wildlife
- direct take of terrestrial species
- disturbance from project activity

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to DFG personnel, or personnel from another state, federal, or local agency upon request.

1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on

the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.

1.3 Notification of Conflicting Provisions. Permittee shall notify DFG if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, DFG shall contact Permittee to resolve any conflict.

1.4 Project Site Entry. Permittee agrees that DFG personnel may enter the project site at any time to verify compliance with the Agreement.

1.5 Conduct Only Specified Activities. Only those activities specifically mentioned in the Project Description may be conducted under this Agreement.

1.6 Notify DFG Prior to Work. The Permittee shall notify DFG by email at least five working days prior to commencement of covered activities at each DFG jurisdictional feature. See contact info below.

1.7 Work According to Plans. Except as they are contradicted by measures required by this agreement, all work shall be conducted in conformance with the project description and measures included in the notification and the project plans dated 10-3-2011.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below.

2.1 Seasonal Work Period. To minimize adverse impacts to fish and wildlife all work within the seven DFG jurisdictional locations, described in the project location and description and identified in Exhibit A, shall be confined to the period of June 15 to October 15. Tree removal may occur outside of this work window if the activities are consistent with conditions 2.10 and 2.11. Revegetation work is not confined to this time period.

If the Permittee needs more time to complete the authorized activity within the seven DFG jurisdictional locations, the work period may be extended by submitting a written request to the DFG 1600 Program. The work period extension request shall: 1) describe the extent of work already completed; 2) detail the activities that remain to be completed; 3) detail the time required to complete each of the

remaining activities; and 4) provide photographs of both the current work completed and the proposed site for continued work. Work period extensions are issued at the discretion of DFG. DFG will review the written request to work outside of the established work period. DFG reserves the right to require additional measures to protect fish and wildlife resources as a condition for granting the extension. DFG will have ten (10) calendar days to review and respond to the proposed work period extensions. Permittee shall not proceed until written approval has been obtained from DFG.

2.2 Work During Dry Weather Only. The work period for completing the work within the stream zone, shall be restricted to periods of no stream flow and dry weather. No work shall occur during wet weather. For this specific project, wet weather is defined as when there has been ¼ inch of rain, or more, in a 24-hour period. All erosion control measures associated with project activities must be in place prior to the onset of precipitation. After any storm event, the Permittee shall inspect all sites currently under construction and all sites scheduled to begin construction within the next 72 hours for erosion and sediment problems and take corrective action as needed. Seventy-two hour weather forecasts from the National Weather Service shall be consulted and work shall not start back up until runoff ceases and there is less than a 30% forecast for precipitation for the following 24-hour period.

2.3 No Equipment in the Live Stream. Equipment shall not be operated in wetted areas (including but not limited to ponded, flowing, or wetland areas) without written approval from DFG.

2.4 Qualified Biologist Approval. At least 30-days prior to commencing project activities covered by this Agreement, the Permittee shall submit to DFG, for review and approval, the qualifications for a number of biologist(s) that shall oversee the implementation of the conditions in this Agreement. Project activities covered by this Agreement may not commence unless DFG has approved the proposed biologist(s). At minimum, the DFG approved biologist(s) shall have a combination of academic training and professional experience in biological sciences and related resource management activities.

2.5 Biological Monitor on Site. The Permittee shall designate a person to monitor on-site compliance with all conditions of this Agreement. The monitor shall have received training in special status species identification. The Biological Monitor shall communicate to the

Resident Engineer when any activity is not in compliance with this Agreement and the Resident Engineer shall immediately stop the activity that is not in compliance with this Agreement.

2.6 Limit Disturbance to Vegetation. Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations.

2.7 Flag Work Sites. The perimeter of the work site shall be adequately flagged to prevent damage to adjacent riparian habitat. No work activities shall occur outside the perimeter.

2.8 Stabilize Disturbed Areas. All exposed/disturbed areas within the project site shall be stabilized to the greatest extent possible. Erosion control measures, such as, silt fences, straw hay bales, gravel or rock lined ditches, water check bars, and broadcasted straw shall be used where ever silt laden water has the potential to leave the work site and enter State waters. Modifications, repairs and improvements to erosion control measures shall be made whenever it is needed. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter a water body.

2.9 Concrete. Concrete shall be excluded from surface water for a period of 30-days after it is poured/sprayed. During that time the concrete shall be kept moist and runoff from the concrete shall not be allowed to enter any water body. Commercial sealants may be applied to the concrete surface where difficulty in excluding flow for a long period may occur. If sealant is used, water shall be excluded from the site until the sealant is cured. If groundwater comes into contact with fresh concrete, it shall be prevented from flowing towards surface water.

2.10 Nesting Bird Surveys. To protect nesting birds, no project activities shall occur from February 15 through August 31 unless nesting bird surveys have been completed by a qualified biologist. To prevent nest abandonment, a qualified biologist shall survey within 500 feet of the proposed Project for nesting birds. If nest are found within the Project site or 500 feet from the Project then the qualified biologist shall establish a 50-foot buffer radius for non-raptors nests and a 300-foot buffer radius for raptors nests. The Qualified Biologist shall monitor the nesting birds and shall increase the buffer if the Qualified Biologist determines the birds are showing signs of unusual or distressed behavior by Project activities. To prevent encroachment, the established buffer(s) shall be clearly marked by high visibility material. The established buffer(s) shall remain in effect until the

young have fledged or the nest has been abandoned as confirmed by the qualified biologist. Surveys shall be conducted during periods of peak activity (early morning, dusk) and shall be of sufficient duration to observe movement patterns.

Identified nests shall be reported to DFG. The buffer area shall be fenced off from work activities and avoided until the young have fledged, as determined by a qualified biologist. Active nests found within the vicinity of the project area shall be monitored by the qualified biologist during all work activities to monitor bird behavior. Permittee shall perform at least two hours of pre-construction monitoring of the nest to characterize "normal" bird behavior. During work, should birds indicate unusual or distressed behavior that could be indicative of future nest abandonment, the biologist shall stop work immediately and consult DFG on how to proceed.

2.11 Bat Surveys. A qualified biologist shall conduct a habitat assessment for potentially suitable bat habitat. If the survey reveals suitable bat habitat and tree removal is scheduled from April 16 through August 31 and/or October 16 through February 28 then presence/absence surveys shall be conducted prior to any tree removal. If presence/absence surveys are negative then trees may be removed following the two phase tree removal system. If presence/absence surveys result in bat occupancy then the occupied trees shall only be removed from March 1 through April 15 and/or August 31 through October 15 following the two phased tree removal system. If trees that are suitable for bat habitat are to be removed from March 1 through April 15 and or August 31 through October 15 then the trees shall be removed following the two phased removal system. The two phased removal system shall be conducted over two consecutive days. The first day (in the afternoon), limbs and branches would be removed by a tree cutter using chainsaws only. Limbs with cavities, crevices or deep bark fissures would be avoided, and only branches or limbs without those features would be removed. On the second day, the entire tree would be removed.

2.12 Wildlife Encounters. If any wildlife is encountered during the course of project activities, said wildlife shall be allowed to leave the area unharmed and on their own volition.

2.13 Special-status plant survey. Prior to the start of the seasonal work period and project activities, the Permittee shall submit to DFG a report of a botanical survey of the project site and work areas where activities will occur during the seasonal work period. Surveys shall

be conducted in accordance with DFG's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf). If any special status plants are detected, the Permittee shall consult with the US Fish and Wildlife Service and DFG to determine additional protection measures to be amended into this Agreement.

2.14 Western Pond Turtle. Preconstruction surveys for the western pond turtle in potential habitat shall be conducted 48 hours prior to construction by a qualified biologist approved to conduct such surveys by DFG. If western pond turtles are found in the project area during preconstruction surveys, DFG shall be notified. If preconstruction surveys identify active western pond turtle nests, a qualified biologist shall establish a no-disturbance buffer zone around the nest using temporary orange construction fencing. The radius of the buffer zone and the duration of the exclusion shall be determined in consultation with DFG. The buffer zone and fencing shall remain in place until the young have left the nest, as determined by a qualified biologist. The qualified biologist shall also remain present during construction in the area to inspect the work area, including construction equipment left on-site, for western pond turtles to ensure that individuals have not moved into the work area.

2.15 Agreement Does Not Authorize Take of Listed Species. The Permittee shall comply with all applicable state and federal laws, including the California and Federal Endangered Species Act. This Agreement does not authorize the take of any state or federally endangered listed species. Liability for any take or incidental take of such species remains the responsibility of the Permittee for the duration of the project. Any unauthorized take of listed species may result in prosecution and nullification of the Agreement.

2.16 Culvert Alignment. The bottom of all new culverts shall be placed with at least 10% of their height below the existing stream grade. The culverts shall be monitored and maintained in good working order year round.

2.17 Stabilize Disturbed Areas. All exposed/disturbed areas within the project site shall be stabilized to the greatest extent possible. Erosion control measures, such as, silt fences, straw hay bales, gravel or rock lined ditches, water check bars, and broadcasted straw shall be used where ever silt laden water has the potential to leave the work site and enter State waters. Modifications, repairs

and improvements to erosion control measures shall be made whenever it is needed. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream. Materials containing monofilament or plastic shall not be used.

2.18 Equipment Storage and Maintenance. Staging and storage areas for equipment, materials, fuels, lubricants and solvents, shall be located outside of the creek channel and banks. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the creek shall be positioned over drip pans. Any equipment or vehicles driven and/or operated within or adjacent to the stream must be checked and maintained daily, to prevent leaks of materials that if introduced to water could be deleterious to aquatic life.

2.19 Equipment and materials within tree drip line. No heavy equipment, vehicular traffic, or storage piles of any construction materials shall be permitted within the drip line of any preserved tree.

2.20 Refueling of equipment. Refueling of construction equipment and vehicles shall not occur within 50 feet of any water body, or anywhere that spilled fuel could drain to a water body. Tarps or similar material shall be placed underneath the construction equipment and vehicles, when refueling, to capture incidental spillage of fuels. Equipment and vehicles operating in the project area shall be checked and maintained daily to prevent leaks of fuels, lubricants, or other liquids.

2.21 Remove Trash and Food Wastes. All trash will be properly stored and removed at the end of each work day. Following construction, all trash and construction debris shall be removed.

2.22 No Pets on Site. No pets shall be permitted in the work area.

3. Compensatory Measures

To compensate for adverse impacts to fish and wildlife resources identified above that cannot be avoided or minimized, Permittee shall implement each measure listed below.

3.1 Riparian Vegetation. According the applicants notification information (dated December 1, 2011) this project will impact 13 riparian trees. For this project, impacts to riparian oak and bay tree species greater than 4-inches in diameter a breast height ("dbh," 4.5

feet above the ground) shall be mitigated on at 5:1 ratio, on a per-tree basis, using at least one gallon container stock. Native riparian trees (other than oaks and bays) shall be mitigated at a ratio of 3:1, on a per-tree basis, using at least one gallon container stock. Non-native trees and all shrubs removed shall be mitigated at a ratio of 1:1, on a per-tree (plant) basis, with native species appropriate for that location. Trees that cannot be planted on site, due to spacing constraints, shall be planted at a DFG approved off-site location.

3.2 Creek Impacts. At least 30-days prior to construction, a creek channel mitigation plan shall be prepared by the Permittee and submitted to DFG for review and approval. The creek channel mitigation plan shall provide in-kind mitigation (culvert removal) at a 2:1 ratio for the Project's permanent impacts to approximately 635 linear feet and 0.3 acres of creek habitat. 1,270 linear feet and 0.6 acres of creek habitat shall be restored through in-kind mitigation. If in-kind mitigation is not feasible, then a mitigation plan shall be prepared that mitigates linear and area creek impacts (635 feet and 0.3 acres) at a minimum of a 3:1 ratio at a DFG approved offsite location. 1,905 linear feet and 0.9 acres of creek habitat shall be restored.

4. Reporting Measures

Permittee shall meet each reporting requirement described below.

4.1 Survey Reports. Reports for the nesting bird survey, bat survey, western pond turtle survey, and rare plant survey shall be provided to DFG at least 30 days prior to commencement of work or by date(s) specified above.

4.2 Vegetation Removal Report. The Permittee shall provide a report that details the species, number, and dbh of trees that were removed during Project activities. This report shall be submitted no later than 30-days after tree removal is conducted. A map shall be included that shows the location where trees will be removed. The map shall also show the location(s) where mitigation trees will be planted on site.

4.3 Vegetation Survival Success. All revegetation and restoration efforts shall be monitored for a 10-year period. Reports shall be prepared and submitted to DFG by December 31st of years 2, 4, 6, 8, and 10 after the first revegetation and or restoration effort. This report shall include an overview of the revegetation effort, the diameters-at-breast-height of planted trees, the condition of planted trees, the

survival and percent cover on the replanted areas, the total area of planted areas replaced, presence of exotic species, and other observations or factors that may bear on the success of the revegetation effort. Photos clearly depicting the replanted areas shall be included. All planting shall have a minimum of 80% survival at the end of 10 years with a minimum of two consecutive years (2 growing seasons) of monitoring after the removal of irrigation. This percentage is based on mitigation rates in condition 3.1. If the survival requirements are not meeting these goals, the Permittee is responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve these requirements throughout the monitoring period. Replacement plants shall be monitored with the same survival and growth requirements after planting.

4.4 Notification to the California Natural Diversity Database (CNDDB). If any listed, rare, or special status species are detected during project surveys or on or around the project site during project activities, the Permittee shall submit CNDDB Field Survey Forms to CNDDB within five working days of the sightings. Information on submitting data to CNDDB can be found at http://www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp. Copies of such submittals shall also be submitted to the DFG regional office as specified below.

CONTACT INFORMATION

Any communication that Permittee or DFG submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or DFG specifies by written notice to the other.

To Permittee:

Betcy Joseph
California Department of Transportation
111 Grand Avenue
Oakland, CA 94623
Phone: 510-286-5097

To DFG:

Department of Fish and Game
Bay Delta Region
7329 Silverado Trail

Napa California 94558
Attn: Lake and Streambed Alteration Program – Timothy S. Dodson
Notification #1600-2011-0363-R3
Phone: (707) 944-5513
Email: tdodson@dfg.ca.gov

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute DFG's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

SUSPENSION AND REVOCATION

DFG may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before DFG suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before DFG suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused DFG to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes DFG from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects DFG's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be

required under other federal, state, or local laws or regulations before beginning the project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 et seq. (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish), and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

DFG may amend the Agreement at any time during its term if DFG determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by DFG and Permittee. To request an amendment, Permittee shall submit to DFG a completed DFG "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter DFG approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to DFG a completed DFG "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to DFG a completed DFG

"Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). DFG shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code, § 1605, subd. (f)). .

EFFECTIVE DATE

The Agreement becomes effective on the date of DFG's signature, which shall be: 1) after Permittee's signature; 2) after DFG complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the applicable FGC section 711.4 filing fee listed at http://www.dfg.ca.gov/habcon/ceqa/ceqa_changes.html.

TERM

This Agreement shall expire on December 31, 2016, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a)(2) requires.

EXHIBITS

The documents listed below are included as exhibits to the Agreement and incorporated herein by reference.

Exhibit A. Project Location Map.

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify DFG in accordance with FGC section 1602.

CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR CALIFORNIA DEPARTMENT OF TRANSPORTATION

Wayahat 4/25/12

for Betcy Joseph — Date

FOR DEPARTMENT OF FISH AND GAME

CJ Weightman 4/25/12

Craig J. Weightman — Date

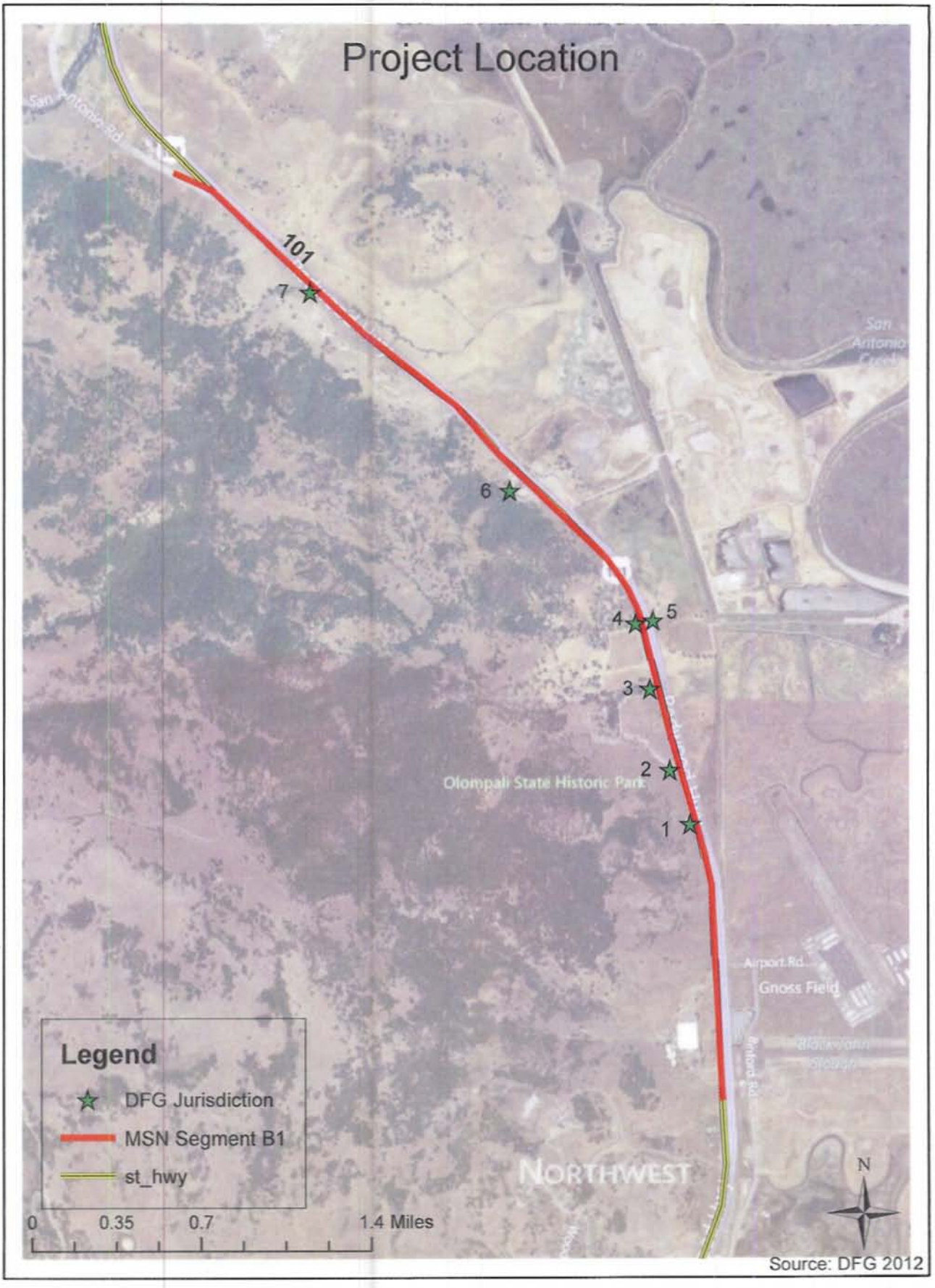
Acting Environmental Program Manager

Prepared by: Timothy S. Dodson
Environmental Scientist

Date sent:	February 16, 2012
Revised Date sent:	March 29, 2012
Date 3rd Revision sent:	April 3, 2012
Date 4th Revision sent:	April 25, 2012

EXHIBIT A

Project Location Map


Project Location
101
7
6
5
4
3
2
1
Olompali State Historic Park
Airport Rd.
Gnoss Field
NORTHWEST
N
Legend
DFG Jurisdiction
MSN Segment B1
st_hwy
0
0.35
0.7
1.4 Miles
Source: DFG 2012

FOR DEPARTMENT USE ONLY				
Date Received	Amount Received	Amount Due	Date Complete	Notification No.
10/7/11	4482.75			600-2011-0363-3

CK# 082-969728
California Dept of Transportation

Edson Swaney

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

Complete EACH field, unless otherwise indicated, following the enclosed instructions and submit ALL required enclosures. Attach additional pages, if necessary.

Fish & Game
OCT 07 2011
Yountville

I. APPLICANT PROPOSING PROJECT

Name	Betcy Joseph		
Business/Agency	California Department of Transportation (Caltrans) District 4		
Street Address	111 Grand Avenue		
City, State, Zip	Oakland, CA 94623		
Telephone	(510) 286-5097	Fax	
Email	betcy_joseph@dot.ca.gov		

II. CONTACT PERSON (*Complete only if different from applicant*)

Name	W. Stuart Kirkham		
Street Address	111 Grand Avenue		
City, State, Zip	Oakland, CA 94623		
Telephone	(510) 286-5602	Fax	(510) 286-6374
Email	stuart_kirkham@dot.ca.gov		

III. PROPERTY OWNER (*Complete only if different from applicant*)

Name			
Street Address			
City, State, Zip			
Telephone		Fax	
Email			

IV. PROJECT NAME AND AGREEMENT TERM

A. Project Name	Marin Sonoma Narrows (MSN) Segment B1
B. Agreement Term Requested	☑ Regular (*5 years or less*) ☐ Long-term (*greater than 5 years*)

C. Project Term		D. Seasonal Work Period		E. Number of Work Days
Beginning (*year*)	Ending (*year*)	Start Date (*month/day*)	End Date (*month/day*)	
2012	2014	06/01	06/30	498.00

5. AGREEMENT TYPE

Check the applicable box If box B, C, D, or E is checked, complete the specified attachment.		
A.	☑ Standard *(Most construction projects, excluding the categories listed below)*	
B.	☐ Gravel/Sand/Rock Extraction (*Attachment A*)	*Mine I.D. Number:* _____
C.	☐ Timber Harvesting (*Attachment B*)	TH *Number:* _____
D.	☐ Water Diversion/Extraction/Impoundment (*Attachment C*)	*SWRCB Number:* _____
E.	☐ Routine Maintenance (*Attachment D*)	
F.	☐ DFG Fisheries Restoration Grant Program (FRGP)	*FRGP Contract Number:* _____
G.	☐ Master	
H	☐ Master Timber Harvesting	

6. FEES

Please see the current fee schedule to determine the appropriate notification fee. Itemize each project's estimated cost and corresponding fee. ***Note: The Department may not process this notification until the correct fee has been received.***

	A. Project	B. Project Cost	C. Project Fee
1	Marin Sonoma Narrows Segment B1	$26,400,000.00	$4,482.75
2			
3			
4			
5			
		D. Base Fee *(if applicable)*	
		E. TOTAL FEE ENCLOSED	$4,482.75

7. PRIOR NOTIFICATION OR ORDER

A. Has a notification previously been submitted to, or a Lake or Streambed Alteration Agreement previously been issued by, the Department for the project described in this notification?

☐ Yes (*Provide the information below*) ☑ No

Applicant: _____ Notification Number: _____ Date: _____

B. Is this notification being submitted in response to an order, notice, or other directive (order) by a court or administrative agency (including the Department)?

☑ No ☐ Yes (*Enclose a copy of the order, notice, or other directive. If the directive is not in writing, identify the person who directed the applicant to submit this notification and the agency he or she represents, and describe the circumstances relating to the order.*)

☐ *Continued on additional page(s)*

3. PROJECT LOCATION

A. Address or description of project location.

(Include a map that marks the location of the project with a reference to the nearest city or town, and provide driving directions from a major road or highway)

The proposed project is located on U.S. 101 between the City of Novato and the City of Petaluma, in Marin County. The proposed project limits are from 1.0 mile north of the North Novato Overhead (an overhead bridge structure that crosses the SMART railroad tracks, north of the Atherton Avenue Interchange) to 0.60 miles south of the Sonoma County line (PM 23.2/27.1), a distance of 3.9 miles.

☐ *Continued on additional page(s)*

B. River, stream, or lake affected by the project.	Olompali Creek and 4 unnamed drainages
C. What water body is the river, stream, or lake tributary to?	Olompali Creek is tributary to San Antonio Creek
D. Is the river or stream segment affected by the project listed in the state or federal Wild and Scenic Rivers Acts?	☐ Yes ☑ No ☐ Unknown
E. County	Marin

F. USGS 7.5 Minute Quad Map Name	G. Township	H. Range	I. Section	J. ¼ Section
Petaluma River	4N	7W		

☐ *Continued on additional page(s)*

K. Meridian (*check one*) ☐ Humboldt ☑ Mt. Diablo ☐ San Bernardino

L. Assessor's Parcel Number(s)

125-180-45, 125-180-77, 125-180-05, 125-160-01, 125-160-20, 125-160-15, 125-160-16, and 125-130-23

☐ *Continued on additional page(s)*

M. Coordinates (*If available, provide at least latitude/longitude or UTM coordinates and check appropriate boxes)*

Latitude/Longitude	*Latitude:* begin: 38-08-05, end:38-10-39	*Longitude:* begin: -122-33-50, end: -122-35-48	
	☑ Degrees/Minutes/Seconds	☐ Decimal Degrees	☐ Decimal Minutes
UTM	*Easting:* see attached	*Northing:* see attached	☐ Zone 0 ☐ Zone 1
Datum used for Latitude/Longitude or UTM	☐ NAD 27	☑ NAD 83 or WGS 84	

9. PROJECT CATEGORY AND WORK TYPE *(Check each box that applies)*

PROJECT CATEGORY	NEW CONSTRUCTION	REPLACE EXISTING STRUCTURE	REPAIR/MAINTAIN EXISTING STRUCTURE
Bank stabilization – bioengineering/recontouring	☐	☐	☐
Bank stabilization – rip-rap/retaining wall/gabion	☐	☐	☐
Boat dock/pier	☐	☐	☐
Boat ramp	☐	☐	☐
Bridge	☐	☐	☐
Channel clearing/vegetation management	☐	☐	☐
Culvert	☑	☐	☐
Debris basin	☐	☐	☐
Dam	☐	☐	☐
Diversion structure – weir or pump intake	☐	☐	☐
Filling of wetland, river, stream, or lake	☑	☐	☐
Geotechnical survey	☐	☐	☐
Habitat enhancement – revegetation/mitigation	☐	☐	☐
Levee	☐	☐	☐
Low water crossing	☐	☐	☐
Road/trail	☑	☐	☐
Sediment removal – pond, stream, or marina	☐	☐	☐
Storm drain outfall structure	☑	☑	☐
Temporary stream crossing	☐	☐	☐
Utility crossing : Horizontal Directional Drilling	☐	☐	☐
Jack/bore	☐	☐	☐
Open trench	☑	☑	☐
Other *(specify)*:	☐	☐	☐

10. PROJECT DESCRIPTION

A. Describe the project in detail. Photographs of the project location and immediate surrounding area should be included.

- Include any structures (e.g., rip-rap, culverts, or channel clearing) that will be placed, built, or completed in or near the stream, river, or lake.
- Specify the type and volume of materials that will be used.
- If water will be diverted or drafted, specify the purpose or use.

Enclose diagrams, drawings, plans, and/or maps that provide all of the following: site specific construction details; the dimensions of each structure and/or extent of each activity in the bed, channel, bank or floodplain; an overview of the entire project area (i.e., "bird's-eye view") showing the location of each structure and/or activity, significant area features, and where the equipment/machinery will enter and exit the project area.

The proposed project is located on U.S. 101 between the City of Novato and the City of Petaluma, in Marin County. The proposed project limits are from 1.0 mile north of the North Novato Overhead (an overhead bridge structure that crosses the SMART railroad tracks, north of the Atherton Avenue Interchange) to 0.60 miles south of the Sonoma County line (PM 23.2/27.1), a distance of 3.9 miles.

The Project will modify the existing Redwood Landfill Interchange from its current hook-ramp and loop-ramp configuration. The project will remove the deceleration lane, acceleration lane, and hook ramp along northbound (NB) US 101 that connect to Redwood Sanitary Landfill Road. Similarly, the project will remove the deceleration lane, acceleration lane, and hook ramp/loop ramp along southbound (SB) US 101 that provides access to the existing Redwood Landfill Overcrossing bridge structure (Bridge No. 27-0115). A portion of the roadway connecting the bridge to Redwood Sanitary Landfill Road will be preserved and reused. The project proposes to modify the existing interchange to a tight diamond (Type L-1) interchange. The existing bridge structure will be widened by approximately 10 feet to the north. The new diagonal on- and off-ramps will connect to the existing highway facility.

☑ *Continued on additional page(s)*

B. Specify the equipment and machinery that will be used to complete the project.

The equipment to be used during construction includes, but is not limited to: cranes, excavators, scrapers, motor graders, concrete pumpers, pavers, compactors, water trucks, dump trucks, rotary drill augers, and tieback anchor driller. "Controlled blasting" has been identified to be used as a possibility with the construction of retaining wall (5).

☐ *Continued on additional page(s)*

C. Will water be present during the proposed work period (specified in box 4.D) in the stream, river, or lake (specified in box 8.B).	☐ Yes ☑ No (*Skip to box 11*)
D. Will the proposed project require work in the wetted portion of the channel?	☐ Yes (*Enclose a plan to divert water around work site*) ☑ No

11. PROJECT IMPACTS

A. Describe impacts to the bed, channel, and bank of the river, stream, or lake, and the associated riparian habitat. Specify the dimensions of the modifications in length (linear feet) and area (sqare feet or acres) and the type and volume of material (cubic yards) that will be moved, displaced, or otherwise disturbed, if applicable.

see attached Supplementary Information document.

☑ *Continued on additional page(s)*

B. Will the project affect any vegetation? ☑ Yes (*Complete the tables below*) ☐ No

Vegetation Type	Temporary Impact	Permanent Impact
Bay-oak woodland	Linear feet: 350 Total area: 0.329 acres	Linear feet: 260 Total area: 0.112 acres
Seasonal wetland	Linear feet: 50 Total area: 0.0001 acres	Linear feet: 235 Total area: 0.0464 acres

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)
see attached Supplementary Information doc.		

☑ *Continued on additional page(s)*

C. Are any special status animal or plant species, or habitat that could support such species, known to be present on or near the project site?

☑ Yes *(List each species and/or describe the habitat below)* ☐ No ☐ Unknown

☑ *Continued on additional page(s)*

D. Identify the source(s) of information that supports a "yes" or "no" answer above in Box 11.C.

United States Fish and Wildlife Service Biological Opinion (File #81420-2008-F-1619-4), issued April 1, 2009.

☐ *Continued on additional page(s)*

E. Has a biological study been completed for the project site?

☐ Yes (*Enclose the biological study*) ☑ No

Note: A biological assessment or study may be required to evaluate potential project impacts on biological resources.

F. Has a hydrological study been completed for the project or project site?

☐ Yes (*Enclose the hydrological study*) ☑ No

Note: A hydrological study or other information on site hydraulics (e.g., flows, channel characteristics, and/or flood recurrence intervals) may be required to evaluate potential project impacts on hydrology.

12. MEASURES TO PROTECT FISH, WILDIFE, AND PLANT RESOURCES

A. Describe the techniqes that will be us ed to prevent sediment from entering watercourses during and after construction.

Erosion control measures will be used to address site soil stabilization and reduce the deposition of sediments into adjacent surface waters. Typical measures include application of soil stabilizers such as hydroseeding, netting, compost blankets, and rock slope protection. During construction, procedures may also be used such as mulch on disturbed areas, fiber rolls along slopes, stabilized construction entrances/exits equipped with tire washing capabilities, and check dams placed strategically to reduce flow velocity and to filter flows in defined drainage ways. Biofiltration strips will be used to the maximum extent feasible, and six bioretention swales are proposed.

☑ *Continued on additional page(s)*

B. Describe project avoidance and/or minimization measures to protect fish, wildlife, and plant resources.

see attached Supplementary Information doc.

☑ *Continued on additional page(s)*

C. Describe any project mitigation and/or compensation measures to protect fish, wildlife, and plant resources.

Caltrans will replace Bay-Oak Woodland trees removed by the project at the six1602-jurisdication areas at the following ratios:
Riparian Oak: 2 removed, mitigated at 5:1 ratio = 10 replacement trees
Other Riparian Native: 11 removed, mitigated at 3:1 ratio = 33 replacement trees

Caltrans is exploring several options to conduct an extensive (separate) tree mitigation project, including tree mitigation opportunities within California State Parks (at Olompali SHP) and conservation covenants on private parcels within the project limits.

☑ *Continued on additional page(s)*

13. PERMITS

List any local, state, and federal permits reqired for the project and check the corresponding bo(es). Enclose a copy of each permit that has been issued.

A.	Individual 404 Army Corps Permit	☑ Applied	☐ Issued
B.	401 Water Quality Certification	☑ Applied	☐ Issued
C.		☐ Applied	☐ Issued

D. bknown whether ☐ local, ☐ state, or ☐ federal permit is needed for the project. (*Check each box that applies*)

☐ *Continued on additional page(s)*

14. ENVIRONMENTAL REVIEW

A. Has a draft or final document been prepared for the project pursuant to the California Environmental Quality Act (CEQA), National Environmental Protection Act (NEPA), California Endangered Species Act (CESA) and/or federal Endangered Species Act (ESA)?

☑ Yes *(Check the box for each CEQA, NEPA, CESA, and ESA document that has been prepared and enclose a copy of each)*

☐ No *(Check the box for each CEQA, NEPA, CESA, and ESA document listed below that will be or is being prepared)*

☐ Notice of Exemption	☐ Mitigated Negative Declaration	☑ NEPA document (*type*): EIS
☐ Initial Study	☑ Environmental Impact Report	☐ CESA document (*type*):
☐ Negative Declaration	☑ Notice of Determination *(Enclose)*	☐ ESA document (*type*):
☐ TPH/ NTMP	☐ Mitigation, Monitoring, Reporting Plan	

B. State Clearinghouse Number (*if applicable*)	2001042115		
C. Has a CEQA lead agency been determined?	☑ Yes (*Complete boxes D, E, and F*)	☐ No (*Skip to box 14.G*)	
D. CEQA Lead Agency	Caltrans		
E. Contact Person	Melanie Brent	F. Telephone Number	(510) 286-5231

G. If the project described in this notification is part of a larger project or plan, briefly describe that larger project or plan.

Caltrans proposes to construct a roadway widening and high occupancy vehicle (HOV) lane project (referred to as Marin Sonoma Narrows or MSN) on U.S. 101 just south of SR 37 in the City of Novato (Marin County) to just north of the Corona Road in the City of Petaluma (Sonoma County). The MSN Project extends from postmile (PM) 18.6 and PM 27.6 in Marin County, and between PM 0.0 and PM 7.1 in Sonoma County. The proposed MSN Segment B1 project is one of five independently funded contracts/phases.

☐ *Continued on additional page(s)*

Has an environmental filing fee (Fish and Game Code section 711.4) been paid?

☐ Yes *(Enclose proof of payment)* ☑ No *(Briefly explain below the reason a filing fee has not been paid)*

Note: If a filing fee is required, the Department may not finalize a Lake or Streambed Alteration Agreement until the filing fee is paid.

15. SITE INSPECTION

Check one box only.

☐ In the event the Department determines that a site inspection is necessary, I hereby authorize a Department representative to enter the property where the project described in this notification will take place at any reasonable time, and hereby certify that I am authorized to grant the Department such entry.

☑ I request the Department to first contact (*insert name*) W. Stuart Kirkham, Caltrans Dist. 4 at (*insert telephone number*) (510) 286-5602 to schedule a date and time to enter the property where the project described in this notification will take place. I understand that this may delay the Department's determination as to whether a Lake or Streambed Alteration Agreement is reqired and/or the Department's issuance of a draft agreement pursuant to this notification.

16. DIGITAL FORMAT

Is any of the information included as part of the notification available in digital format (i.e., CD, DVD, etc.)?
☑ Yes (Please enclose the information via digital media with the completed notification form)
☐ No

17. SIGNATURE

I hereby certify that to the best of my knowledge the information in this notification is true and correct and that I am authorized to sign this notification as, or on behalf of, the applicant. I understand that if any information in this notification is found to be untrue or incorrect, the Department may suspend processing this notification or suspend or revoke any draft or final Lake or Streambed Alteration Agreement issued pursuant to this notification. I understand also that if any information in this notification is found to be untrue or incorrect and the project described in this notification has already begun, I and/or the applicant may be subject to civil or criminal prosecution. I understand that this notification applies only to the project(s) described herein and that I and/or the applicant may be subject to civil or criminal prosecution for undertaking any project not described herein unless the Department has been separately notified of that project in accordance with Fish and Game Code section 1602 or 1611.

Betsy Joseph
Signature of Applicant or Applicant's Authorized Representative

9/2/11
Date

BETCY JOSEPH
Print Name

NOTIFICATION OF LAKE OR STREAMBED ALTERATION
SUPPLEMENTARY INFORMATION

Project Name: MSN Segment B1

8M. Coordinates:

UTM		
	Begin	***End***
Northing:	4220852.7	4225586.2
Easting:	538219.3	535326.1
Zone 10		

10A. Project Description, continued

Three new frontage roads will be constructed adjacent to US 101. The first frontage road will begin just south of the City of Novato/Marin County limit, located approximately 2.1 miles south of the Redwood Landfill overcrossing, west of US 101. This frontage road will be an extension of the existing Redwood Boulevard and will continue north adjacent to US 101 and terminate at the entrance of the Olompali State Historic Park (SHP). The second frontage road would be constructed east of US 101. The roadway will begin approximately 0.7 mile south of the overcrossing, near the existing Burdell Island access road (Mira Monte Marina), and connect to the existing Redwood Sanitary Landfill Road. The third frontage road will be located to the west of US 101 and will begin at the termini of the proposed southbound US 101 on- and off-ramps associated with the Redwood Landfill Interchange and continue approximately 1.4 miles north of the overcrossing, and conform to South San Antonio Road. The removal of the existing US 101/South San Antonio Road at-grade intersection will be included as part of this frontage road construction.

A Class III access road and Class I bike path will be constructed west of US 101 from the terminus of the first frontage road at the Olompali SHP entrance to the SHP residences, and continue north, through the park, and connect near the terminus of the proposed southbound US 101 on- and off-ramps associated with the Redwood Landfill Interchange. The 19-foot wide access road (Olompali SHP entrance to the residences) will be accessible by vehicles, pedestrians, and bicycles and the 12-foot wide bike path (Olompali residences to the Redwood Landfill Interchange) will be accessible to both bicycles and pedestrians.

A location map and vicinity map are Attachment 1 to the Notification of Lake or Streambed Alteration application. Project plans are included on CD-ROM. California Department of Fish and Game (CDFG) Jurisdictional Areas are shown on the attached Project Impact Maps, Attachment 2.

Retaining walls are proposed at the following three locations on the west side of US 101, to minimize the project footprint:

- Retaining Wall No. 2. will be located approximately 0.45 mile north of the existing Olompali SHP entrance/exit. The retaining wall will be approximately 271 feet long and have height that ranges from 2.5 to 7.6 feet tall. The design follows a Standard Caltrans Type 1 Retaining Wall without a gutter. Aesthetically, the retaining wall will have a dry stack rock texture, pilasters and smooth finishes and a chain-link fence along the top of the wall. (Attachment 2, Map-7).

2. US Army Corp 404 Permit

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

REPLY TO
ATTENTION OF:

APR -3 2012

Regulatory Division

SUBJECT: File Number 2001-262140N

Mr. Jeffrey Jensen
California Department of Transportation
111 Grand Avenue
Oakland, California 94623-0660

Dear Mr. Jensen:

Enclosed is your signed copy of a Department of the Army permit (Enclosure 1) to complete phases B1 and B2/B4 of the Marin Sonoma Narrows Project. Phase B1 includes modification and reconstruction of the Redwood Landfill Overcrossing, construction of frontage roads adjacent to U.S. 101 and installation of a Class I bike path adjacent to southbound U.S. 101. The combined B2/B4 phase would construct a new Petaluma Boulevard South interchange, including associated frontage roads, and replacement of the existing Petaluma River Bridge. Phase B1 is located along 4 miles of U.S 101 extending from North of Buck Center Drive to north of San Antonio Road in the town of Novato. The B2/B4 phase is located from the Gunn Drive connection south of the City of Petaluma to immediately south of the U.S. 101/SR 116 separation in the city of Petaluma, Sonoma County, California

Please complete the appropriate parts of "Project Status" form (Enclosure 2), and return it to this office as your work progresses. You are responsible for ensuring that the contractor or workers executing the activity authorized herein are knowledgeable of the terms and conditions of this authorization.

Should you have any questions regarding this matter, please call Paula Gill of our Regulatory Division at (415) 503-6776. Please address all correspondence to the Regulatory

Division and refer to the File Number at the head of this letter. If you would like to provide comments on our permit review process, please complete the Customer Survey Form available online at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Jane M. Hicks

Torrey A. DiCiro, P.E., PMP.
Lieutenant Colonel, U.S. Army
Commanding

Enclosures

Copies Furnished (w/encl 1 only):

US CG, Alameda, CA
US EPA, San Francisco, CA
US FWS, Sacramento, CA
US NMFS, Santa Rosa, CA
CA DFG, Yountville, CA
CA RWQCB, Oakland, CA

PROJECT STATUS

Please use the forms below to report the dates when you start and finish the work authorized by the enclosed permit. Also if you suspend work for an extended period of time, use the forms below to report the dates you suspended and resumed work. The second copy is provided for your records. If you find that you cannot complete the work within the time granted by the permit, please apply for a time extension at least one month before your permit expires. If you materially change the plan or scope of the work, it will be necessary for you to submit new drawings and a request for a modification of your permit.

(cut as needed) ----------

Date:_____

NOTICE OF COMPLETION OF WORK under Department of the Army Permit No., 2001-262140N
TO: District Engineer, US Army Corps of Engineers, Regulatory Division, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No. 2001-262140N, this is to notify you that work was completed on_____.

Permittee: Caltrans, Mr. Jeffrey Jensen
Address: 111 Grand Avenue, Oakland, California 94623-0660

(cut as needed) ----------

Date:_____

NOTICE OF RESUMPTION OF WORK under Department of the Army Permit No. 2001-262140N
TO: District Engineer, US Army Corps of Engineers, Regulatory Division, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No. 2001-262140N, this is to notify you that work was resumed on _____.

Permittee: Caltrans, Mr. Jeffrey Jensen
Address: 111 Grand Avenue, Oakland, California 94623-0660

(cut as needed) ----------

Date:_____

NOTICE OF SUSPENSION OF WORK under Department of the Army Permit No. 2001-262140N
TO: District Engineer, US Army Corps of Engineers, Regulatory Division, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No., 2001-262140N, this is to notify you that work was suspended on _____.

Permittee: Caltrans, Mr. Jeffrey Jensen
Address: 111 Grand Avenue, Oakland, California 94623-0660

(cut as needed) ----------

Date:_____

NOTICE OF COMMENCEMENT OF WORK under Department of the Army Permit No. 2001-262140N
TO: District Engineer, US Army Corps of Engineers, Regulatory Division, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No. 2001-262140N, this is to notify you that work was commenced on _____.

Permittee: Caltrans, Mr. Jeffrey Jensen
Address: 111 Grand Avenue, Oakland, California 94623-0660

DEPARTMENT OF THE ARMY PERMIT

PERMITTEE: California Department of Transportation, District 4

PERMIT NO.: SPN-2001-262140 N

ISSUING OFFICE: San Francisco District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate District or Division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below:

PROJECT DESCRIPTION:

The Marin Sonoma Narrows project will construct high-occupancy vehicle (HOV) lanes on U.S. 101 from just south of State Route 37 in the City of Novato to just north of Corona Road in the City of Petaluma. The MSN project will include construction and modification of interchanges as well as the establishment of new frontage roads. Phase B1 will include modification and reconstruction of the Redwood Landfill Overcrossing, construction of frontage roads adjacent to U.S. 101 and installation of a Class I bike path adjacent to southbound U.S. 101. The combined B2/B4 phase will construct a new Petaluma Boulevard South interchange, including associated frontage roads, and replace the existing Petaluma River Bridge.

Phase B1:

Project implementation will include modification and reconstruction of the Redwood Landfill Overcrossing, construction of frontage roads adjacent to U.S. 101, and installation of a Class I bike path adjacent to southbound U.S. 101. Specific improvements will include modifying the existing Redwood Landfill Overcrossing from a hook-ramp and loop-ramp configuration to a tight diamond interchange. The existing bridge structure will be widened to 10' to the north. Three new frontage roads will be constructed. The first will be an extension of the existing Redwood Boulevard and will continue north and terminate at the entrance to Olompali State Historic Park (SHP). The second frontage road will beginning near the Burdell Island access road and will connect to the existing Redwood Sanitary Landfill Road. The third frontage road will begin at the termini of the proposed southbound U.S. 101 on- and off-ramps associated with the Redwood Landfill and will end 1.4 miles north of the overcrossing. The removal of the existing U.S. 101/South San Antonio Road at-grade intersection will be included as part of this frontage road construction. A Class III access road and Class I bike path (10-foot wide) will be constructed west of U.S. 101 from the terminus of the first frontage road at the Olompali SHP entrance and will connect near the terminus of the proposed southbound U.S. 101 on- and off-ramps associated with the Landfill Interchange. Retaining walls have been proposed to minimize the project footprint at four locations (0.45 mile north of the Olompali SHP entrance, west of the southbound U.S. 101 ramp termini of the Redwood Landfill Interchange, 0.28 mile north of the Redwood Landfill Interchange, and adjacent to the Redwood Interchange east of 101). Project construction will include utility relocations, including 11,000 linear feet of aquaduct owned by the North Marin Water District.

Phase B2/B4:

Specific improvements will include conversion of the existing U.S. 101 four-lane expressway to a full access-controlled freeway. The Project will accommodate future construction of HOV lanes in both directions and future construction to meet the Department's horizontal alignment and vertical profile and sight distance standards. Work will include replacement of the existing Petaluma Boulevard South Interchange with a diamond interchange. The new interchange will be constructed immediately south of the existing Petaluma Boulevard South undercrossing. The interchange will include an overcrossing connecting the new west frontage road to Petaluma Boulevard South on the east side of U.S. 101. Replacement of the existing nine-span, twin structure U.S. 101 Petaluma River Bridge with a new five-span, single deck bridge will occur. All nine of the existing bridge piers will be removed from the Petaluma River. The new bridge will be

supported on four piers with two abutments at either end. Pile-driving, cofferdams for pier footing excavations, dewatering, and false work will be utilized during bridge construction. The temporary trestle will be approximately 1,000 feet long and 36 feet wide and will be built on 20- to 24-inch diameter steel piles. Construction of frontage roads on both sides of U.S. 101 for maintaining access to intersecting roads and private property will be required. The western frontage road will connect the proposed Petaluma Boulevard South overcrossing with the existing Kastania Road. The proposed eastern frontage road will extend from the termination of Petaluma Boulevard South to a private driveway approximately across U.S. 101 from the southern-most extent of Kastania Road. This roadway will also be widened. Construction of a temporary auxiliary lane along southbound U.S. 101 between the southbound on-ramp, from State Route 116 and the southbound U.S. 101 off-ramp, to Petaluma Boulevard South will be required. Three new retaining walls will be constructed. Work will also include removal of the existing Petaluma Boulevard South U.S. 101 undercrossing and relocation of utility lines (i.e. Sonoma County Water Agency, North Marin Water District and City of Petaluma water line facilities). Overhead electrical and underground gas lines will also be relocated.

All work shall be completed in accordance with the plans and drawings titled "*USACE File #2001-262140N, Marin Sonoma Narrows-Segment B1, March 21, 2012, Figures 1 to 16*", and "*USACE File #2001-262140N, Marin Sonoma Narrows-Segment B2/B4, March 21, 2012, Figures 17 to 31*" provided as enclosure 1.

The project will result in the discharge of fill material into 3.73 acres of seasonal wetland and 0.42 acre of other waters of the United States. Temporary impacts will occur to 2.65 acres of jurisdictional wetlands and 0.93 acre of jurisdictional waters of the U.S. Discharge of fill material is depicted in drawings titled, "*USACE File # 2001-262140N, Marin Sonoma Narrows- Segments B1 and B2/B4 Impact Maps, March 29, 2012, Figures 1 to 22*" provided as enclosure 2. Permanently impacted jurisdictional seasonal wetlands have been mitigated off site by the purchase of wetland mitigation credits (45 credits, December 2, 1010) from the Burdell Ranch Wetland Conservation Bank.

PROJECT LOCATION: The project stretches from North of the intersection of Buck Center Drive and Highway 101 in Novato to immediately south of the U.S. 101/SR 116 separation in the city of Petaluma, Marin County, California.

PERMIT CONDITIONS:

GENERAL CONDITIONS:

1. The time limit for completing the work authorized ends on April 15, 2017. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. Conditioned water quality certifications have been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certifications are attached (enclosures 3).

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

7. You understand and agree that, if future operations by the United States require the removal, relocation or other alteration of the structure or work authorized herein, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, you will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

SPECIAL CONDITIONS:

1. This Corps permit does not authorize you to take an endangered species. In order to legally take a listed species, you must have a separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit or a Biological Opinion (BO) under ESA Section 7 with "incidental take" provisions with which you must comply). The enclosed U.S. Fish and Wildlife Service (USFWS) BO dated April 1, 2009 (see Enclosure 4), and National Marine Fisheries Service (NOAA-Fisheries) BO dated January 26, 2009 (see Enclosure 5), contain mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that are also specified in the BO and letter of concurrence. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take authorized by the attached BO and letter of concurrence, whose terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BO or letter of concurrence, where a 'take' of the listed species occurs, would constitute an unauthorized take and it would also constitute non-compliance with this Corps permit. The USFWS and NOAA-Fisheries are the appropriate authorities to determine compliance with the terms and conditions of their BO, letter of concurrence, and with the ESA.

2. You shall employ sediment and erosion control best management practices as needed throughout the project area. No objects or fill shall be placed where they can be eroded or washed into drainage systems in the project area. All debris generated as a result of the project, shall be removed from the site and disposed of at an approved location outside of Corps jurisdiction. All project staging and equipment storage areas shall be located away from areas subject to the jurisdiction of the Corps. After construction, any materials used to dewater areas within the creeks shall be removed in their entirety.

3. Within 1-year of initiation of temporary impact to a jurisdictional feature, you shall re-contour the temporarily impacted area and replant it with appropriate soil-stabilizing native species. You shall monitor each re-vegetated area for 5 years. At the end of the fifth year, re-vegetated areas shall provide 75% absolute vegetative cover. In re-vegetated wetlands, over half of the cover must be occupied by hydrophytic plants (having a facultative (FAC) or wetter indicator status). You shall submit a monitoring report for the re-vegetated areas at the end of years 1, 3, and 5. The reports shall include representative photos of the re-vegetated areas. If the cover requirements for the re-vegetated areas are not met, the Corps may require further monitoring, re-vegetation, and/or off-site mitigation.

4. A Final Mitigation and Monitoring Plan (plan) consistent with the "*Mitigation and Monitoring Plan Summary*" dated March 2012, for restoration and enhancement activities on Sonoma Land Trust property at Tolay Creek for restoration of Other Waters of the U.S. shall be submitted no later than September 1, 2012. Once approved by the Corps, all mitigation required in plan shall be fully implemented within 1-year of initiation of impact to a jurisdictional Other Water of the U.S.

5. In the event that you are unable to implement the plan described in special condition 3 within 1-year of initiation of temporary impact to a jurisdictional feature, you must purchase credits at a Corps approved mitigation bank to compensate for the temporary impact at a 3:1 ratio. If no approved bank or in-lieu fee is available, you shall propose an alternative mitigation plan to be reviewed and approved by the Corps.

6. Your responsibility to complete the required compensatory mitigation as set forth in Special Conditions 3-5 above will not be considered fulfilled until you have demonstrated mitigation success and have received written verification from the Corps.

7. Prior to commencement of work on the Petaluma Bridge all requirements pursuant to the General Bridge Act of 1946 administered by the Coast Guard shall be satisfied. A copy of the final written approval from the Coast Guard shall be provided to the Corps.

8. You shall comply completely with the conditions established in the *"Memorandum of Agreement Between The Federal Highway Administration and the California State Historic Preservation Officer Regarding Lane Widening of Highway 101, Marin and Sonoma Counties, California"* signed September 11, 2008 (enclosure 6).

FURTHER INFORMATION:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

(x) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403).
(x) Section 404 of the Clean Water Act (33 U.S.C. Section 1344).
( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. Section 1413).

2. Limits of this authorization:

a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate. (See Item 4 above.)

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 C.F.R. Section 325.7 or enforcement procedures such as those contained in 33 C.F.R. Sections 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 C.F.R. Section 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Wayahat _____ 4/2/12 _____

(PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Jane M. Hicks _____ 4/3/12 _____

Torrey A. DiCiro, P.E., PMP (DATE)
Lieutenant Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

_____ _____

(TRANSFEREE) (DATE)

3. San Francisco Bay RWQCB 401 Permit

March 26, 2012
CIWQS Place No. 778521
401 Database No.: 02-49-C0300

Sent via electronic mail--no hard copy to follow

California Department of Transportation
Attn: Ms. Betcy Joseph
Betcy_Joseph@dot.ca.gov
111 Grand Ave.
Oakland, CA 94612-3717

Subject: Water Quality Certification for the U.S. 101 Marin Sonoma Narrows Project, Contract B1 at Old Redwood Landfill Interchange, Sonoma County

Department Project No.: EA 04-264071

Dear Ms. Joseph:

We have reviewed and hereby issue water quality certification to the California Department of Transportation (Department) for the United States Highway 101 (U.S. 101) Marin Sonoma Narrows, Old Redwood Landfill Interchange, Contract B1, Project (Project). The Department is seeking an Individual Permit for the Project from the U.S. Army Corps of Engineers (ACOE) pursuant to Section 404 of the Clean Water Act (33 U.S.C. § 1344). As such, the Department has applied to the San Francisco Bay Regional Water Quality Control Board (Water Board) for a Clean Water Act Section 401 water quality certification that the Project will not violate State water quality standards.

Project: The Department is proposing to upgrade U.S. 101 between Novato and Petaluma as part of the Marin-Sonoma Narrows HOV Widening Project (MSN). The Department has divided the overall MSN project into six individual contracts:

- A1, from State Route 37 to just north of Atherton Avenue in Novato. A 401 certification was issued for this project on July 22, 2010;
- A3, between Marin County U.S. 101 post-miles 22.2 and 24.1. A 401 certification application has not yet been submitted to the Water Board for this project;
- B-1, the subject of this certification;

- B-3, in the vicinity of San Antonio Creek between Marin County U.S. 101 post-miles 27.0 and 27.6, and Sonoma County U.S. 101 post-miles 0.0 and 2.5. The Department intends to submit a 401 certification application in 2013;
- B-2/B-4, between Sonoma County U.S. 101 post-miles 0.9 and 3.6. A 401 certification application was submitted to the Water Board on November 10, 2011; and
- C-3, between Sonoma County U.S. 101 post-miles 3.4 and 4.1. A 401 certification application was submitted to the Water Board on February 29, 2012.

This certification addresses activities at and in the vicinity of the Old Redwood Landfill interchange, just north of the Novato city limits, between Marin County U.S. 101 post-miles 23.3 and 27.6. Major elements of the Project include:

- Converting existing U.S. 101 access points to controlled-access facilities. The existing access to Olompali State Historic Park would be replaced by an access point from a new Redwood Boulevard frontage road extension;
- Construction of a tight-diamond interchange at the Redwood Landfill Overcrossing to replace the existing hook on- and off-ramps;
- Roadway and bridge widening. New pavement and four new retaining walls would be constructed. The existing Redwood Landfill Overcrossing would be widened by approximately 10 feet to accommodate 12-foot travel lanes with minimum 8-foot shoulders;
- Construction of new frontage roads. The existing Redwood Boulevard would be extended to the south to provide access to Olompali State Park. From there, a new, 19-foot wide, 2,400-foot long maintenance road would be constructed and extend to the Redwood Sanitary Landfill Road interchange. On the east side of U.S. 101, a 21-foot wide frontage road would be constructed to connect the Mira Monte Marina driveway and Redwood Sanitary Landfill Road. A new frontage road would also be constructed on the west side of U.S. 101 to connect the existing San Antonio Road with the Redwood Sanitary Landfill Road interchange;
- Construction of new bicycle paths. A continuous bikeway would be constructed through the Project; and
- Relocation of utility lines. An approximately 2,000 foot-long, and 8,900 foot-long, segments of the existing North Marin Water District aqueduct would be relocated along the proposed Redwood Boulevard extension, within Olompali State Park, and near the existing Redwood Sanitary Landfill Road interchange. Additionally, the existing 12-inch water line to Redwood Landfill would be relocated and constructed in conjunction with construction of the proposed Redwood Landfill frontage road.

Overhead electrical and underground gas lines would also be relocated. Utility relocation would be accomplished by trenching, directional boring beneath the proposed frontage road, and jack and bore methods beneath U.S. 101.

Utility relocation would require hydrostatic pressure testing and discharge or disposal of water used for testing. Condition number 10 of this certification includes a condition for discharge of hydrostatic pressure testing water.

The Project area drains to the San Antonio Creek and Rush Creek watersheds via unnamed tributaries, but does not cross either creek.

Impacts: Project implementation would result in the permanent fill of approximately 2.539 acres of jurisdictional seasonal freshwater wetlands and approximately 2,220 linear feet of jurisdictional waters. Permanent waters and wetlands impacts are summarized below in Table 1, *Summary of Permanent Impacts.*

Project implementation would result in temporary impacts to approximately 1.948 acres of jurisdictional seasonal freshwater wetlands and approximately 1,578 linear feet of jurisdictional waters as a result of construction access. Temporary Project impacts are summarized below in Table 2, *Summary of Temporary Impacts.*

Table 1: Summary of Permanent Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact
Redwood Boulevard frontage road and culvert construction	Seasonal wetlands (WW-2, WW-3) roadside drainage channel between Redwood Boulevard and southbound U.S. 101	0.086 acres
Redwood Boulevard frontage road and culvert construction	Jurisdictional waters (OW-3, OW-5, OW-6) first drainage north of current terminus of Redwood Boulevard	166 linear feet
Redwood Boulevard frontage road and culvert construction	Jurisdictional water (OW-9) second drainage north of current terminus of Redwood Boulevard	119 linear feet
Redwood Boulevard frontage road and culvert construction	Jurisdictional waters (OW-12, OW-16) third drainage north of current terminus of Redwood Boulevard	126 linear feet
Redwood Boulevard frontage road and culvert construction	Jurisdictional water (OW-17) fourth drainage north of current terminus of Redwood Boulevard	349 linear feet
Redwood Boulevard frontage road and culvert construction	Seasonal wetland (WW-8) adjacent southbound 101, immediately south of existing Olompali State Park entrance	0.185 acres
Maintenance road and culvert construction	Seasonal wetland (WW-9) adjacent southbound 101, just south of Olompali Creek	0.053 acres

Table 1: Summary of Permanent Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact
Maintenance road and culvert construction	Jurisdictional water (OW-23) Olompali Creek, outside of southbound 101	53 linear feet
Maintenance road and culvert construction	Seasonal wetland (WW-10) adjacent southbound 101, just north of Olompali Creek	0.022 acres
Maintenance road and culvert construction	Seasonal wetland (WW-12) adjacent southbound 101, north of Olompali Creek	0.034 acres
Maintenance road and culvert construction	Seasonal wetland (WW-16) adjacent southbound 101, north of Olompali Creek	0.014 acres
Landfill/Marina frontage road construction	Seasonal wetland (WW-18) adjacent southbound 101, south of the existing Redwood Sanitary Landfill Road	0.169 acres
Bike path and culvert construction	Seasonal wetland (WW-20) adjacent southbound U.S. 101	0.001 acres
Bike path and culvert construction	Jurisdictional water (OW-27) adjacent southbound U.S. 101, first drainage north of Olompali Creek	57 linear feet
Landfill/Marina frontage road and culvert construction	Jurisdictional water (OW-31) adjacent northbound 101, downstream segment of OW-27	202 linear feet
Landfill/Marina frontage road and culvert construction	Seasonal wetlands (WW-23, WW-26, WW-29) adjacent northbound U.S. 101, immediately south of the existing Redwood Sanitary Landfill Road	1.760 acres
Construction of bicycle path	Jurisdictional water (OW-35) along southbound U.S. 101, just south of Redwood Landfill interchange	85 linear feet
Construction of northbound U.S. 101 off-ramp to Redwood Landfill	Seasonal wetland (WW-30) adjacent northbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	0.020 acres
San Antonio frontage road extension, southbound U.S. 101 off-ramp, and culvert construction and installation of North Marin Water District aqueduct	Jurisdictional water (OW-37) on west side of southbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	448 linear feet

Table 1: Summary of Permanent Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact
San Antonio frontage road extension and culvert construction, and installation of North Marin Water District aqueduct	Jurisdictional water (OW-39) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	31 linear feet
Northbound U.S. 101 on-ramp and culvert construction	Seasonal wetland (WW-31) on east side of northbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	0.006 acres
Northbound U.S. 101 on-ramp and culvert construction	Jurisdictional water (OW-40) on east side of northbound U.S. 101, just north of WW-31	43 linear feet
San Antonio frontage road extension and culvert construction, and installation of North Marin Water District aqueduct	Jurisdictional water (OW-43) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	85 linear feet
San Antonio frontage road and box culvert extension construction, and installation of North Marin Water District aqueduct	Jurisdictional water (OW-45) on west side of southbound U.S. 101, drainage from Silveira Dairy Ranch	209 linear feet
San Antonio frontage road extension and culvert construction and installation of North Marin Water District aqueduct	Seasonal wetlands (WW-36, WW-37) drainage channel, along west side of southbound U.S. 101, north of the Silveira Dairy driveway	0.177 acres
San Antonio frontage road extension and culvert construction and installation of North Marin Water District aqueduct	Jurisdictional water (OW-47) second drainage from northern Project boundary	164 linear feet
San Antonio frontage road extension and culvert construction and installation of North Marin Water District aqueduct	Jurisdictional water (OW-49), west side of southbound U.S. 101, first drainage from northern Project boundary	83 linear feet
Installation of double thrie-beam barrier	Seasonal wetland in the U.S. 101 median at the northern Project boundary	0.012 acres
	totals:	2.539 acres of wetland fill; 2,220 linear feet of jurisdictional waters

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetland (WW-1), roadside channel adjacent northbound 101	0.033 acres
Redwood Boulevard frontage road and culvert construction access	Seasonal wetland (WW-4) drainage channel between Redwood Boulevard and southbound U.S. 101	0.012 acres
Redwood Boulevard frontage road and culvert construction access	Jurisdictional waters (OW-1, OW-2) drainage channel between Redwood Boulevard and southbound U.S. 101	270 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional waters (OW-4, OW-7) immediately north of current terminus of Redwood Boulevard	32 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-8) roadside drainage channel adjacent northbound U.S. 101 at southern extent of Airport Road	476 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetland (WW-5) roadside channel adjacent northbound 101	0.003 acres
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-14), roadside drainage channel adjacent northbound 101	18 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-10) second drainage north of current terminus of Redwood Boulevard	13 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-11) roadside drainage channel adjacent southbound U.S. 101 mainline	100 linear feet
Redwood Boulevard frontage road and culvert construction access	Seasonal wetland (WW-6) roadside channel adjacent southbound 101	0.005 acres

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Redwood Boulevard frontage road and culvert construction access	Jurisdictional waters (OW-13, OW-15) third drainage north of current terminus of Redwood Boulevard	66 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-18), roadside drainage between northbound 101and Airport Road	16 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-19) roadside drainage between northbound 101and Airport Road	30 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-20) fourth drainage north of current terminus of Redwood Boulevard	18 linear feet
Redwood Boulevard frontage road and culvert construction access	Seasonal wetland (WW-7) adjacent OW-21 and southbound 101	0.008 acres
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-21) fifth drainage north of current terminus of Redwood Boulevard	6 linear feet
Maintenance road and culvert construction access	Jurisdictional waters (OW-22, OW-24) Olompali Creek, outside of southbound 101	15 linear feet
Metal beam guard railing construction	Jurisdictional water (OW-25) Olompali Creek, outside of northbound U.S. 101	19 linear feet
Maintenance road and culvert construction access	Seasonal wetland (WW-11) adjacent southbound U.S. 101, just north of Olompali Creek	0.003 acres
Maintenance road and culvert construction access	Seasonal wetland (WW-13) adjacent southbound U.S. 101, north of Olompali Creek	0.002 acres
Maintenance road and culvert construction access	Seasonal wetlands (WW-14, WW-15) adjacent southbound U.S. 101, north of Olompali Creek	0.033 acres
Landfill/Marina frontage road construction access and access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetlands (WW-17, WW-19) adjacent northbound U.S. 101, south of Redwood Sanitary Landfill Road	0.161 acres
Bike path and culvert construction access	Seasonal wetland (WW-21) adjacent southbound U.S. 101	0.006 acres

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Bike path and culvert construction access	Jurisdictional waters (OW-26, OW-28, OW-29) adjacent southbound U.S. 101, first drainage north of Olompali Creek	46 linear feet
Landfill/Marina frontage road and culvert construction access	Jurisdictional water (OW-30) adjacent southbound 101, downstream segment of OW-26 OW-28, OW-29	41 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-32) roadside drainage adjacent southbound 101	47 linear feet
Landfill/Marina frontage road and culvert construction access and access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetlands (WW-22, WW-24, WW-25, WW-27, WW-28) adjacent northbound U.S. 101, immediately south of the existing Redwood Sanitary Landfill Road	1.640 acres
Landfill/Marina frontage road and culvert construction access and access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-33) roadside drainage just south of the existing Redwood Sanitary Landfill Road, adjacent northbound U.S. 101	117 linear feet
Access for construction of bicycle path	Jurisdictional water (OW-34) adjacent southbound U.S. 101, just south of the existing Redwood Sanitary Landfill Road	23 linear feet
San Antonio frontage road extension, southbound U.S. 101 off-ramp, and culvert construction access and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-36) on west side of southbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	18 linear feet
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-38) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	15 linear feet
Northbound U.S. 101 on-ramp and culvert construction access	Seasonal wetland (WW-32) on east side of northbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	0.011 acres

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Northbound U.S. 101 on-ramp and culvert construction access	Jurisdictional water (OW-41) on east side of northbound U.S. 101, just north of WW-32	39 linear feet
San Antonio frontage road extension and culvert construction access, and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-42) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	15 linear feet
San Antonio frontage road and box culvert extension construction access, and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-44) on west side of southbound U.S. 101, drainage from Silveira Dairy Ranch	52 linear feet
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct	Seasonal wetlands (WW-33, WW-34) on west side of southbound U.S. 101, north of the Silveira Dairy driveway	0.012 acres
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct	Seasonal wetland (WW-35) drainage channel, along west side of southbound U.S. 101, north of Silveira Dairy driveway	0.019 acres
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct. Access for removal of existing overhead electrical lines	Jurisdictional water (OW-46), west side of southbound U.S. 101, second drainage from northern Project boundary	46 linear feet
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct. Access for removal of existing overhead electrical lines	Jurisdictional water (OW-48), west side of southbound U.S. 101, first drainage from northern Project boundary	21 linear feet
Construction of right-of-way fencing	Jurisdictional water (OW-50), east side of southbound U.S. 101, first drainage from northern Project boundary	19 linear feet
	totals:	1.948 acres of wetlands; 1,578 linear feet of waters

Roadway Pollutant Impacts: Project implementation would result in approximately 10.25 acres of new and 5.17 acres of reworked impervious area (the new impervious figure excludes 0.87 acres of new bike paths). Stormwater runoff from impervious areas may contain hydrocarbons, metals, volatile organic compounds, trash, and sediment at levels that may significantly impact jurisdictional waters if left untreated.

Hydromodification Impacts: Added impervious areas may result in alterations to existing hydrologic regimes, resulting in erosion and/or changes of sediment transport in receiving waters (hydromodification). Project implementation would result in approximately 11.12 acres of added impervious area and therefore the Department is required to evaluate and mitigate potential hydromodification impacts. The Department evaluated susceptibility for hydromodification impacts to all receiving waters within the Project limits. The Department proposed mitigation as appropriate (see Hydromodification Mitigation, page 13).

Avoidance and Minimization: The Department has avoided and minimized impacts to wetland and waters by incorporating retaining walls, selecting a project alternative with fewer impacts to wetlands, particularly the wetlands south of Redwood Sanitary Landfill Road, and minimizing the width of the frontage road connecting Mira Monte Marina and Redwood Sanitary Landfill Road.

Mitigation: To mitigate for permanent impacts to 2.539 acres of jurisdictional seasonal freshwater wetlands, the Department purchased 3.5 acres of wetland mitigation bank credits from Burdell Ranch Wetland Conservation Bank on December 2, 2010.

To mitigate for the approximately 2,220 linear feet of permanent impacts to jurisdictional waters, the Department shall enhance Tolay Creek by providing riparian tree re-vegetation along 4,760 linear feet of the creek, and 115 linear feet of a Tolay Creek tributary. Riparian tree species established shall include a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple. The Department shall also provide cattle exclusion along 115 linear feet of a Tolay Creek tributary (see condition 3). The 4,760 linear feet of Tolay Creek has already been provided with cattle exclusion by the Sonoma Land Trust. Mitigation shall be done in cooperation with the land owner, Sonoma Land Trust.

Additionally, the Department will mitigate off-site as well as re-build on-site for impacted drainage channels. The Department shall reconstruct 2,077 linear feet of natural bottom channels near their former locations (see Condition No. 7).

To mitigate for temporarily impacted wetlands and waters, the Department shall restore those areas to their original or improved conditions (see Condition No. 6).

Roadway Pollutant Mitigation: As mitigation for increased pollutant loads associated with impervious areas, the Department shall provide treatment of stormwater runoff from no less than 15.71 acres of impervious area using 28 bioretention swales and 22 biofiltration strips (see Tables 3 and 4, below, for swale and strip information). The swales and strips would treat approximately 11.74 and 3.97 acres of impervious area, respectively. This would be 0.29 acres more than the required 15.71 acres. The Department may use the 0.29 acres of surplus treatment as credit towards the treatment obligations of a future, neighboring project (see certification Condition No. 2).

The following bioretention swales and strips would mitigate water quality impacts resulting from Project implementation:

Table 3: Bioretention Swale Summary (continued)

Location	Swale Surface Area (feet^2)	From Post Mile	To Post Mile	Treated Impervious Area (acres)
West side of Redwood Boulevard	576	23.23	23.26	0.17
West side of Redwood Boulevard	1,474	23.49	23.63	0.27
West side of Redwood Boulevard	946	23.63	23.72	0.18
West side of Redwood Boulevard	268	23.78	23.80	0.06
West side of Redwood Boulevard	1,068	23.81	23.89	0.18
West side of Redwood Boulevard	582	23.90	23.96	0.10
West side of Redwood Boulevard	1,074	23.96	24.00	0.09
West side of Redwood Boulevard	1,100	24.00	24.11	0.06
West side of Redwood Boulevard	440	24.11	24.15	0.23
West side of Redwood Boulevard	950	24.15	24.22	0.14
West side of Redwood Boulevard	600	24.22	24.25	0.06
West side of Redwood Boulevard	260	24.25	24.27	0.04
West side of Redwood Boulevard	902	24.27	24.36	0.16
West side of access road, north of Redwood Boulevard entrance to Olompali State Park	3,570	24.49	24.71	0.26
West side of access road, north of Redwood Boulevard entrance to Olompali State Park	2,274	24.72	24.82	0.11
West side of access road, north of Redwood Boulevard entrance to Olompali State Park	1,200	24.82	24.89	0.09
West side of San Antonio Road	1,800	26.99	27.11	0.45
Adjacent southbound U.S. 101	942	25.18	25.21	0.14
Adjacent southbound U.S. 101	1,185	25.21	25.29	0.39
Adjacent southbound U.S. 101	2,100	25.45	25.55	0.24
Adjacent southbound 101	2,024	25.55	25.64	0.25
Adjacent east side of Redwood Landfill on-ramp to northbound U.S. 101	913	25.61	25.62	0.30
			total:	*3.97*

Table 4: Biofiltration Strip Summary (continued)

Location	Width (feet)	Strip Surface Area (acres)	From Post Mile	To Post Mile	Treated Impervious Area (acres)
East side of Redwood Boulevard	8	0.31	23.26	23.78	0.63
East side of Redwood Boulevard	8	0.01	23.80	23.81	0.07
East side of Redwood Boulevard	8	0.37	23.81	24.20	0.78
East side of Redwood Boulevard	8	0.24	24.21	24.46	0.49
West side of Redwood Boulevard at entrance to Olompali State Park	8	0.02	24.46	24.49	0.03
East side of Redwood Boulevard at entrance to Olompali State Park	8	0.01	24.48	24.49	0.06
East side of access road, north of Redwood Boulevard entrance to Olompali State Park	5	0.15	24.47	24.71	0.26
East side of access road, north of Redwood Boulevard entrance to Olompali State Park	5	0.12	24.72	24.92	0.25
West side of frontage road connecting Redwood Sanitary Landfill Road and Mira Monte Marina Driveway	15	0.19	24.83	24.93	0.47
West side of frontage road connecting Redwood Sanitary Landfill Road and Mira Monte Marina Driveway	15	0.66	24.94	25.30	0.94
East side of frontage road connecting Redwood Sanitary Landfill Road and Mira Monte Marina Driveway	15	0.18	25.30	25.40	0.34
Redwood Sanitary Landfill Road at frontage road, west side	15	0.02	25.40	25.41	0.02
Adjacent northbound U.S. 101	15	0.26	25.35	25.50	0.60
Adjacent northbound U.S. 101	15	0.05	25.58	25.61	0.10
Adjacent southbound U.S. 101	15	0.14	26.87	26.95	0.19
Adjacent northbound U.S. 101 off-ramp to Redwood Sanitary Landfill Road	15	0.44	25.25	25.49	1.01
Adjacent east side of southbound U.S. 101 off-ramp to Redwood Sanitary Landfill Road	15	0.20	25.61	25.60	0.34
Adjacent south side of Redwood Sanitary Landfill Road between southbound U.S. 101 on-ramp and mainline	15	0.02	25.61	25.62	0.03
Adjacent east side of San Antonio Frontage Road	15	0.13	25.63	25.71	0.16
Adjacent east side of San Antonio	12	0.27	25.71	25.90	0.73

Table 4: Biofiltration Strip Summary (continued)

Location	Width (feet)	Strip Surface Area (acres)	From Post Mile	To Post Mile	Treated Impervious Area (acres)
Frontage Road					
Adjacent west side of San Antonio Frontage Road	11	0.06	26.03	26.07	0.17
Adjacent west side of San Antonio Frontage Road	12	0.16	26.10	26.21	0.65
Adjacent west side of San Antonio Frontage Road	12	0.12	26.23	26.31	0.38
Adjacent west side of San Antonio Frontage Road	13	0.39	26.33	26.59	1.01
Adjacent west side of San Antonio Frontage Road	13	0.11	26.62	26.69	0.51
Adjacent west side of San Antonio Frontage Road	12	0.40	26.71	26.99	1.07
Adjacent west side of southbound U.S. 101 off-ramp to Redwood Sanitary Landfill Road	15	0.16	25.60	25.69	0.33
Adjacent west side of Redwood Sanitary Landfill Road on-ramp to southbound U.S. 101	15	0.07	25.46	25.50	0.12
				total:	11.74

Hydromodification mitigation: To mitigate for receiving waters susceptible to hydromodification impacts, the Department shall construct a detention basin in the northwest quadrant of the Old Redwood Landfill interchange, between the southbound off-ramp and the southbound mainline. The Department shall also install compost-amended biofiltration strips to help attenuate peak runoff.

CEQA Compliance: The Department prepared and approved an Environmental Impact Report for this Project pursuant to the provisions of the California Environmental Quality Act. The Department filed a Notice of Determination on July 27, 2009 (SCH No. 2001042115).

California Wetlands Portal: It has been determined through regional, state, and national studies that tracking of mitigation/restoration projects must be improved to better assess the performance of these projects, following monitoring periods that last several years. In addition, to effectively carry out the State's No Net Loss Policy for wetlands, the State needs to closely track wetland losses, gains, and mitigation/restoration project success. Therefore, we require that the Department use the California Wetlands Standard Form to provide Project information related to impacts and mitigation/restoration measures (see

Condition Nos. 8 and 9 of this certification). An electronic copy of the form and instructions can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml

Project information concerning impacts and mitigation/restoration will be made available at the web link: http://www.californiawetlands.net

Certification: I hereby issue an order certifying that any discharge from the referenced project will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003 - 0017 – DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification" which requires compliance with all conditions of this Water Quality Certification. The following conditions are associated with this certification:

1. To mitigate for receiving waters susceptible to hydromodification impacts, the Department shall construct a detention basin in the northwest quadrant of the Old Redwood Landfill interchange, between the southbound off-ramp and the southbound mainline;

2. As mitigation for increased pollutant loads associated with impervious areas, the Department shall treat stormwater runoff from no less than 15.71 acres of impervious area using 28 bioretention swales and 22 biofiltration strips. The swales and strips shall be installed consistent with the swale and strips summaries in Tables 3 and 4, and Attachment A of this certification. Any change in swale and strip dimensions and placement shall be prohibited without acceptance by Water Board staff. The Department shall regularly inspect and maintain swales and strips to perform optimally. The Department may use the 0.29 acres of surplus treatment as credit towards the treatment obligations of a future, neighboring project;

3. The Department shall submit, subject to the acceptance of Water Board staff, a Final Mitigation and Monitoring Plan for restoration and enhancement activities on Sonoma Land Trust property at Tolay Creek (Plan). The Plan shall be submitted not later than September 1, 2012. Project construction is prohibited until a Plan has been found acceptable to Water Board staff. The Plan shall include:

    a. A proposal to re-vegetate 2,260 linear feet of Tolay Creek (both banks) in "Area B" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a

combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

b. A proposal to re-vegetate 2,500 linear feet of Tolay Creek (both banks) in "Area D" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

c. A proposal to re-vegetate 115 linear feet of Tolay Creek (both banks) in "Area T1.2" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

d. A proposal to install cattle exclusion fencing around "Area T1.2" as identified in Attachment B, "Tolay Creek Mitigation Site Map";

e. An invasive species control plan for areas B, D, and T1.2;

f. Success criteria for all plantings;

g. A monitoring period no less than ten years;

h. A plan to provide additional planting, maintenance and monitoring until the success criteria are satisfied, if the required success criteria are not met;

i. A plan to not consider any plantings successful if supplemental watering has been employed at any time during the previous two growing seasons;

j. A plan to submit Annual Reports to the Water Board. At a minimum, mitigation monitoring reports shall be submitted for years 0 (as-built report), 1, 3, 5, 7, and 10. All monitoring reports shall include photo-documentation utilizing consistent photo vantage points. If the monitoring report includes management recommendations, then the report must express whether the Department has the intention to immediately implement those recommendations;

4. All mitigation required in Tolay Creek areas B and D shall be fully implemented prior to Project completion. Failure to meet this deadline may result in additional mitigation requirements. Area T1.2 mitigation may be incorporated into the mitigation plan required by the Water Board for the MSN B3 contract certification. Completion of Area T1.2 mitigation activities shall be completed by the MSN B3 certification deadlines. The Department intends to apply for MSN B3 certification in 2013;

5. Mitigation areas at Tolay Creek shall be subject to the terms of the December 21, 2007, Grant Deed of Conservation Easement (Easement), and the November 2009,

Tolay Creek Ranch Management Plan (Management Plan). Any subsequent change to the Easement or Management Plan shall be subject to the acceptance of Water Board staff;

6. The Department shall restore all jurisdictional wetlands and waters to their pre-project or improved conditions, within the first growing season following cessation of construction activity in those areas. All temporarily disturbed areas shall be re-vegetated using only native plant species. The Department shall not cause, through operation of heavy machinery, or any other construction activity, compaction of wetlands or waters. Any compaction of wetlands or waters shall require mitigation. The Department shall submit photo-documentation to the Water Board of the pre- and post-project conditions of temporarily impacted areas annually during Project construction;

7. The Department shall construct no less than 2,077 linear feet of unlined channels at the following nine locations:

    a. Line N2R, station 275+61, to station N2R, station 279+82 ;
    b. Line BK, station 303+00, to station BK, station 303+66 ;
    c. Line BK, station 303+66, to station BK, station 304+30 ;
    d. Line BK, station 304+30, to station BK, station 305+19 ;
    e. Line RL3, station 336+19, to station RL3, station 338+51 ;
    f. Line RL3, station 338+51, to station RL3, station 341+49 ;
    g. Line RL3, station 341+49, to station RL3, station 345+47 ;
    h. Line RL2, station 336+20, to station RL2, station 339+78 ; and
    i. Line RL3, station 345+47, to station N2R, station 347+65 .

    The Department shall submit an as-built report of all nine constructed channels, not later than three months from the Project completion date. Photo-documentation shall be provided each year thereafter, for three years, to demonstrate that the nine channels are exhibiting wetland and water characteristics;

8. The Department is required to use the California Wetlands Standard Form to provide project information describing impacts and mitigation/restoration measures within 30 days from the date of this certification. An electronic copy of the form can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml. The completed California Wetlands form shall be submitted electronically to habitatdata@waterboards.ca.gov or shall be submitted as a hard copy to both: 1) The Water Board, 1515 Clay St., Suite 1400, Oakland, CA 94612, to the attention of California Wetlands Portal; and 2) San Francisco Estuary Institute, 4911 Central Ave., Richmond, CA 94804, to the attention of Mike May;

9. Tolay Creek mitigation monitoring reports shall be submitted to the Water Board by January 1 of each year. Modification of this deadline is subject to the acceptance of Water Board staff. The reports may be submitted by upload to the California Wetlands Portal website at http://www.californiawetlands.net/tracker/ba/list. Select the Tolay Creek restoration project from the Bay Area Project List and then use the "Files & Links" web-link on the mitigation site project page to upload the report. The Department shall immediately notify appropriate Water Board staff once the monitoring report has been uploaded. If the Department cannot, or chooses not to submit the report using the California Wetlands Portal, the report may be submitted directly to Water Board staff electronically, via e-mail;

10. Discharge of utility line hydrostatic testing water shall not be discharged if residual chlorine levels exceed 0.0 mg/L, or pH is below 6.5, or above 8.5. Chlorine residual detection methods shall have a detection limit no greater than 0.5 mg/L. Discharge of hydostatic testing water shall be subject to pH testing every 15 minutes until a steady state of discharge is reached. Discharge of water shall not cause erosion at the point of discharge;

11. The Project shall be constructed in conformance with the Project Description described in this certification and certification application materials. Any change in the Project may require modification to the certification and shall be reported to the Water Board prior to implementation of the changes;

12. The Department shall adhere to the conditions imposed by the Individual Permit issued to the Department by the Corps, to the Streambed Alteration Agreement issued to the Department by the California Department of Fish and Game, and to the Biological Opinion issued to the Department by the U.S. Fish and Wildlife Service on April 1, 2009;

13. Regardless of date, erosion control measures shall be utilized throughout all phases of construction where sediment-laden runoff threatens to enter waters of the State. At no time shall sediment-laden runoff be allowed to enter waters of the State;

14. No fueling, cleaning or maintenance of vehicles or equipment shall take place within jurisdictional waters or within any areas where an accidental discharge to waters of the State may occur;

15. Except as expressly allowed in this Certification, the discharge, or creation of the potential for discharge, to waters of the State of any construction wastes and/or soil materials including cement, fresh concrete, or washings thereof, silts, clay, sand, oil or petroleum products and other organic materials to waters of the State is prohibited;

16. This certification does not allow for the take, or incidental take, of any special status species. The Department shall use the appropriate protocols, as approved by the California Department of Fish and Game and the U.S. Fish and Wildlife Service, to ensure that Project activities do not impact the Beneficial Use of the Preservation of Rare and Endangered Species;

17. The Department shall maintain a copy of this water quality certification at the Project site so as to be available at all times to site operating personnel. It is the responsibility of the Department to assure that all personnel (employees, contractors, and subcontractors) are adequately informed and trained regarding the conditions of this certification;

18. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section 13330 of the California Water Code (CWC) and Section 3867 of Title 23 of the California Code of Regulations(23 CCR);

19. This certification action does not apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license, unless the pertinent certification application was filed pursuant to California Code of Regulations (CCR) Title 23, Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought; and

20. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR Section 3833). Water Board staff received full payment of $13,634.00 on December 20, 2011.

We anticipate your cooperation in implementing these conditions. However, please be advised that any violation of water quality certification conditions is a violation of State law and subject to administrative civil liability pursuant to California Water Code (CWC) section 13350. Failure to respond, inadequate response, late response, or failure to meet any condition of this certification may subject you to civil liability imposed by the Water Board to a maximum of $5,000 per day per violation or $10 for each gallon of waste discharged in violation of this certification.

Condition numbers 3, and 6-9 are requirements for information and reports. Any requirement for a report made as a condition to this action is a formal requirement pursuant to CWC section 13267, and failure or refusal to provide, or falsification of such required report is subject to civil liability as described in CWC section 13268.

We anticipate no further action on this request. Should new information come to our attention that indicates a water quality problem with this project, the Water Board may issue Waste Discharge Requirements pursuant to 23 CCR Section 3857.

If you have any question, please contact Brendan Thompson at (510) 622-2506, or via e-mail to BThompson@waterboards.ca.gov.

Sincerely,

Bruce H. Wolfe
Executive Officer

cc (via e-mail): Mr. Bill Orme SWRCB-DWQ
Ms. Laurie Monnrres, USACE
Ms. Jane Hicks, Regulatory Branch, USACE
Mr. Tim Dodson, CDFG
Mr. Bob Neale, Sonoma Land Trust
Mr. Dale Bowyer, Water Board
Mr. Cyrus Vafai, Caltrans
Mr. Hardeep Takhar, Caltrans
Mr. Jason Brush, USEPA
Ms. Paula Gill, USAC

Attachment A

Biofiltration Swale and Strip Specifications

10-1.__ IMPORTED BIOFILTRATION SOIL

GENERAL

Summary

This work includes furnishing, and applying biofiltration soil mix.

Submittals

Imported biofiltration soil must be accompanied by a Certificate of Compliance, from the soil supplier, in conformance with the provisions in Standard Specification Section 6-1.07, "Certificates of Compliance."

Before mixing compost with sand and soil, submit a copy of the compost producer's compost technical data sheet and a copy of the compost producer's Seal of Testing Assurance certification. The compost technical data sheet must include:

1. Laboratory analytical test results
2. List of product ingredients

Before mixing compost with sand and soil, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Quality Control and Assurance

Saturated hydraulic conductivity for imported biofiltration soil must be at least 5 inches per hour.

MATERIAL

Imported biofiltration soil consists of a uniform mixture of sand, compost, and soil. The ratio of the components of imported biofiltration soil by volume must consist of two parts sand; one part compost; and 0.5 part soil.

Sand

Sand must be free of wood, waste, coating such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing No. 200 sieve size must be non-plastic. Sand must be graded within the following limits:

Sieve Sizes	Percentage Passing
3/8"	100
No. 4	90 - 100
No. 8	70 - 100
No. 16	40 - 95
No. 30	15 - 70
No. 40	5-55
No. 100	0 - 15
No. 200	0 - 5

Grain size analysis results of the sand component must be performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.

Compost

The compost producer must be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate solid waste facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

The compost producer must be a participant in the United States Composting Council's Seal of Testing Assurance program.

Compost may be derived from any single or mixture of any of the following feedstock materials:

1. Green material consisting of chipped, shredded, or ground vegetation; or clean processed recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

Compost feedstock materials such that weed seeds, pathogens and deleterious materials are reduced as specified under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3.

Compost must not be derived from mixed municipal solid waste and must be reasonably free of visible contaminates. Compost must not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Compost must not possess objectionable odors.

Metal concentrations in compost must not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

Compost must comply with the following:

Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.5–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–6.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	35–75
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	 8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification	Inches % Passing 3 100%

	% Dry Weight Basis	1/2 0 – 95% 1/4 0-75% Max. Length 4 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

NOTE: TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Soil

Soil must be free of wood, waste or other deleterious material. The soil texture must be loamy. Overall dry weight percentages must be 60 to 90 percent sand, with less than 20 percent passing the No.200 sieve, less than 5 percent clay, and no gravel.

CONSTRUCTION

Comply with Section 20-3.02, "Preparation," of the Standard Specifications.

Place imported biofiltration soil in lifts 8 to 12 inches. Lifts are not to be compacted.

MEASUREMENT AND PAYMENT

Imported biofiltration soil is measured by the cubic yard.

The contract price paid per cubic yard for imported biofiltration soil includes full compensation for furnishing all labor, materials, tools, equipment, incidentals, and for doing all the work involved in imported biofiltration soil, including testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER 10/3/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL STATE OF CALIFORNIA

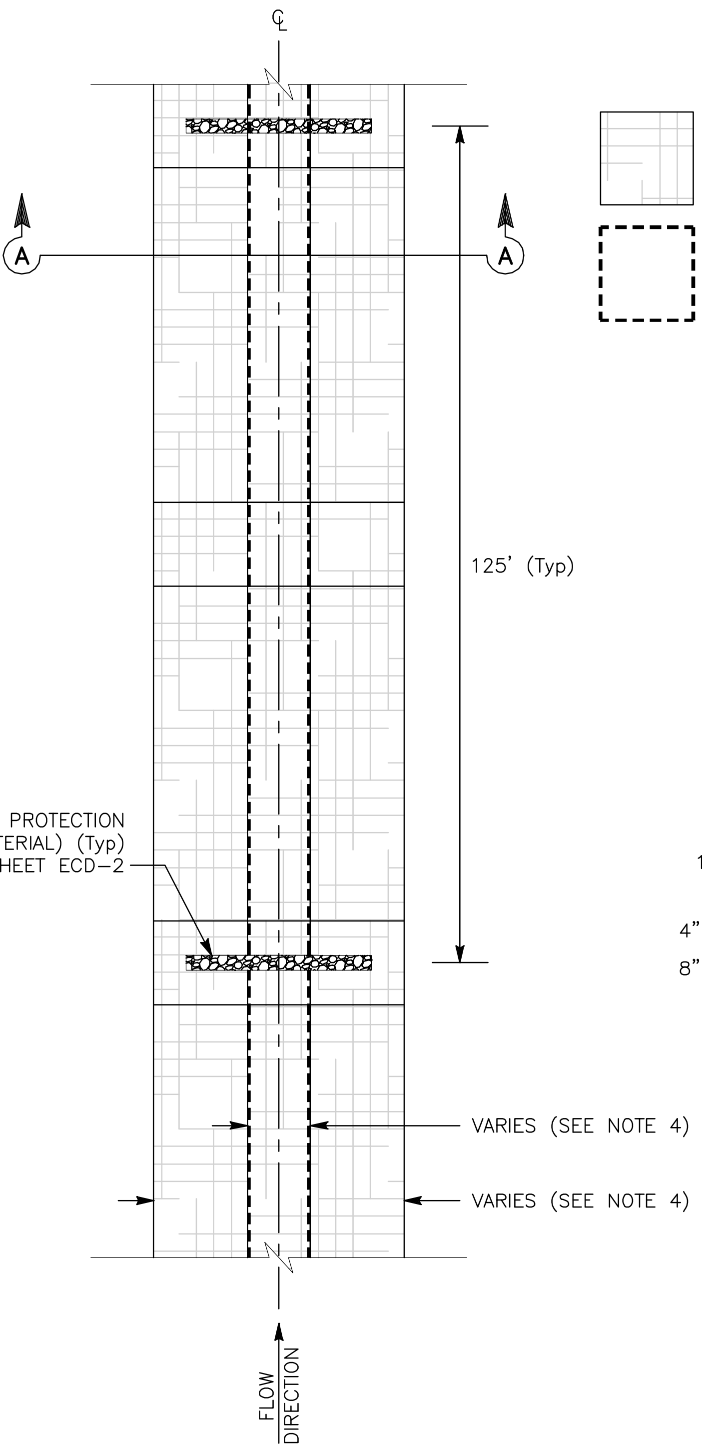
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

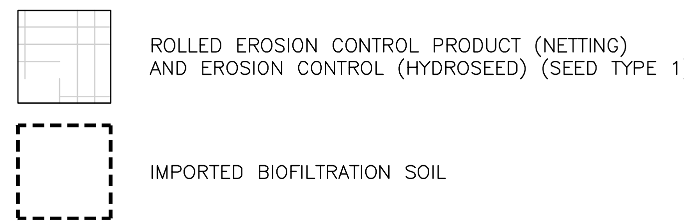
NOTES:

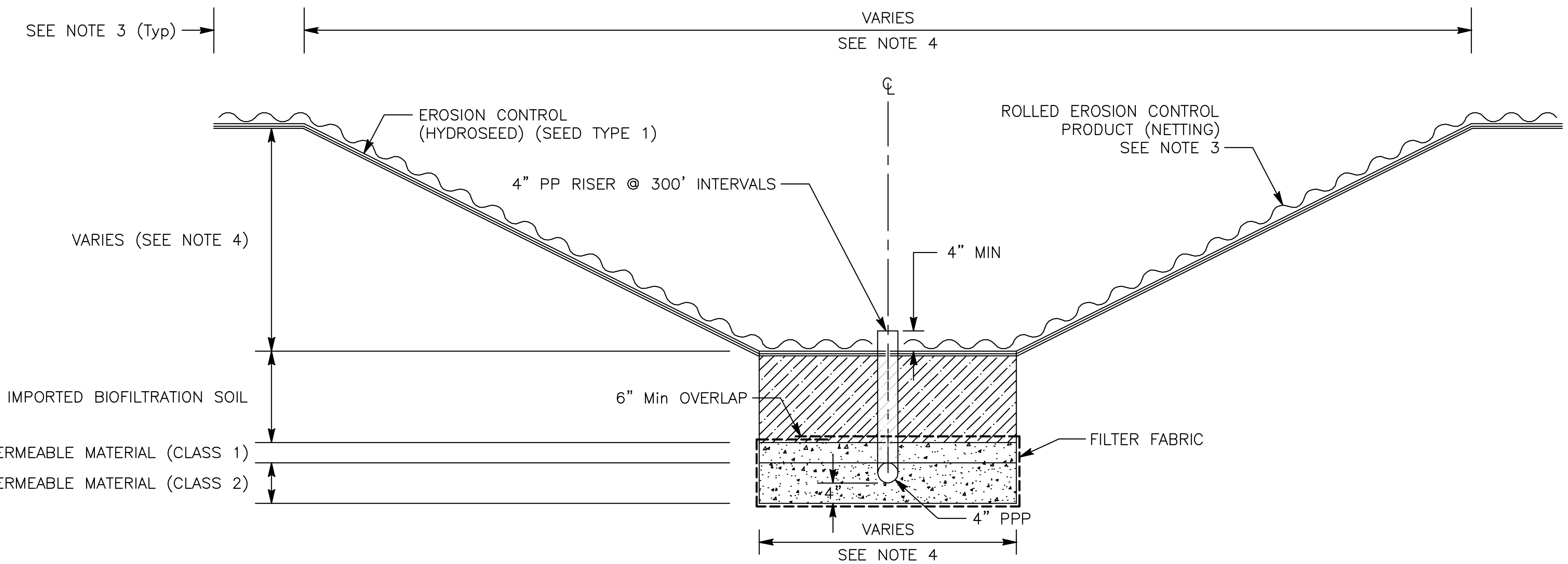
1. DIMENSIONS MAY VARY TO FIT ACTUAL FIELD CONDITIONS.
2. BEGINNING AND END OF BIORETENTION SWALES MAY VARY. EXACT DIMENSIONS SHALL BE DETERMINED BY THE ENGINEER.
3. WHERE ROLLED EROSION CONTROL PRODUCT (NETTING) IS PROPOSED, INSTALLATIONS SHALL CONFORM TO MANUFACTURER'S SPECIFICATIONS AND THE SPECIAL PROVISIONS.
4. FOR LINEAR BIORETENTION SWALE DIMENSIONS, SEE DRAINAGE SHEET DD-5.
5. FOR PERFORATED PLASTIC PIPE (PPP) AND PLASTIC PIPE (PP) QUANTITIES, SEE DRAINAGE QUANTITIES SHEETS.



PLAN

TYPICAL LINEAR BIORETENTION SWALE





SECTION A-A

LINEAR BIORETENTION SWALE

EROSION CONTROL DETAILS

NO SCALE

ECD-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR	NATALINA V. BERNARDI
CALCULATED-DESIGNED BY	SHERWIN MANALO
CHECKED BY	GORDON SWEET
REVISED BY	SM
DATE REVISED	10/3/11

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 6:32 pm

LAST REVISION 10-3-11

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

NOTES:

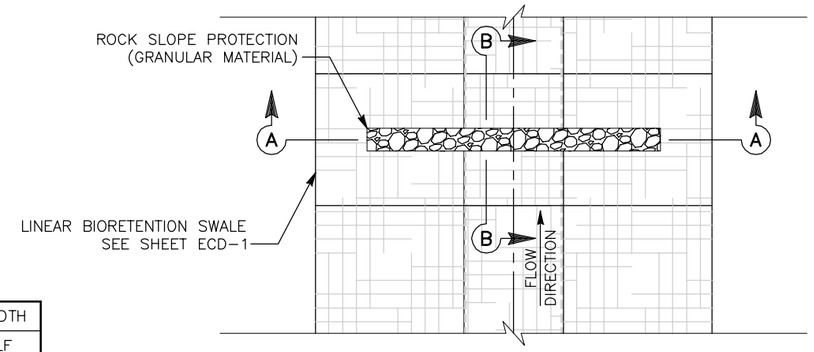
1. WIDTH OF GRAVEL BERM SHALL BE THE LENGTH REQUIRED TO ACHIEVE A MININMUM HEIGHT OF 4.5" FROM THE BOTTOM OF THE SWALE.
2. DIMENSIONS MAY VARY TO FIT ACTUAL FIELD CONDITIONS.
3. ROCK SLOPE PROTECTION (GRANULAR MATERIAL) SHALL BE 7-INCH THICK COBBLE. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.
4. ROCK SLOPE PROTECTION (GRANULAR MATERIAL) SHALL BE KEYED IN A MINIMUM OF 3 INCHES BELOW SWALE SURFACE.
5. FOR LINEAR BIORETENTION SWALE DIMENSIONS, SEE DRAINAGE SHEETS DD-5.
6. STATION LIMITS ARE APPROXIMATE AND MAY VARY TO FIT ACTUAL FIELD CONDITIONS.
7. SEE TYPICAL CROSS SECTIONS AND LAYOUT SHEETS FOR MORE INFORMATION.

STATION LIMITS*	WIDTH LF
"FR1" 227+37.18 Rt TO "FR1" 244+47.66 Rt	8.0
"FR1" 245+08.81 Rt TO "FR1" 245+89.09 Rt	8.0
"FR1" 246+07.41 Rt TO "FR1" 266+19.52 Rt	8.0
"FR1" 266+80.48 Rt TO "FR1" 279+99.17 Rt	8.0
"FR1" 279+99.17 Lt TO "FR1" 281+58.97 Lt	8.0
"FR1" 281+02.62 Rt TO "FR1" 281+56.97 Rt	8.0
"BK" 280+57.32 Rt TO "BK" 293+32.59 Rt	5.0
"BK" 293+64.47 Rt TO "BK" 304+58.75 Rt	5.0
"FR2" 299+46.03 Lt TO "FR2" 305+01.29 Lt	15.0
"FR2" 305+38.31 Lt TO "FR2" 324+58.51 Lt	15.0
"FR2" 324+58.51 Rt TO "FR2" 329+75.70 Rt	15.0
"FR2" 329+58.14 Lt TO "FR2" 330+08.96 Lt	15.0
"N2R" 327+30.69 Rt TO "RL1" 335+00.00 Rt	15.0
"N2R" 339+52.58 Rt TO "N2R" 340+89.15 Rt	15.0
"N2R" 407+50.00 Lt TO "N2R" 411+49.95 Lt	15.0

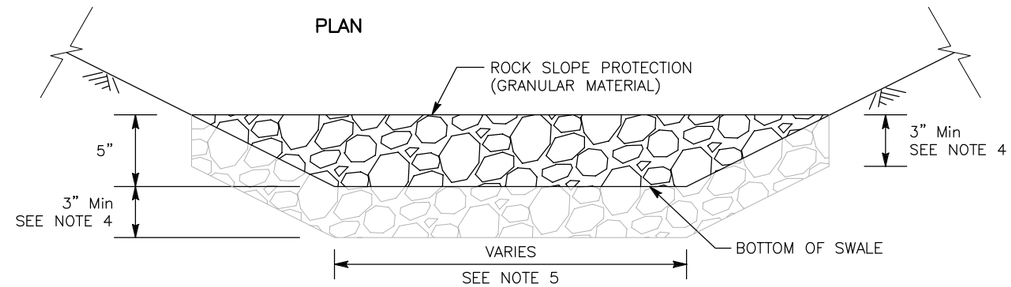
* SEE NOTE 6.

STATION LIMITS*	WIDTH LF
"N2R" 321+89.92 Rt TO "RL1" 334+68.42 Rt	15.0
"RLF" 340+85.00 Rt TO "RL3" 340+34.71 Rt	15.0
"RLF" 340+85.00 Lt TO "RLF" 341+55.69 Lt	15.0
"RLF" 342+02.85 Rt TO "RLF" 346+35.53 Rt	15.0
"RLF" 346+35.53 Rt TO "RLF" 356+19.44 Rt	12.0
"RLF" 363+00.00 Lt TO "RLF" 365+25.00 Lt	11.0
"RLF" 366+75.00 Lt TO "RLF" 372+62.93 Lt	12.0
"RLF" 373+62.97 Lt TO "RLF" 378+00.28 Lt	12.0
"RLF" 378+84.28 Lt TO "RLF" 392+45.07 Lt	13.0
"RLF" 394+23.62 Lt TO "RLF" 398+04.38 Lt	13.0
"RLF" 398+98.23 Lt TO "RLF" 413+49.91 Lt	12.0
"RL3" 340+34.71 Lt TO "RL3" 345+00.00 Lt	15.0
"RL4" 332+96.22 Lt TO "RL4" 334+87.25 Lt	15.0

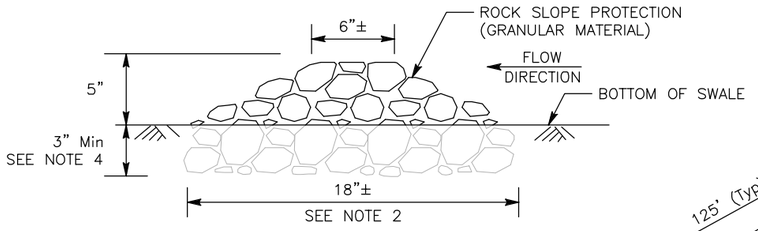
* SEE NOTE 6.



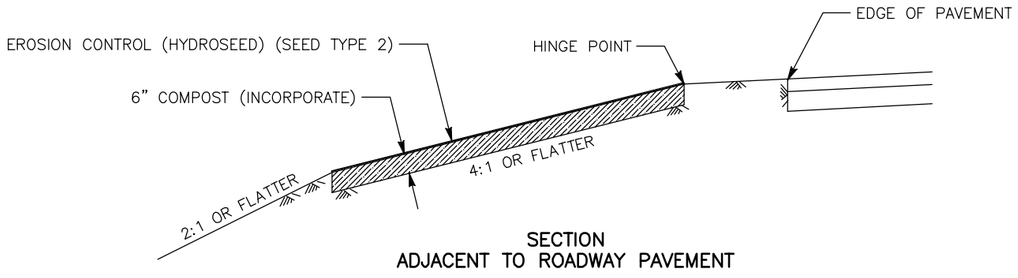
PLAN



SECTION A-A

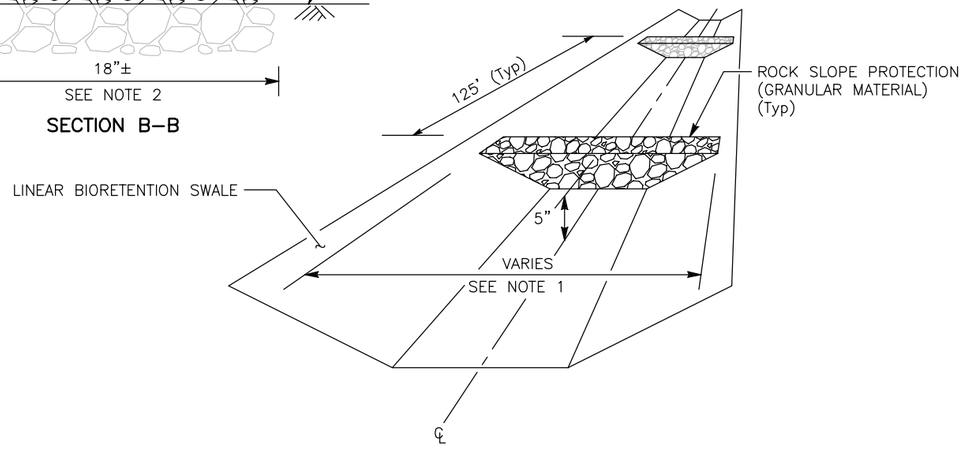


SECTION B-B



SECTION
ADJACENT TO ROADWAY PAVEMENT

BIOFILTRATION STRIP



PERSPECTIVE

ROCK SLOPE PROTECTION (GRANULAR MATERIAL)

EROSION CONTROL DETAILS

NO SCALE

ECD-2

REVISED BY	DATE REVISED
SM	10/3/11

CALCULATED-DESIGNED BY: SHERWIN MANALO
CHECKED BY: GORDON SWEET
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

P:\Proj\BKF\07003\DWG\SHEETS\EROSION CONTROL\ECD-02.dwg 07 Oct 2011 6:33:44pm mana

LAST REVISION 10-3-11 — DATE PLOTTED => Oct 07 2011 — TIME PLOTTED => 6:33 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Attachment B

Tolay Creek Mitigation Site Map

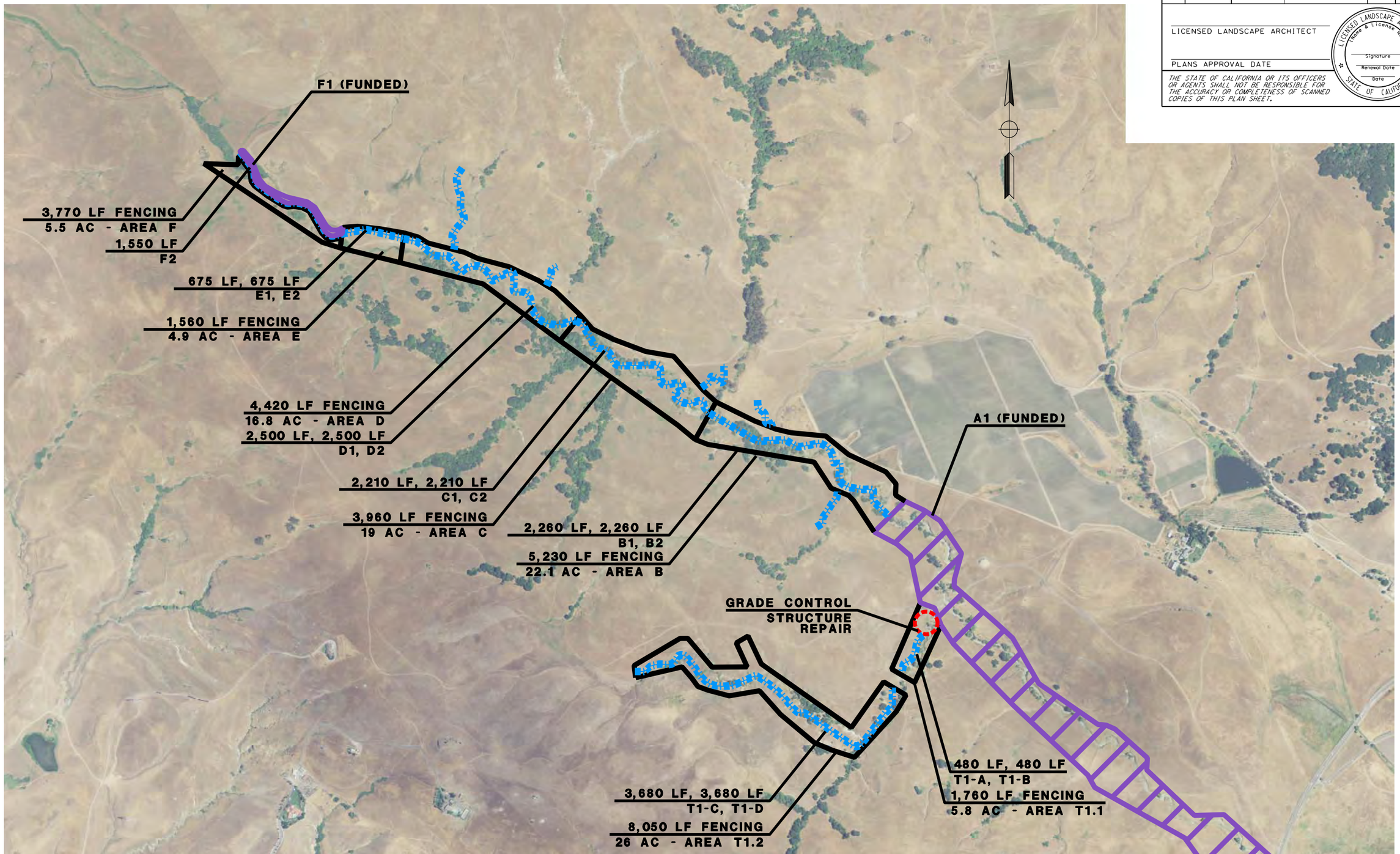
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

LICENSED LANDSCAPE ARCHITECT

PLANS APPROVAL DATE

LICENSED LANDSCAPE ARCHITECT (Name & License No.) Signature Renewal Date Date STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.



TOLAY CREEK & TRIBUTARY MITIGATION COUNT

0 500 1000 1500

SCALE: 1" = 500'

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

SENIOR LANDSCAPE ARCHITECT

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

02-29-12

USERNAME => $USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 00000000001

Tolay Creek Ranch2.dgn 2/29/2012 1:49:59 PM

4. USFWS Biological Opinion (BO)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
81420-2008-F-1619-4

APR 0 1 2009

Mr. Walter C. Waidelich Jr.
Federal Highway Administration
U. S. Department of Transportation
650 Capitol Mall, Suite 4-100
Sacramento, California 95814

Subject: Biological Opinion for the State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle Widening Project, Marin and Sonoma Counties, California (Caltrans EA 264000) on the Threatened California Red-legged Frog and the Endangered Salt Marsh Harvest Mouse

Dear Mr. Waidelich:

This is in response to your June 18, 2008, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle Widening Project, Marin and Sonoma Counties, California. Your request was received in this office via an electronic mail message on June 24, 2008, and included the request for formal consultation on the threatened California red-legged frog (*Rana aurora draytonii*) and the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*). This document represents the Service's biological opinion on the effects of the proposed action on this listed species. This document is issued under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act).

Protocol level surveys have not been completed in the action area due to scheduling issues and access problems for the soft bird's beak (*Cordylanthus mollis* ssp. *mollis*), endangered Baker's larkspur (*Delphinium bakeri*), endangered Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*), endangered showy Indian clover (*Trifolium amoenum*), and endangered Contra Costa goldfields (*Lasthenia conjugens*). Suitable habitat is located within the action area for all of these listed plants. At this time, based on the preliminary and incomplete information provided to the Service, we concur that the proposed project may affect, but is not likely to adversely affect these five listed plant species. At a meeting with the Service on June 5, 2008, and in a letter to the Service dated June 18, 2008, the Federal Highway Administration (FHWA) stated that they will complete protocol level surveys within the action area for all of these listed

species prior to groundbreaking and reinitiate consultation pursuant to section 7 if any or all of these taxa are found, with the understanding that the presence of any or all of these plants could lead to additional conservation measures that will be determined in conjunction with the Service, project delays, project redesign, or other significant effects on the State Route 101 Marin Sonoma Narrows project.

Based on our current knowledge regarding their distribution we have determined the proposed action is not likely to adversely affect the endangered Sebastopol meadowfoam (*Limnanthes vinculans*, endangered Sonoma County Distinct Population Segment of the California tiger salamander (*Ambystoma californiense*), or the endangered California clapper rail (*Rallus longirostris obsoletus*) due to lack of appropriate habitat in the action area.

This biological opinion is based on: (1) May 2008 Biological Assessment; (2) June 19, 2008, field review; (3) additional project information provided by the California Department of Transportation (Caltrans) on August 27, 2008; (4) miscellaneous correspondence and electronic mail concerning the proposed action between the Service and Caltrans, the Transportation Authority of Marin, and the Sonoma County Transportation Authority; and (5) other information available to the Service.

Consultation History

April 21, 2008	The Service received a letter dated April 17, 2008, regarding a tentative meeting agenda and information on a proposed Least Environmentally Damaging Preferred Alternative for the Marin-Sonoma Narrows Project.
June 2, 2008	The Service received a letter dated May 30, 2008, providing a summary of the May 7, 2008, meeting to discuss the proposed Least Environmentally Damaging Preferred Alternative for the Marin-Sonoma Narrows Project.
June 5, 2008	The Service received an advance copy of the Biological Assessment for the proposed State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle (HOV) Widening Project, Marin and Sonoma Counties, California, at a meeting with the FHWA and Caltrans. In the Biological Assessment, Caltrans determined that the proposed project *is likely to adversely affect* Burke's goldfields, Sonoma alopecurus, Contra Costa goldfields, Sebastopol meadowfoam, California red-legged frog, and the salt marsh harvest mouse; but *will not affect* the soft bird's beak, showy Indian clover, California tiger salamander, or the California clapper rail. The Service recommended that FHWA and Caltrans revise their current determinations to a *no effect* for the Sebastopol meadowfoam and a *may affect, not likely to adversely affect* for the five remaining listed plant species given their commitment to reinitiate consultation following completion of protocol surveys for these species within suitable habitat

within the action area prior to construction. The Service also recommended that FHWA/Caltrans consider the presence of upland and aquatic habitat for California red-legged frog on the east side of State Route 101. This was based on the existing east-west connectivity provided by culverts and bridge crossings under State Route 101, particularly in Segment B. During the meeting Caltrans requested that the biological opinion first be issued as a draft for their review.

June 19, 2008 — The Service attended a field review of the project with Caltrans, the Transportation Authority of Marin (TAM), the Sonoma County Transportation Authority (SCTA), and their consultants. Following the field review, the Service met with Caltrans, TAM, and SCTA to summarize the information requests that arose during the visit. The information requests were primarily associated with the need for more complete project description for activities at creek and river crossings.

June 24, 2008 — The Service received a letter dated June 18, 2008, from the Federal Highway Administration (FHWA) requesting formal consultation for the proposed State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle (HOV) Widening Project, Marin and Sonoma Counties, California. The letter was received via an electronic mail message. In the letter, FHWA requested formal consultation on the threatened California red-legged frog, the endangered salt marsh harvest mouse, and seven listed plants. It was noted in the letter that FHWA was requesting formal consultation on seven listed plants due to their incomplete plant surveys of the action area. FHWA also outlined their plan to reinitiate consultation on the individual listed plants following the completion of additional protocol plant surveys within the action area prior to ground disturbing activities.

June 25, 2008 — The Service sent FHWA a request for additional information to adequately review the determination of the effects of the project on listed species (Service File: 81420-2008-I-1619-1). The information requested primarily focused on the need for additional project description information, particularly for those activities associated with drainage crossings. Other issues of particular focus included: the effects to salt marsh harvest mouse potential habitat under the Petaluma River Bridge; the acknowledgement of California red-legged frog habitat on the east side of State Route 101 in Segment B; the potential for California red-legged frog to occur in the more urban drainages of Segments A and C; appropriate compensation ratios to offset effects; and the previously mentioned recommended listed plant species determinations.

August 7, 2008	The Service received additional information dated August 5, 2008, from Caltrans in response to the June 25, 2008, information request and questions asked during the June 19, 2008, field visit. Of note, the Caltrans letter revised the California red-legged frog effects acreage to 206.94 acres (203.78 acres of permanent effects and 3.16 acres of temporary effects) and FHWA and Caltrans revised their effects determination for the Sebastopol meadowfoam to "no effect." Caltrans also revised their determination for soft bird's beak, Baker's larkspur, Sonoma alopecurus, and Contra Costa goldfields to a "may affect, not likely to adversely affect." Caltrans committed to completing protocol level surveys for these four listed plants within the action area prior to construction. FHWA will reinitiate consultation with the Service if a listed species is found in the action area or could otherwise be affected by the project.
August 13, 2008	The Service received a revised project description from Caltrans developed for the formal consultation process with the National Marine Fisheries Service via an electronic mail message.
August 27, 2008	The Service received a revised a complete project description from Caltrans via an electronic mail message.
August 29, 2008	The Service issued a draft biological opinion (file # 81420-2008-F-1619-2).
September 16, 2008	The Service met with FHWA, Caltrans, TAM, and SCTA to discuss the draft biological opinion.
September 19, 2008	The Service received additional project information, comments on the draft biological opinion, and September 16, 2008, meeting notes from Caltrans via an electronic mail message.
September 24, 2008	The Service received elevation contours for action area near the Petaluma Bridge from Caltrans via an electronic mail message.
September 26, 2008	The Service received comments on the draft biological opinion from FHWA.
October 9, 2008	The Service met representatives from Caltrans and CDFG to discuss the proposed geotechnical borings for the Petaluma Bridge portion of the proposed action.
December 2, 2008	The Service received project description information from Caltrans for the proposed geotechnical borings for the Petaluma Bridge portion of the

proposed action via an electronic mail message. A hardcopy of the information was received on December 3, 2008.

December 10, 2008 The Service received an electronic message from Caltrans outlining the proposed compensation language for the biological assessment. The statement proposed the fulfillment of appropriate California red-legged frog compensation through either purchase of credits at a conservation bank, establishment of a conservation easement, or fee title habitat acquisition. As stated in the message, a conservation easement would include a management plan and endowment. Caltrans referenced the Lawson's Landing property as a potential site for compensation through purchase on a conservation easement.

December 11, 2008 The Service received additional project description information from FHWA for the proposed geotechnical borings for the Petaluma Bridge portion of the proposed action and other outstanding Service information requests via an electronic mail message.

December 15, 2008 The Service received a map depicting the mean high water limits in the Petaluma River Bridge portion of the action area attached to an electronic mail message. This map was sent in response to the Service's request for information regarding available upland refuge for the salt marsh harvest mouse during high water events.

December 22, 2008 The Service issued a second draft of the biological opinion (file # 81420-2008-F-1619-3).

December 22, 2008 The Service issued a second draft of the biological opinion (file # 81420-2008-F-1619-3).

December 10, 2009 The Service received comments from Caltrans regarding the second draft of the biological opinion. The comments were attached to an electronic mail message as an undated letter that represented the consolidated comments of the SCTA, TAM, FHWA, and Caltrans.

March 5, 2009 The Service met with Caltrans and FHWA to discuss the second draft of the biological opinion (file # 81420-2008-F-1619-3).

March 27, 2009 The Service received additional information from Caltrans regarding proposed project scheduling and compensation phasing via an electronic message. The correspondence also included language related to contractor actions and compliance with the Act.

March 31, 2009 The Service received project description revisions and requested terms and conditions revisions from Caltrans via an electronic mail message.

BIOLOGICAL OPINION

Description of the Proposed Action

FHWA and Caltrans propose to construct HOV lanes on State Route 101 from just south of State Route 37 in the City of Novato to just north of Corona Road in the City of Petaluma. These transportation improvements also will include construction and modification of interchanges as well as the establishment of a new frontage road. According to Caltrans, the project is intended to reduce congestion and improve mobility while providing an incentive for commuters to use buses, carpools, or vanpools for peak period travel, and to improve freeway operations including providing safe access to and from State Route 101. The project will be referred to in the remainder of this biological opinion as the Marin-Sonoma Narrows Project.

Caltrans is in the process of developing bridge designs for the Marin-Sonoma Narrows Project and not all of the project description has been fully developed. According to the May 2008, Biological Assessment, additional design engineering will be completed for Segments B and C when funding becomes available for those segments. FHWA will reinitiate consultation with the Service if the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in this project description.

Construction Schedule and Funding

The proposed project is divided into three project segments (A, B, and C) that are further divided into sub-segments (such as A1 and B2). The overall project will be completed in two primary construction phases. Construction Phase 1 will include segments A1, B2, and B3. Construction Phase 2 will include all remaining project segments.

Construction in Phase 1 is scheduled to begin in Fiscal Year 2010/2011 (between July 1, 2010, and June 30, 2011). Construction in Phase 2 is scheduled to begin in Fiscal Year 2014/2015 (between July 1, 2014, and June 30, 2015).

The activities associated with the sub-segments are described as follows:

1. A1 consists of constructing approximately 1.5 miles of the southbound HOV lane between State Route 37 and Rowland Boulevard in Novato (Segment A), and approximately 4 miles of the northbound HOV lane between State Route 37 and Atherton Avenue in Segments A and B.

2. B1 consists of converting the existing Redwood Landfill overcrossing to a full interchange, including the construction of associated frontage roads in Segment B.

3. B2 consists of constructing a new Petaluma Boulevard South interchange including associated frontage roads in Segment B.

4. B3 is fully funded as well and consists of constructing a new mainline bridge at San Antonio Creek in Segment B. This segment would shift US-101 traffic to the west and allow the existing highway to be converted to a frontage road.

5. B4, not yet fully funded, would replace the Petaluma River bridges in Segment B and northbound State Route 116 bridge in Segment C. The southbound State Route 116 bridge, also in Segment C, would be widened as part of this phase.

Additional sub-phases are contemplated and will be defined and advanced as funding is identified.

Two upland and two aquatic geotechnical investigation bores under the Petaluma River Bridge will likely occur prior to construction of the three project segments. The bores are expected to be completed in approximately one week. Scheduling will be weather dependent to avoid boring activities and access of equipment in and out of the action area during rain and when the ground is wet. Additional borings will be accessed from the State Route 101 median and performed in areas that are not identified as listed species habitat or having the potential to adversely affect listed species.

Project Components

Caltrans has divided the approximately 16.1 mile long Marin-Sonoma Narrows Project into three segments, based on the activities occurring in each distinct segment and the construction schedule. The segments are labeled from south to north as A, B, and C. Segments A and C consist of the existing freeway in the cities of Novato and Petaluma, respectively. Segment B is the existing expressway between the two cities. The project activities are discussed by segment as follows. Caltrans has characterized the planned activities in each segment as those that will and will not affect aquatic habitat for listed species.

Segment A

HOV Lane Construction. The existing Segment A includes the existing State Route 101 roadway from State Route 101/State Route 37 Interchange and north of the Atherton Avenue Interchange through the City of Novato. The existing Segment A roadway consists of six 12-foot wide lanes (three in each direction) with 10 foot outside shoulders and 5 foot inside shoulders. The existing non-paved median between the opposite lanes of travel vary in width from 28 to 45 feet and include a double thrie-beam barrier.

According to Caltrans, the majority of the existing drainage features in the existing roadway right-of-way will remain with only minor modifications due to a lack of drainage issues.

Caltrans proposes to widen the Segment A roadway by adding a new HOV lane to each direction of travel. These new 12 foot lanes will be added to the median and will separated by a concrete barrier and varying-width inside shoulders. The new median width from the start of the project to the Atherton Avenue interchange will vary between 22 to 28 feet and will be paved. The median between the Atherton Avenue interchange and Olompali State Historic Park will vary between 28 to 44 feet with 10 foot minimum paved shoulders with the remainder unpaved.

To construct the HOV lanes, heavy equipment would be used to excavate the existing material to sub-grade for the proposed structural section. Excavated material would be tested for the presence of aerially deposited lead (ADL) and if high levels are found, Caltrans would require that the material be handled in compliance with state and federal requirements. According to an August 5, 2008 letter from Caltrans, recycled roadbed material will only be placed on areas that are classified as permanently disturbed by project activities, including material that will be used as fill or base material under the roadway. Material that exceeds the threshold for re-use would be hauled off-site to a Service-approved and/or Type 1 facility. Existing soil under the existing roadway will be used as fill. Temporary impact areas will not have stockpiles.

According to their August 5, 2008 letter, Caltrans would not place any stockpiles of material containing ADL near any sources of run-off. The contractor will place and cover stockpiles of ADL material on 0.33 millimeter thickness plastic sheeting. These stockpiles would not be placed in environmentally sensitive areas and in addition to be covered with plastic, they piles would be surrounded by either hay bales or wattles to protect them from runoff.

Dump or haul trucks would transport borrow and aggregate materials for placement and compaction. Water trucks would spray water on excavated material to maintain control of dust. Sub-base and base material would be compacted and leveled using vibratory rollers and other standard compacting equipment. Aggregate material would be placed in multiple lifts set at a maximum depth of 0.5 feet. The concrete median barrier would be placed via a concrete slip form machine. Asphalt concrete material would be hauled onto the site, and the asphalt would then be spread with a paving machine and rolled with a roller for compaction.

Sub-Grade Correction at the Rowland Interchange. According to Caltrans the existing sub-grade at the Rowland Interchange is failing due to poor soil conditions created by soft clay (Bay Mud) that is not able to support the existing roadbed.

Caltrans plans to remove 11 feet of existing fill and replace it with a lightweight fill material to stabilize the roadbed.

Caltrans will correct the sub-grade with a two-stage construction operation. Temporary lanes would be constructed to the outside of the mainline and traffic would be shifted. These new temporary lanes would require a temporary realignment of the northbound onramp at the Rowland Interchange. Once traffic is shifted, one half of the mainline would be dug out with excavation equipment and temporary retaining walls would be put in place to shore the excavation. Lightweight fill material would be placed 0.5 foot lifts and compacted with rollers. After the sub-grade has been reached and compacted, base and sub-base aggregates would be trucked and placed in 0.5 foot lifts and compacted with rollers. Asphalt concrete (AC) material would be hauled onto the site and the asphalt will then be spread with an AC paving machine and rolled with a roller for compaction. After the first stage is complete, traffic would be moved over to the median and the same process would be repeated for the outside lanes and shoulders. After the existing fill has been replaced, centerline and roadway edges would be re-striped.

Roadway Resurfacing and Striping. Caltrans plans to repair deteriorated localized sections of the existing pavement and put down an overlay on all of the existing six lanes of pavement to prevent reflective cracking and extend the service life of the roadway by 20 years. The centerline and roadway edges would be re-striped following rehabilitation.

Damaged roadway would be removed with a grinder or excavation equipment. The excavated material would be recycled and reused as embankment material for the fill section, or removed off-site. The dig-out areas would be patched with material and overlayed and striped during the rehabilitation process.

Culvert Improvements. According to Caltrans, the existing roadway drainage is conveyed by a depressed median to drainage inlets at low points in the median. There are thirty-five cross culverts that convey storm water to swales along the outside which then drain to adjacent water courses.

Caltrans proposes to replace the depressed median with new HOV lanes, shoulders, and a median barrier. The new roadway would sheet flow drainage towards the outside shoulders, away from the median. Through mainline horizontal curves when sheet flow drainage is directed towards the median due to super elevation, 27 existing drainage inlets would be reconfigured at the median. Cross culverts that are not needed would be abandoned in place and plugged. Caltrans determined that some of the cross culverts would need to be replaced due to deterioration or the need for a larger culvert.

After new cross-culvert construction has been completed, repaving methodology will be similar to those described for roadway rehabilitation. Existing cross culverts that are to

be abandoned would be capped with concrete at each end or filled with either a concrete slurry or sand.

California Highway Patrol (CHP) Pullouts, HOV Bypass Lanes, Ramp Metering. The addition of HOV Lanes would require the addition of HOV bypass lanes, CHP pullouts and ramp metering.

Caltrans proposes to widen existing on-ramps for HOV bypass lanes, CHP pullouts, and install ramp-metering infrastructure at all four of the existing interchanges in Segment A (State Route 37, Rowland, DeLong, and Atherton). An additional 12 foot lane would be added to the interchange ramps. The CHP pull outs would be 15 feet wide and 100 feet long. The length of the bypass lane will vary by ramp and all on-ramps within the action area would have HOV bypass lanes, CHP pullouts, and ramp-metering infrastructure.

The ramp widening would consist of importing fill material and placing in multiple lifts set at a maximum depth of 0.5 feet. The fill material would then be compacted between lifts until the sub-grade depth is met. Dump or haul trucks would transport aggregate materials for placement and compaction. Asphalt concrete material would be hauled to the site and then spread with an AC paving machine and rolled with a roller for compaction. Before AC is placed, electrical conduit would be trenched and placed for the ramp metering system infrastructure.

Sound Walls. Caltrans plans to erect sound walls at four locations within Segment A. The combined length of the four walls will be 4,770 feet.

The sound wall locations would be cleared and bulldozed to meet finished grade for the sound wall footing. The foundation type would depend on soil type. After the foundation is complete, a pile cap would be formed up with wood forming, steel would be placed within the cap, and concrete would be poured to complete the pile cap. If the sound wall is within 30 feet of the edge of travel way, the sound wall is required to be placed on a concrete protective barrier. Once the pile cap or the concrete barrier is in place, the concrete masonry blocks would be set and mortared to the top of the barrier or pile cap until the wall is complete.

Retaining Walls. Caltrans plans to construct retaining walls to reduce the widening needed to construct additional lanes at three existing ramps (the State Route 101/State Route 37 Southbound Connector, the DeLong Southbound On-Ramp, and the South of Rowland Southbound On-Ramp).

The retaining wall locations would be cleared and excavated with excavation equipment to reach grade for the retaining wall footing. Once grade is met, the footing would be formed, steel would be placed and the concrete would then be poured for the footing.

After the footing is poured, the same process would be used to build the stem wall. After the wall is complete, the excavated material would be backfilled and compacted.

In instances where a retaining wall is included in the design as a means of reducing the project footprint in the vicinity of sensitive resources, the following construction techniques and equipment will be used:

1. Retaining walls with spread footings: This work involves excavating through the existing shoulder backing to the substrate below using excavators and/or backhoes. The retaining walls would be constructed before the shoulder widening takes place and may involve the use of a crane from the roadway.

2. Retaining walls with pile foundations: This work involves constructing a retaining wall foundation which could include driven concrete or steel piles, cast-in-drilled-hole (CIDH) piles, or cast-in-steel shell (CISS) piles. If CIDH or CISS piles are used, a drill auger would be used to remove soil at the piles location.

3. Mechanically Stabilized Earth (MSE) retaining walls: This work involves constructing a retaining wall without a foundation. Precast concrete panels would be placed at the bottom of the wall to create the wall face. Reinforcing steel would connect to the wall panels and extend behind the wall. Fill would be placed in layers on top of the reinforcing steel and compacted in place. This procedure would be repeated until the wall is built up to the elevation of the highway.

If subsurface water is encountered during the drilling or excavation, the excavation will be de-watered under the direction of their Best Managmeent Practices (BMPs) of the Storm Water Pollution Prevention Plan (SWPPP). Residues may include aerially deposited lead material. If the residue exceeds the level of lead standards, the material would be deposited off-site at an approved location.

Structures. According to Caltrans, roadway widening would require modification to existing structures such as railing, sound walls, deck treatment, and bridges. Caltrans describes the proposed bridge work as follows.

> *Novato Creek Bridge*. There are two existing Novato Creek Bridges that are only wide enough to accommodate the three lanes of north or southbound traffic plus 5 foot inside shoulders and 8 to 10 foot outside shoulders. Both of the existing 192 foot long structures were built in 1974 and consist of a five-span continuous reinforced concrete T-beam superstructures on 18 inch +/- octagonal pre-stressed concrete pile bents (total 44 octagonal bent piles) and diaphragm type abutments on reinforced concrete piles.

Caltrans proposes to widen and connect the Novato Creek Bridges in the median to allow for the two HOV lanes and 10 foot shoulders. It is also proposed to replace the existing bridge barriers with current standard barriers. The widening of the existing bridges would include the construction of a new cast-in-place reinforced concrete T-beam superstructure, including new concrete bent caps and abutments. The substructure would consist of Class 140 driven pre-cast concrete piles at the abutments and driven CISS piles at the bents. The location and bearing for the new abutments and bents would match with the alignments of the existing abutments and bents. It is anticipated that four-2 foot diameter new CISS piles would be required per bent for a total of 16 piles for the 4 bents.

Caltrans would widen the Novato Creek Bridges by constructing and connecting the right and left parallel bridge structures to the median side of each of the existing bridge structures and closing the median gap. The existing bridge barrier would be replaced with current standard barriers. A portion of the existing overhang in the median would be removed. Access to the existing channel would be required for construction. (In Phase A1, the existing northbound structure would be widened to provide for the northbound HOV lane and shoulders. The complete widening and the ultimate connection of the northbound and southbound structures will not be completed until a future project phase.)

The construction of the CISS piles would likely include driving down the steel pipe pile into ground, removing the soil inside the steel pile, inserting bar reinforcing steel (rebar cages) into the steel pipe and filling the remaining void inside the steel pipe with concrete using a concrete pump truck. The piles would extend into the superstructure.

Existing pilings that need to be removed during construction or demolition (e.g. those in conflict with new bridge or falsework) would be removed by commonly practiced methods. These include pulling by crane or through use of vibratory methods. It may also be possible that some existing pilings can be left in place and cut off below ground.

According to Caltrans, temporary supports also known as falsework would be required to construct the superstructure. The falsework is used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc). According to Caltrans, the falsework system usually consists of a series of falsework bents placed in the creek at certain intervals with steel beams (falsework stringers) spanning across the falsework bents. Plywood deckings are then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing the superstructure. The falsework bents may be constructed using braced steel or timber posts supported on timber pads placed on top of existing ground or supported on timber

or steel piles driven into the ground depending on the bearing capacity of the soil. Falsework piles may be completely removed or cut below the ground elevation and left in place.

Types of hammers used in piling installation would conform to Caltrans Standard Specifications (49-1.05). Impact hammers would be steam, hydraulic, air or diesel hammers sufficient to drive piles at a penetrations rate of not less than 1/8 inches per blow at the specified nominal resistance. Vibratory hammers would not be used for installation of permanent piles unless shown on the plans or specified in the special provisions. Caltrans might use vibratory hammers to install shoring, coffer dam or falsework piles unless otherwise restricted in the Contract Special Provisions or as listed in permits.

Once the falsework is complete the reinforced concrete T-beam superstructure would be constructed. After completion of the structure, all temporary falsework material would be removed, the creek banks would be stabilized and erosion control BMP's would be placed.

The Novato Creek Bridge work will be located approximately 28 meters east of potential salt marsh harvest mouse habitat. In their August 5, 2008 letter, Caltrans maintained that the bridge work will be accessed from the opposite side of the existing bridge and this pickleweed habitat would be effectively avoided.

Storm Water Quality Systems and Construction Site BMPs. The proposed project would incorporate bio-filtration strips, swales, and Austin sand filters to receive storm water discharges from the highway or other impervious surfaces. The project will also likely include off-site storm water treatment.

Bio-filtration strips would be located at the base of fill slopes and graded to flow perpendicular to the mainline. Bio-filtration swales would also be located at the base of fill slope and convey water parallel with the main line. Swales would be a graded trapezoidal channel with side slopes of 4:1 or flatter.

Bio-filtration strips and swales have the same means of construction. A backhoe and excavator would be used to excavate and set grade for the channel. After the channel is graded, it would be planted with a vegetative species that has filtration properties.

An Austin sand filter is a two-chamber device with the first chamber used to settle out larger sediment and meter flow into the second chamber. The second chamber is a sand media filter that removes the finer particulates from the influent. The treated effluent is then discharged back into the drainage system.

Construction Site BMPs. To maintain water quality during construction, Caltrans would implement BMPs to reduce unnecessary water quality impacts. The following methods and practices would be implemented:

1. Earth dikes/drainage swales and lined ditches
2. Outlet protection/velocity dissipation devices
3. Check dams
4. Silt fencing with maintenance openings
5. Fiber rolls
6. Concrete washouts
7. Drainage inlet protection
8. Construction entrance/exit protection

Staging Locations. Staging locations would be used for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices. The primary staging area in Segment A would be located within the interchange at the South Novato overcrossing. According the Caltrans project description, areas that are located within the State Right-of-Way and quantified as within the project area of effect may also be used, subject to approval of the contractor submitted SWPPP. Contractors may independently seek off-site staging locations. Off-site staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

Segment B

Nonstandard Shoulders, Vertical and Horizontal Curves. The existing State Route 101 roadway in Segment B is a four-lane expressway with two 12 foot wide lanes in each direction. Most of the existing roadway in this segment does not meet current horizontal alignment, vertical profile and sight distance requirements for the 70 mile per hour corridor design speed. The shoulders are variable width, with the outside shoulders varying from 5 to 8 feet and the inside shoulders varying from 2 to 4 feet. The non-paved median varies in width from 11 to 51 feet and contains a double thrie-beam barrier.

Caltrans plans to improve the Segment B roadway design by upgrading the existing nonstandard shoulders, constructing a HOV lane in each direction, and bringing vertical and horizontal curves to current standards. The proposed project design would include 10 foot shoulders with a concrete median barrier. Nonstandard vertical and horizontal curves would be brought to current standards to meet stopping sight distance requirements. Within the concrete medians, Type S barriers for wildlife crossing would be installed every 20 feet and Type M wildlife crossings would be installed every 0.25 miles. Type S barriers are a type 60 concrete barrier with a 6 inch diameter opening at the base of the barrier for small animal passage. Type M wildlife crossings are a type 60

concrete barrier with a 2-foot break in the barrier, with the break protected by a thrie-beam guard rail to deflect vehicle traffic.

Caltrans proposes to realign the roadway mainline to correct vertical and horizontal curves throughout Segment B.

The proposed horizontal alignment would shift from the existing alignment throughout Segment B to correct nonstandard curves. Approximately 75% of the existing alignment would be reconstructed with a new structural section. The additional 25% of Segment B would utilize the existing roadway alignment and would be widened in the median for HOV lanes and shoulders.

According to Caltrans, the proposed vertical alignment would correct nonstandard curves. The locations of the profile corrections are from approximately 229 feet south of the Redwood Landfill OC to approximately 3280 feet north of the OC; from approximately 656 feet south of San Antonio Creek to Gambini Road, and from South Kastania Road to the Petaluma River Bridge. Through these areas the proposed profile would shift the new roadway up to 28 feet above or up to 24 feet below the existing roadway.

Due to the rolling terrain in Segment B, Caltrans will use two methods for the construction of the proposed roadway realignment. When the alignment is shifted through a hillside, material would be cut from the hillside until finished grade is met. Typical equipment to be used for this method would include excavators, bulldozers, earth movers, and compaction equipment. Excess fill cut from other locations within the project would be used in areas where the roadway needs to be built up. This material would either be hauled in by trucks for long hauls, or from earth moving equipment for short hauls. Once the fill material is hauled in, it will be placed in multiple lifts set at a maximum depth of 0.5 feet. Fill material would then be compacted between lifts until the sub-grade depth is met. Dump or haul trucks would then transport aggregate materials for placement and compaction. Asphalt concrete material will be hauled to the site and then spread with an AC paving machine and rolled with a roller for compaction.

Upgrade Expressway to Freeway with the Addition of Frontage Roads. Residents, ranches, and other land uses are only directly accessible off of State Route 101 in Segment B. There are currently 31 driveways and seven at-grade intersections that connect directly to State Route 101. Also in Segment B there is no other north-south bicycle passage other than on the shoulder of State Route 101. These conditions make the State Route 101 through Segment B an expressway rather than a freeway. Caltrans proposes to upgrade Segment B to a freeway by constructing off-ramps to new frontage roads. Local access and bicycle traffic will be moved to frontage roads or a dedicated bicycle and pedestrian facility.

Therefore the proposed project will convert the existing expressway in Segment B to an access-controlled freeway. Converting the existing expressway would require reconfiguring the existing Landfill Overcrossing into an interchange, reconfiguring the Petaluma Boulevard South interchange, and building a frontage road system to maintain access to intersecting roadways and adjacent parcels, as well as replacing bicycle and pedestrian access. Bicycle access will be moved to frontage roads or a dedicated bicycle and pedestrian facility.

As previously described, due to the rolling terrain in Segment B, Caltrans will use two methods for the construction of the proposed roadway realignment. When the alignment is shifted through a hillside, material would be cut from the hillside until finished grade is met. Typical equipment to be used for this method would include excavators, bulldozers, earth movers, and compaction equipment. Excess fill cut from other locations within the project would be used in areas where the roadway needs to be built up. This material would either be hauled in by dump trucks for long hauls, or from earth moving equipment for short hauls. Once the fill material is hauled in, it will be placed in multiple lifts set at a maximum depth of 0.5 feet. Fill material would then be compacted between lifts until the sub-grade depth is met. Dump or haul trucks would then transport aggregate materials for placement and compaction. Asphalt concrete material will be hauled to the site and then spread with an AC paving machine and rolled with a roller for compaction.

Culvert Improvements. As described for Segment A, existing drainage in Segment B is conveyed by a depressed median to drainage inlets at low points in the median. Cross culverts convey the storm water to swales along the outside which drain to adjacent water courses.

The roadway realignment would replace the depressed median with new HOV lanes, shoulders, and a median barrier. These improvements would cause the sheet flow to drainage towards the outside shoulders, away from the median. Through mainline horizontal curves, where sheet flow drainage is directed towards the median due to super elevation, existing drainage inlets would be reconfigured at the median. Cross culverts that are no longer needed would be abandoned in place.

Caltrans determined that the majority of culverts are still in a state of good repair and function adequately. Some systems will require replacement due to deteriorated conditions or resizing to handle additional flow.

As described for culvert work in Segment A, Caltrans determined that some of the cross culverts would need to be replaced due to deterioration or the need for a larger culvert.

Caltrans plans to abandon unneeded culverts in place. The extension of existing box culverts may require accessing creeks.

According to an August 5, 2008 Caltrans letter, Caltrans is considering adding cross culverts, where feasible, in Segment B specifically to provide wildlife passage under State Route 101.

After new cross-culvert construction has been completed, repaving methodology will be similar to those described for roadway rehabilitation. Existing cross culverts that are to be abandoned would be capped with concrete at each end and filled with either a concrete slurry or sand.

Recurring Flooding and Culvert Improvements. Caltrans plans to replace or upgrade the majority of the drainage facilities through Segment B due to their age, capacity or condition. There are two locations, San Antonio Creek and Gunn Lane, where roadway flooding has been a problem.

Caltrans plans to realign and raise the road profile through San Antonio Creek and near Gunn Lane to alleviate recurring flooding and replace the majority of the existing culvert systems due to the proposed realignment or deteriorated condition. Cross culverts would be sized to pass design-year flows with a minimum diameter of 24 inches for maintenance and approximately 79 new cross culverts will be added.
Caltrans plans to address the flooding issue by building a fill section with a higher profile through the area. This would be constructed using the previously described methods for constructing nonstandard shoulders, vertical and horizontal curves. During construction of the new fill sections, cross-culverts would be placed as the fill section is being built. Existing drainage systems that only require extensions or reconfigurations would be installed as previously described for Segment A.

Retaining Walls. Caltrans plans to construct retaining walls to avoid a historic residence near Kastania Road, trees on the new frontage road at the Landfill Interchange, and salt marsh harvest mouse habitat near the northbound off-ramp at the Petaluma Boulevard, South Interchange.

The retaining walls near Kastania Road and the Landfill Interchange locations would be one of the three types described for Segment A.

The retaining wall near the Landfill Interchange would be a soil nail or tieback retaining structure. Soil would be excavated from the top of the wall down approximately 5 to 10 feet to the first tieback or soil nail location. Horizontal drill equipment would drill holes along the length of the wall and a post tensioned tieback tendons or soil nails would be installed and grouted in place. If post tensioned tiebacks are used, a reinforced concrete whaler would be constructed at the tieback location horizontally across the wall. Tendons would be post tensioned and locked against the concrete whaler. In either case, reinforcing steel would be placed in front of the excavation and shotcrete would be placed against the excavated hillside. If soil nails are used, they would be locked against steel

plates. The hillside would then be excavated to the next tieback or soil nail location and the process would be repeated to reach the bottom of the wall. A reinforced concrete or shotcrete facing would then be constructed to complete the wall.

Utility Relocations. The project design in Segment B would require a significant number of intricate utility relocations. According to Caltrans, the exact location and condition of the existing facilities would not be determined until positive location (potholing) work has been completed. As the designs of these relocations proceed, the remaining service life of the existing individual facilities would be calculated and a cost/benefit analysis would be performed to determine the feasibility of their retention. If retention appears to be the preferred alternative, encroachment exceptions would be requested on a case-by-case basis. Otherwise, the utility will be relocated at a location within the project footprint. Depending on the nature of the utility relocations, FHWA may reinitiate Section 7 consultation to address any additional effects to listed species not described in this biological opinion.

Structures. The proposed project includes modifications to several bridges. Of these, the San Antonio Creek Bridge (mainline), San Antonio Creek Bridge (frontage road), and the Petaluma River Bridge all cross over bodies of water, and are discussed below. Although bridge designs have not been determined, Caltrans stated in their August 5, 2008, letter that the described action area is based on the alternative with the largest footprint.

San Antonio Creek Bridge (mainline). The existing San Antonio Creek Bridges are located within an area of recurring flooding. The new San Antonio Creek Bridge would be built on a realigned portion of State Route 101, west of the existing highway, with a raised profile. The bridge is proposed as a cast-in-place concrete pre-stressed box girder with reinforced concrete bent caps and abutments. The existing northbound structure would be used for a new frontage road creek crossing and the southbound structure would be removed.

Two structure alternatives are proposed for the new bridge. Alternative 1 is a five-span structure, 634.8 feet long by 115.2 feet wide, with 4 columns per bent for a total of 16 columns for the 4 bents. Alternative 2 is a three-span structure, 428.1 feet long by 115.2 feet wide, with 4 columns per bent for a total of 8 columns for the two bents. The bridge layout for Alternative 1 and Alternative 2 are similar except that Alternative 2 includes a Mechanically Stabilized Earth (MSE) wall at abutment 1 which would result in a shorter bridge. The substructure would consist of reinforced concrete columns and abutments supported on a concrete pile cap with driven pre-cast concrete piles. The column size is expected to be approximately 5.5 feet in diameter. Each column footing size is approximately 22 by 22 by 6 feet deep. There would be approximately 25 piles per column footing. The dimensions of the pre-cast concrete pile are approximately 1.24 x 1.24 feet.

It is anticipated that the construction footprint would extend 50feet beyond each side of the edge of bridge deck. Access to the existing channel would be required for construction.

To construct the new bridge, soil at the abutment locations would be re-graded to raise the profile. If Bridge Alternative 2 is selected, the MSE wall would be constructed as the profile is raised at Abutment 1. After the profile is raised at the abutment locations, the precast concrete piles would be driven into the ground. A reinforced concrete footing would be constructed on top of the piles. Then, a reinforced concrete abutment would be constructed on the pile cap.

The contractor would excavate soil at the column footing locations. If water is anticipated at the footing elevations, cofferdams consisting of driven sheet pilings would be construction around the perimeter of the footings. If needed, cofferdams would be approximately 32 by 32 feet per column footing. After cofferdams are placed, soil would be excavated to the footing elevation. The column footing piles would then be driven with an impact hammer. If water is encountered, it would be pumped from the cofferdam to trucks or a sediment basin permitted by the Water Quality Control Board. A lean concrete seal course might be placed to minimize water intrusion. Reinforced concrete pile caps and columns would be constructed at each column footing.

To construct the new superstructure, temporary supports also known as falsework would be required. The falsework is used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc.). The falsework system usually consists of a series of falsework bents placed at certain intervals with steel beams spanning across the falsework bents. Plywood decking is then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing the superstructure. The falsework bents might be constructed using steel or braced timber posts supported on timber pads which have been placed on top of existing ground or steel piles that have been driven into the ground depending on the bearing capacity of the soil. Once the falsework is complete the reinforced concrete box girder superstructure would be constructed. After completion of the structure, all temporary cofferdam and falsework material would be removed, the creek banks would be stabilized and erosion control BMP's would be placed. Falsework piles may be completely removed or cut below the ground elevation and left in place.

Bridge removal work would consist of breaking and removing the existing concrete structure. Over land, the bridge would be dropped in sections onto filter fabric or similar material and removed. Over the creek, the contractor would use approved BMP's to protect the creek from falling debris.

San Antonio Creek Bridge (frontage road). The existing historic San Antonio Creek Bridge on San Antonio Road is approximately 101 feet long and 23 feet wide. According to Caltrans the existing structure is not wide enough to provide two new12 foot-wide lanes and 5 foot wide shoulders and the historic nature of the structure does not allow it to be widened. Therefore Caltrans plans to build a new bridge to cross San Antonio Creek. The existing structure will be re-striped for a one-way bridge and a bike lane.

Two structure alternatives are proposed for the new San Antonio Creek bridge. Alternative 1 is proposed as a cast-in-place concrete slab with reinforced concrete bent caps and abutments. This seven-span bridge is approximately 227.5 feet long and 42 feet wide. The substructure would consist of Class 140 driven precast concrete piles at the abutments and driven cast-in-steel shell piles at the bents. Caltrans anticipates that five 2-foot diameter new CISS piles will be required per pier for a total of thirty for the 6-piers. Alternative 2 is proposed as a cast-in-place concrete pre-stressed box girder with reinforced concrete bent caps and abutments. This new two-span bridge would be approximately 235 feet long and 42 feet wide. The substructure would consist of reinforced concrete columns (total two) approximately 4 feet in diameter and abutments that are supported on a concrete pile cap with driven pre-cast concrete piles. The size of the column footings is approximately 28 by 28 by 6 feet. Each column footing would have approximately 25 driven piles. The size of each pile is approximately 15 x 15 inches.

Caltrans anticipates that the area required for construction activities would extend 50 feet beyond each side of the edge of bridge deck. Access to the existing channel would be required for construction.

To construct the new bridge, soil at the abutment locations would be re-graded to raise the profile. After the profile is raised at the abutment locations, the precast concrete piles would be driven into the ground. A reinforced concrete footing would be constructed on top of the piles. Then, a reinforced concrete abutment would be placed on the pile cap.

If Alternative 1 is selected, the contractor would drive CISS piles into the ground at column locations. The soil inside the steel shells would be drilled out, a reinforcing steel cage would be placed inside the shell, and concrete would be placed by a pump. The foundation piles would be extended as columns into the deck slab.

If Alternative 2 is selected, the contractor would excavate soil at the column footing locations. If water is anticipated at the footing elevations, cofferdams consisting of driven sheet pilings would be construction around the perimeter of

the footings. If needed, cofferdams would be approximately 38 by 38 feet per column footing. After cofferdams are placed, soil would be excavated to the footing elevation. The column footing CISS piles would then be driven with an impact hammer. If water is encountered, it would be pumped from the cofferdam to trucks or a sediment basin permitted by the Water Quality Control Board. A lean concrete seal course might be used to minimize water intrusion. The soil inside the steel shells will be dug out, a reinforcing steel cage would be placed inside the shell, and concrete would be placed by a pump. Reinforced concrete pile caps and columns would be constructed at each column footing.

To construct the superstructure, temporary supports also known as falsework would be required. The falsework would be used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc). According to Caltrans, the falsework system usually consists of a series of falsework bents placed at certain intervals with steel beams spanning across the falsework bents. Plywood decking is then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing of the superstructure. The falsework bents might be constructed using steel or timber posts supported on timber pads which have been placed on top of existing ground or on timber or steel piles that have been driven into ground depending on the bearing capacity of the soil. Access to the existing channel would be required for pile driving, pile cap construction and falsework construction. Once the falsework is complete the reinforced concrete slab or box girder superstructure would be installed. After completion of the structure, all temporary cofferdam and falsework material would be removed, the creek banks would be stabilized and erosion control BMP's would be installed. Falsework piles may be completely removed or cut below the ground elevation and left in place.

Petaluma River Bridge. The existing Petaluma River Bridge on State Route 101 consists of two separate structures, each 885 feet long and 31 feet wide. The bridges were built in 1955.

Due to the age of the existing structures and the costs associated with bringing them up to current standards, it is proposed to replace the two existing bridges with a single bridge. There is an existing fender system protecting the bridge bents at each side of the waterway. This fender system would be removed during construction in order to facilitate bridge construction work. The new bridge would increase the span over the waterway to 210 feet long and the new Pier 3 would be located above the waterway limit. A new bridge fender system would likely be required for Pier 4 even though it would be located closer to the north bank.

Caltrans has proposed two structure alternatives for the new bridge. Both alternatives would include construction of an 855 foot long and 115 foot wide, five-span bridge. Alternative 1 would consist of a reinforced concrete box girder superstructure. Alternative 2 would consist of a Precast/Pre-stressed Concrete Bulb "T" girder superstructure. The substructure for both alternatives consists of reinforced concrete column piers supported on spread footings or on pile caps with either cast-in-drilled hole (CIDH) or cast-in-steel shell (CISS) pilings. Both alternatives would include between 3 to 5 columns per pier for a total of between 12 to 20 columns for the 4 piers. The size of the individual column footings would be approximately 35 by 28 by 7 feet deep. Caltrans anticipates that each column footing would consist of between twenty-five to forty 18-inch to 30-inch diameter CIDH or CISS pilings for each of the twelve to twenty columns.

Geotechnical investigation will be needed prior to construction of the new Petaluma River Bridge. The purpose of the investigation is to characterize the subsurface conditions and to evaluate engineering properties of the soils and/or rock for the design development of the replacement of the Petaluma River Bridge. As part of the geotechnical investigation for the proposed improvements of Segment B4 of the Marin Sonoma Narrows project, four borings, ranging from 50 to 100 feet in depth, are planned to investigate the bents of the proposed Petaluma River Bridge Replacement located north of the Petaluma River. Two of the bore sites will be located in the designated temporary staging areas and the other two will be located in the Petaluma River. Additional borings will be accessed from the State Route 101 median and performed in areas that are not identified as listed species habitat or having the potential to adversely affect listed species.
The drilling will be completed using a track-mounted drill rig, a truck-mounted drill rig, or a potable drill rig may be used to access the slopes along the east side of the freeway between the Petaluma River Bridge and the 101/116 Separation and Overhead, and the banks of the Petaluma River. A skid-mounted drill rig attached to a sectional barge will be used to explore the bent on the river bank and in the river. Drilling will be completed using rotary wash methods; the size of the borehole will be about 5 inches in diameter.

Prior to the start of the field investigation Underground Service Alert (USA) will be contacted at least 48 hours before the start of work to clear underground utilities. All boring locations will also be cleared utilizing the services of a private underground utility locator. Some locations may require that the boring first be advanced using a hand auger to a depth of at least 3 feet to check for underground utilities, and then be advanced with the drill rig.

Boring permits are required by County of Sonoma, Department of Health Services, Environmental Health Division, for completion of the borings. The permit applications will be processed by consultant, URS. The borings will be

completed during daylight hours. Traffic control will be provided during drilling pursuant to Caltrans standards and as specified in the encroachment permit. A traffic control specialty contractor will be retained to provide traffic control for other borings, where required.

Sampling in the borings will be completed at 5-foot intervals or closer intervals at changes in material type as the drilling progresses. Caltrans anticipates that the majority of the sampling will be completed using a Standard Penetration Test (SPT) or Modified California (MC) sampler. If soft cohesive soils are encountered thin-walled Shelby tube samples will also be obtained.

All soil cuttings generated during the drilling of the borings will be placed in drums and stored at an offsite location designated by Caltrans. The soil cuttings in the drums will be sampled for waste characterization (approximately 1 sample for 3 drums) and disposed of at the nearest non-hazardous waste landfill following reception of the analytical testing results and acceptance of the materials for disposal. If analytical results indicate that the soil cuttings cannot be disposed of at the nearest non-hazardous landfill further testing and analysis may be required to dispose of the drums of soil at an appropriate facility.

Waste associated with the drilling operation such as drilling fluid, material containers, and personal trash will be placed in drums or containers and moved offsite for proper disposal.

All drilling equipment and vehicles will access the drill locations using an existing designated road/path. Access will be confined to this designated route to minimize effects to adjacent pickleweed habitat for the salt marsh harvest mouse.

The two upland borings (R-08-005 and R-08-006) will be explored by using a track mounted rig. The exploration for the two borings in the Petaluma River (R-08-005A and R-08-005B) is planned using a skid-mounted CME 45 rotary drill rig attached to a sectional barge that would be floated to the proposed locations at appropriate high tide levels. The remaining proposed borings will be explored with a truck-mounted rotary drill rig.

For rotary drilling, a one-ton service truck equipped with a water tank will support the drill rig. In general, the drill rig will access the site at the beginning the job and be parked over night until drilling is complete. On the other hand, the service truck will access the site in the morning at the beginning of each shift of drilling and leave the site at the end of the day to refill for the next day. It will leave the site during the day only if the drill hole requires more water for the drilling fluid mixture. The service truck will also be used to transport drill waste containers and soil cutting drums.

The new Petaluma River Bridge would be constructed in three stages. During Stage 1, the middle portion of the new bridge would be built in between the two existing structures and the existing median barriers would be removed. During Stage 2, the existing southbound structure would be removed for the new bridge construction. During stage 3, the northbound structure would be removed to allow for the construction of the final portion of the new bridge. Pile driving for the column footings will occur year-round. Other construction activities that will occur year-round on land include: bridge demolition, vegetation clearing and planting, and road construction for site access, removal of existing piles, falsework removal and cleanup, and concrete pouring (which may involve some work over water using appropriately sealed forms).

Access to the existing channel would be required for construction. The contractor would access the north bank of the river from State Route 116 along the east side of State Route 101. The contractor would access the south bank of the river from Petaluma Boulevard South. Piers 2 and 5 are located above the banks of the Petaluma River. Pier 3 is located on land at the edge of the south bank the river. Pier 4 is located in the river, adjacent to the north bank. Caltrans anticipates that the contractor would need to construct a trestle bridge to gain access to Pier 4 and to gain access to the north side of Pier 3. The trestle would also need to be extended around the existing piers for demolition of the existing bridge and towards the center of the channel for falsework, temporary erection tower, and temporary fender pile installation. A navigational opening would be maintained for mariners on the Petaluma River. The size of the opening would be negotiated and subject to approval of the U.S. Coast Guard. At the north and south sides of the opening a temporary fender system consisting of driven piles and steel and timber barriers would be placed to protect the falsework and/or erection towers from being hit from a vessel. The contractor would drive piles in the river and place a timber deck on the pilings to create a work platform or trestle above the river. The maximum trestle size is estimated at 1000 by 36 feet. Trestle and temporary fender piles would be either steel H-piles or steel pipe piles. Pipe would be approximately 20 to 24 inches in diameter. Piles would initially be driven with a vibratory hammer. Bearing would be confirmed with an impact hammer. Caltrans anticipates that a maximum of 300 temporary trestle and fender piles would be needed. Trestle and fender piles would be between 20 to 45 feet deep and would be installed between June 15 and October 31 of any year. Caltrans estimates that the contractor would install approximately 2 to 10 trestle and/or fender piles per day. Trestle and fender piles would be installed on approximately 20 to 75 days over a three year period. When an impact hammer is used to confirm bearing, each pile would receive approximately 5 to 20 strikes. If required for noise reduction, trestle piles would be driven inside a double walled isolation casing when an impact hammer is used.

Cofferdams consisting of sheet pilings will then be installed around the perimeter of Piers 3 and 4 footings. It is anticipated that one large cofferdam approximately 135 by 38 feet would be installed per pier location. Cofferdams might also be used at Piers 2 and 4, if ground water is anticipated. Four additional cofferdams approximately 39 by 22 feet would be used during demolition of the existing column footings in the river. Cofferdams would be constructed of interlocking sheet pilings, which would be driven by a vibratory hammer. If difficult driving is encountered, an impact hammer might be used for the final few feet of installation. Cofferdams would be installed between June 15 and October 31 of any year.

According to the August 5, 2008, Caltrans letter an existing ditch that contains pickleweed and acts as a connector between two pickleweed areas on the east and west sides of the existing Petaluma River Bridges. Caltrans would construct a new bridge pier and footing at the site of the existing ditch. A new ditch would be constructed slightly south of the existing ditch to maintain flow regimes during construction. The new ditch would be culverted for three years so construction equipment can access the area to construct the new pier and footing. Once construction is complete, Caltrans would restore the ditch, which will include removing the culvert and grading it to mimic the current ditch, including the same elevation, topography, and vegetation. This will be done in order to encourage the pickleweed to self-propagate as it has in the existing ditch.

The pickleweed removal would be the first order of work at the Petaluma River Bridge, prior to any heavy equipment being brought onto the site. The pickleweed will be removed by hand and the area is expected to be re-vegetated based on previous pickleweed propagation information. Caltrans makes this assumption based on other projects such as the Guadalcanal Tidal Marsh Restoration Project on State Route 37 in Solano County where a levee was breached and pickleweed self-propagated within several years.

Additionally, the construction access road would require an approximate 25-foot long temporary culvert in the vicinity of the SMART railroad bridge. Currently drainage traverses into the Petaluma River via an open ditch that contains some pickleweed. This culvert will also be in place for approximately 3-years, during construction. At the conclusion of construction, the culvert will be removed and the ditch will be restored to pre-construction conditions

Caltrans has developed minimization and avoidance measures to address potential adverse effects to listed salmonids and will implement those measures according to the separate biological opinion issued by National Marine Fisheries.

After cofferdams are completed and cleared of salmonid issues by the fisheries biologist, the contractor would install permanent foundation piles and the soil would be excavated to the footing elevation. If final design indicates CIDH piles, the contractor would likely use temporary steel casings at pile locations to help prevent caving and control water. CIDH piles would be constructed by drilling holes to the pile tips. Slurry would also likely be placed in the holes to control water and prevent caving. Once drilling is complete, a reinforcing steel cage would be placed in the hole and concrete would be pumped to the bottom of the hole, displacing the slurry, which would be pumped into holding tanks. If final design indicates CISS piles, Caltrans anticipates that the contractor would initially drive the piles with a vibratory hammer and complete driving into bedrock with an impact hammer. Piles at Piers 3 and 4 are estimated to be between 30 to 50 feet long and each pile will receive between 200 to 600 strikes. Piles will extend to bedrock and the contractor would likely install between 2 to 20 CISS piles per day. The contractor would likely be driving piles at Piers 3 and 4 with an impact hammer for up to 60 days over an 18 month period. CISS would be installed year round from completed trestle and cofferdams. If required for noise reduction, bubble curtains would be used around CISS piles, inside of cofferdams at Piers 3 and 4, when driving with an impact hammer. After piles are driven, soil would be excavated from inside the pile shells by drilling. Slurry would likely be pumped inside the shells to displace water. A reinforcing steel cage would be placed inside the shell, and structural concrete would be pumped to the bottom of the shell, displacing the slurry. Slurry would be pumped to holding tanks.

After piles are constructed, a seal course of lean concrete would likely be placed at the bottom of the footing to prevent water intrusion. Water would be pumped from the cofferdam into a baker tanks or a sediment basin permitted by the Water Quality Control Board. Then, a reinforced concrete footing cap and columns would be constructed on top of the pilings.

To construct the superstructure, temporary supports also known as falsework would be required for Alternative 1 and temporary erection towers would be needed for Alternative 2. The falsework would be used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc). According to Caltrans, the falsework system usually consists of a series of falsework bents placed at certain intervals with steel beams spanning across the falsework bents. Plywood decking is then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing the superstructure. The falsework bents might be constructed using steel or timber posts supported on timber pads which have been placed on top of existing ground or on timber or steel piles that have been driven into ground depending on the bearing capacity of the soil. Temporary erection towers are needed to provide temporary support and a work platform for splicing precast concrete bulb T-

Girders. Erection towers would be supported by piles driven in the water. Steel and/or timber posts, beams, and lateral supports would complete the tower to the bottom of the superstructure elevation. Falsework or temporary erection piles would be either steel H-piles or steel pipe piles. The pipe would be approximately 20 to 24 inches in diameter. Piles would initially be driven with a vibratory hammer. Bearing would be confirmed with an impact hammer. It is estimated that a maximum of 160 falsework or temporary erection piles would need to be driven in Petaluma River. Falsework or temporary erection piles would be between 20 to 45 feet deep and would be installed between June 15 and October 31 of any year. Caltrans estimates that the contractor would install approximately 2 to 20 falsework or temporary erection piles per day. Trestle piles would be installed on approximately 20 to 80 days over a three year period. When an impact hammer is used to confirm bearing, each pile would receive approximately 5 to 20 strikes. If required for noise reduction, falsework or temporary erection piles would be driven inside a double walled isolation casing when an impact hammer is used.

After the completion of the Stage 1 bridge construction, the existing northbound bridge would be removed. After the completion of the Stage 2 bridge construction, the existing southbound bridge would be removed. For the portion of the structure over the waterway, the structure would likely be removed by saw cutting between precast concrete girders and then using crane(s) to lift the girders out of place. Subject to the engineer's approval, the crane(s) would likely be located at the adjacent spans of the bridge or barge cranes would be utilized to remove the girders. Bridge removal protective cover, if necessary, would be attached to the existing bridge soffit/bents. Cofferdams of approximately 39 feet long by 22 feet wide each (total 4) would be required for the removal of the existing columns and/or spread footings at Pier 5 and Pier 6. Access would be gained by using the temporary trestle.

For bridge demolition work on non-waterway areas, the columns would likely be tipped over and demolished on ground or on protective ground cover such as crane mats etc. Existing footings in water and on banks would be removed to a required minimum elevation or distance below original ground.

After completion of the new bridge, all temporary cofferdam, temporary fender system, temporary erection tower, and falsework material would be removed. Piles would be removed by vibrating and/or pulling the piles with a crane. Alternatively, the piles may be cut at an elevation specified by the U.S. Coast Guard and left in place below existing grade. A new permanent pier protective system consisting of either a closed fill system or a fender system of driven piles and barriers would be placed to protect the new bridge Pier 4. The permanent fenders would consist of approximately 60 driven piles. Piles would be made of

steel pipe, steel H, or timber. Pipe would be approximately 20 to 24 inches in diameter. Piles would initially be driven with a vibratory hammer. Bearing would be confirmed with an impact hammer. Permanent fender piles would be between 20 to 45 feet deep and would be installed between June 15 and October 31 of any year. It is estimated that the contractor would install approximately 2 to 20 permanent fender piles per day. Permanent piles would be installed during approximately 3 to 15 days over a three year period. When an impact hammer is used to confirm bearing, each pile would receive approximately 5 to 20 strikes. If required for noise reduction, permanent fender piles would be driven inside a double walled isolation casing when an impact hammer is used.

The creek banks would then be stabilized and erosion control BMP's would be implemented.

Storm Water Quality Systems and Construction Site BMPs. The proposed project would incorporate bio-filtration strips and swales to receive storm water discharges from the highway or other impervious surfaces. The project would also likely include off-site storm water treatment.

The Segment B on-site storm water treatment would include bio-filtration strips, bio-filtration swales, and Austin sand filters. The installation of these features were discussed in the Segment A project description.

Construction Site BMPs. To maintain water quality during construction, Caltrans would implement BMPs to reduce unnecessary water quality impacts. The following methods and practices would be implemented:

1. Earth Dikes/Drainage Swales and Lined Ditches
2. Outlet Protection/Velocity Dissipation Devices
3. Check Dams
4. Silt Fencing with Maintenance Openings
5. Fiber Rolls
6. Concrete Washouts
7. Drainage Inlet Protection
8. Construction Entrance/Exit Protection

Staging Locations. Caltrans would use staging locations for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices. The primary staging areas in Segment B would be located within the new interchange at the Sanitary Landfill Road (Station 1405-1409), at the new interchange off of Kastania Road (Station 2039-2045), and below and along the sides of the Petaluma River Bridge (Station 2053-2055). Caltrans proposes areas that are located within the State Right-of-Way and quantified as within the project area of effect,

subject to approval of the contractor submitted SWPPP. Contractors may independently seek off-site staging locations. Off- site staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

Segment C

HOV Lane Construction. The existing State Route 101 Segment C roadway travels through the City of Petaluma. This segment is classified as a freeway, and includes two 12 foot lanes in each direction, 10 foot outside shoulders and 5 foot inside shoulders. The majority of existing curves in Segment C meet current horizontal alignment, vertical profile and sight distance requirements for the 70 mile per hour corridor design speed with the exception of the Petaluma Overhead. The existing Petaluma Overhead vertical profile is nonstandard and would be brought to current standards with this project. The non-paved median varies in width from 28 to 35 feet and contains a double thrie-beam barrier. The majority of the drainage facilities through Segment C can be utilized with only minor modifications and no historical drainage issues or recurring flooding has been documented.

In Segment C, Caltrans proposes to add a 12 foot wide HOV lane in each direction between south of the Lakeville Highway/State Route 116 Interchange and north of the Corona Road Overcrossing. The new roadway would be separated by a concrete barrier and would include 10 foot-wide inside shoulders. The majority of the widening would be in the median, with some outside widening. The roadway would be reconstructed at the approaches to the North Petaluma Overhead to correct the existing nonstandard vertical alignment. The proposed profile would be a new roadway located up to 17 feet above the existing roadway.

The HOV roadway construction would be completed as described for Segment A.

Vertical Curve Correction at the Petaluma Overhead. Caltrans plans to reconstruct the vertical profile through the Petaluma Overhead to achieve standard specification and replace the structure. The work would be completed in three stages. The first stage would consist of constructing the median portion of the overhead and fill the section leading up to both sides of the structure. Temporary retaining walls would be set in place for the fill section and imported material would be trucked in and placed in 0.5 foot lifts. Each lift would be spread and compacted with grading compacting equipment. The structural section would then be placed and compacted using the same methodology as described for HOV construction. Once the median is constructed, northbound traffic would be shifted to the median, and the same process would be used to construct the northbound portion of the vertical curve correction. Finally, northbound traffic would be moved to the new northbound lanes and southbound traffic would be shifted to the median for construction of the southbound lanes.

Roadway Resurfacing and Striping. Roadway resurfacing and striping for Segment C would use the same methodology as that described for Segment A.

Culvert Improvements. As described for the previous segments existing roadway drainage in Segment C is conveyed by a depressed median to drainage inlets at low points in the median. Segment C includes fifteen cross culverts that convey storm water to swales along the outside of the roadway which drain to adjacent water courses.

Caltrans would replace the depressed median with new HOV lanes, shoulders, and a median barrier. These improvements would result in sheet flow drainage towards the outside shoulders, away from the median. Sixteen existing drainage wells will be reconfigured at the median in Segment C. Cross culverts that are no longer needed would be abandoned in place and plugged. Caltrans has determined that most of the existing culverts are adequate but some would require replacement due to deterioration and improper sizing.

The construction methods for removing, installing, and extending culverts are as described for Segment A.

CHP Pullouts, HOV Bypass Lanes, and Ramp Metering. The addition of CHP pullouts, HOV bypass lanes, and ramp metering in Segment C will be similar to the methodology described for Segment A. These features will be added Landfill, Petaluma Boulevard South, State Route 116/Lakeville, and East Washington interchanges.

Sound Walls. Caltrans will construct new sound walls at four locations within Segment C. These locations include Ponderosa Drive to East Washington, North of Lynch Creek, Napa Drive to Corona Road, and East Washington to north of Lynch Creek. The combined length of the new walls would be approximately 12,230 feet.

Retaining Walls. Caltrans plans to construct three retaining walls for structural reasons in Segment C. The walls will be located north on both sides of the Petaluma Bridge and from McGregor Avenue Drive to East Washington. The combined length of the retaining walls in Segment C would be 3,635 feet long and will vary between 4 and 7 feet high. The walls will be constructed as described in Segment A.

Structures. Six bridges would be modified for the widening and include the structures at Route 101/116, Caulfield Lane, East Washington Street, Washington Creek, Lynch Creek, and North Petaluma. Only the two creek crossings are further described as follows.

> *Washington Creek Bridge*. The existing 67 foot-long Washington Creek Bridges accommodate two 12 foot-wide lanes of traffic and one 2 foot-wide inside shoulder and a 4 foot-wide outside shoulder in each direction.

Caltrans plans to widen both bridges in order to add the 12 foot wide HOV lane along with 10 foot-wide shoulders and HOV bypass. The existing twin bridges will be widened by connecting the right and left bridges and matching the existing structures to make a total width of 139.8 feet. It is also proposed that the existing bridge barriers with current standard barriers be replaced.

Access to the existing channel would be required for construction. Widening would involve the construction of a new cast-in-place reinforced concrete slab superstructure including new concrete bent caps and abutments. The substructure would consist of class 140 driven steel shell piles approximately 1.2 feet in diameter at the abutments and piers. Caltrans anticipates that there would be 11 new driven steel shell piles (pier columns) per pier for a total of 22 for the two piers. The piles would extend into the superstructure.

The Washington Creek Bridge would be constructed using the same methods described for Segment B.

Lynch Creek Bridge. The two Lynch Creek Bridges are only wide enough to accommodate two 12 foot wide lanes along with 2 foot wide inside shoulders and 4 foot wide outside shoulders. Both of the existing bridges were built in 1955 and consist of a three-span continuous reinforced concrete slab superstructure on reinforced concrete pile bents and reinforced concrete "U" open abutments.

As with the Washington Creek Bridge, Caltrans plans to widen the Lynch Creek Bridges to accommodate an additional 12 foot-wide HOV lane, 10 foot wide shoulders, and a ramp taper. Caltrans also plans to replace the existing bridge barriers with current standard barriers.

Access to the existing channel would be required for construction. Caltrans would widen the Lynch Creek Bridge by constructing and connecting parallel bridge structures to the median side of each of the existing bridge structures and closing the median gap as well as constructing and connecting a parallel bridge structure to the northbound side of the existing bridge. Caltrans would construct the widened portions of the bridge similar to the existing structure so that the widened portions match the existing structure in strength, durability, and flexibility.

Caltrans also plans to construct a sound wall on a bridge barrier on the southbound side of the structure. According to Caltrans, the widening of the existing bridge would require the construction of new a cast-in-place reinforced concrete slab superstructure including new concrete bent caps and abutments. The substructure consists of Class 140 (12 by 12 inch) driven precast concrete piles

Caltrans anticipates that there would be 10 new driven precast concrete piles (pier columns) per pier for a total of 20 piles for the 2 piers. The piles would extend into the superstructure.

The location and bearing for the new abutments and bents would match with the alignments of the existing abutments and bents. The use of falsework and erosion control BMPs would be similar to that used for the other bridges in this project.

Storm Water Quality Systems and Construction Site BMPs. Segment C would use the same BMPs as described for Segment B.

Construction Site BMPs. Segment C would use the same BMPs as described for Segment B.

Staging Locations. Caltrans would use staging locations for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices. The primary staging areas in Segment C would be located within the State Route 116 Interchange. Caltrans proposes to use areas that are located within the State Right-of-Way and quantified as within the project area of effect, subject to approval of the contractor submitted SWPPP. Contractors may independently seek off-site staging locations. Off- site staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

Construction Site Restoration

Caltrans plans to restore areas of temporary ground disturbances, including storage and staging areas, and temporary roads. These areas will be re-contoured, if appropriate, and revegetated with seeds and/or cuttings of appropriate plant species to promote restoration of the area to pre-project conditions. Caltrans defines areas of "temporary" disturbance to be any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Caltrans will be developing a restoration plan that will be submitted to the Service for comment prior to initial ground breaking. According to Caltrans, to the maximum extent practicable (i.e., presence of natural lands), topsoil will be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion will be prevented with straw bales, straw wattles, or similar means provided they do not entangle, block escape or dispersal routes of listed animal species.

Proposed Avoidance and Minimization Measures

According to the May 2008 Biological Assessment and the revised project description provided by Caltrans on August 27, 2008, FHWA/Caltrans propose to avoid, minimize, and compensate for effects to listed species by implementing the following measures:

Federally Listed Plants

If listed plants may be affected by the project, Caltrans will implement the following:

1. Minor design modifications will be made to avoid effects to listed plant species.

2. Any area where federally listed plants and/or populations have been observed within the temporary work area will be designated an Environmentally Sensitive Area and marked in the field with orange construction fencing.

3. The location of all Environmentally Sensitive Area's will be shown on project construction drawings and noted for monitoring during construction.

4. Preconstruction botanical surveys will be conducted prior to construction during the appropriate time of year (during spring and early summer), by qualified botanists familiar with the regional flora, and will follow Service, California Department of Fish and Game, and CNPS approved protocols.

California Red-Legged Frog

1. To compensate for the potential effects to 203.78 acres of California red-legged frog habitat Caltrans and FHWA will provide compensation at a 1:1 ratio totaling approximately (203.78 acres). This compensation, which is being provided pursuant to CEQA/NEPA and FHWA policies on mitigating effects to natural lands, and which is incorporated as part of the project description, will be achieved using a combination of the following:

    a. Purchasing credits at a resource agency approved mitigation bank servicing the action area;

    b. Purchasing conservation easements at or as close to the project site as practical within Marin and/or Sonoma Counties;

    c. Purchasing fee title and preserving the land for California red-legged frog at or as close to the project site as practical within Marin and/or Sonoma Counties.

Compensation may be provided by Caltrans itself or to the extent feasible with the assistance of a state or local partner such as a park or open space district or a resource conservation district. Compensation for California red-legged frog will be provided before or concurrent with the project effects to California red-legged frog for each project Construction Phase.

2. A Service-approved biologist(s) will be designated for the construction phase activities in Segment B and Segment C that will affect California red-legged frog habitat. The qualified biologist(s) will be on-site during specific construction activities for each construction phase work in potential California red-legged frog habitat. The qualifications of the biologist(s) will be presented to the Service for review and written approval prior to ground-breaking at the project site. The biologist(s) will coordinate through the Resident Engineer, to stop any work that may result in take of the California red-legged frog. If work is stopped, the biologist(s) will notify the Service by telephone and electronic mail within one (1) working day. The Service contact will be Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Field Office at telephone (916) 414-6600.

3. The Resident Engineer will halt work and immediately contact the Service-approved project biologist(s) and the Service in the event that a California red-legged frog gains access to a construction zone. The Resident Engineer will suspend construction activities in the immediate construction zone within Segment B and Segment C for each specific project phase that may affect California red-legged frog habitat until the animal leaves the site voluntarily or is removed by the biologist(s) to a release site using Service-approved handling techniques.

4. All construction supervisory personnel for each specific project phase within Segment B and Segment C that are working in areas of potential endangered species habitat will attend an environmental education program delivered by the Service approved biologist prior to working on the project site. The program will include an explanation as how to best avoid the accidental take of California red-legged frogs. The Service approved biologist(s) will conduct a training session that would be scheduled as a mandatory informational field meeting by the Caltrans Resident Engineer for all construction contractor supervisory personnel. The field meeting will include topics on species identification, life history, descriptions, and habitat requirements during various life stages. Emphasis will be placed on the importance of the habitat and life stage requirements within the context of project maps showing areas where minimization and avoidance measures are being implemented. The program will include an explanation of appropriate federal and state laws protecting endangered species as well as the importance of compliance with Caltrans and various resource agency conditions.

5. To minimize temporary disturbances in areas of potential California red-legged frog habitat, project related vehicle traffic within Segment B and Segment C for construction phases with potential California red-legged frog habitat will be restricted to established roads, construction areas, and other designated areas. These areas also should be included in pre-construction surveys and, to the maximum extent practicable, should be established in locations disturbed by previous activities to prevent further adverse effects. Project related vehicles will observe a 20-mile per hour speed limit within Segment B and Segment C for construction phases with potential California red-legged frog habitat, except on County roads, and State and Federal highways. Off-road traffic outside of designated action areas of Segment B and Segment C for construction phases with potential California red-legged frog habitat will be prohibited.

6. Dust control measures will be implemented within Segment B and Segment C for construction phases with potential California red-legged frog habitat, consisting of regular truck watering of constriction access areas and disturbed soil areas with the use of organic soil stabilizers to minimize airborne dust and soil particles generated from graded areas. Regular truck watering will be a requirement of the construction contract. In addition, for disturbed soil areas, an organic tackifier to control dust emissions blowing off of the right-of-way or out of the construction area during construction will be included in the contract special provisions. Watering guildelines for dewatering will be established to avoid any excessive run-off that may flow into contiguous areas. Any material stockpiles will be watered, sprayed with tackifier or covered, to minimize dust production and wind erosion.

7. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

8. To eliminate an attraction to predators of the California red-legged frog, all food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a day from the action area.

9. To avoid injury or death of a California red-legged frog, no firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

10. To prevent harassment, injury or mortality of a California red-legged frog or destruction of their refuge, project personnel will not be permitted to have dogs or cats in the action area.

11. Use of rodenticides and herbicides in the action area will be used in such a manner to prevent primary or secondary poisoning of a California red-legged frog and the depletion of vegetation on which they depend. All uses of such compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other appropriate State and Federal regulations, as well as additional project-related restrictions deemed necessary by the Service or the California Department of Fish and Game.

12. Dedicated fueling and refueling practices will be designated as part of the approved SWPPP. Dedicated fueling areas will be protected from storm water run-on and run-off and will be located at least 50 feet from downslope drainage facilities and water courses. Fueling must be performed on level-grade areas. On site fueling will only be used where it is impractical to send vechicles and equipment off-site for fueling. When fueling must occur on-site, the contractor will designate an area to be used subject to the approval of the Resident Engineer, representing Caltrans. Drip pans or absorbent pads will be used during on-site vehicle and equipment fueling.

13. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of California red-legged frog habitat and at a minimum of 150 feet from any downstream riparian habitat, aquatic habitat, culvert, or drainage feature.

14. For each specific project phase within Segment B and Segment C, and to the extent practicable, areas outside of the construction zones containing suitable habitat for the California red-legged frog will be delineated with high visibility temporary fencing at least 4 feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto sensitive areas during construction activities. The fencing will be removed only when all construction equipment is removed from the site. No project activities will occur outside the delineated project construction area.

15. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans will allow access by Service personnel to the action area to inspect project effects to California red-legged frogs and their habitats. Due to safety concerns, Caltrans requests that Service staff check in with the Resident Engineer prior to accessing the construction site.

16. For work on each construction phase within Segment B and Segment C that may affect California red-legged frog habitat, a Service-approved biologist(s) will be on-site to monitor the initial ground disturbance activities for the road construction. The biologist(s) will perform a clearance survey immediately prior

to the initial ground disturbance. Safety permitting, the Service-approved biologist(s) will investigate areas of disturbed soil for signs of listed species within thirty (30) minutes following the initial disturbance of that given area.

17. To prevent inadvertent entrapment of California red-legged frogs during work within construction Phase B4, all excavated, steep-walled holes or trenches more than 2 feet deep will be covered at the close of each working day by plywood or similar materials. Alternatively, an additional 4-foot high vertical barrier, independent of exclusionary fences, may be used to further prevent the inadvertent entrapment of California red-legged frogs. If it is not feasible to cover an excavation or provide an additional 4-foot high vertical barrier, independent of exclusionary fences, one or more escape ramps constructed of earth fill or wooden planks will be installed. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the on-site biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and electronic mail within one working day.

18. Plastic mono-filament netting (erosion control matting) or similar material will not be used at the project site because California red-legged frogs may become entangled or trapped in it. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

19. Injured California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the on-site biologist; dead individuals must be placed in a sealed plastic bag with the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service and the California Department of Fish and Game will be notified within one (1) working day of the discovery of death or injury to a California red-legged frog that occurs due to project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Fish and Wildlife Office (916/414-6600), and Dan Crum, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660. The California Department of Fish and Game contact is Mr. Scott Wilson at telephone (707) 944-5563. Sightings of any listed or sensitive animal species should be reported to the California Natural Diversity Database of the California Department of Fish and Game

20. Caltrans will submit post-construction compliance reports for each Segment B and Segment C construction phase with potential California red-legged frog habitat, prepared by the on-site biologist, to the Service within sixty (60) calendar days following completion of each phase with potential California red-legged frog habitat or within sixty calendar days of any break in construction activity lasting more than sixty calendar days. This report will detail (1) dates that construction occurred; (2) pertinent information concerning the success of the project in implementing avoidance and minimization measures for listed species; (3) an explanation of failure to meet such measures, if any; (4) known project effects on California red-legged frogs, if any; (5) occurrences of incidental take of any of these species; (6) documentation of employee environmental education; and (7) other pertinent information. The reports will be addressed to the Deputy Assistant Field Supervisor of the Endangered Species Program, Sacramento Field Office of the Service.

Salt Marsh Harvest Mouse

Caltrans stated in their August 5, 2008 letter that the following measures would be implemented during activities associated with the Petaluma Bridge. Caltrans will avoid potential salt marsh harvest mouse habitat adjacent to the action area at other locations.

1. Caltrans will begin restoration of all salt marsh harvest mouse pickleweed and upland habitat associated with the action area to baseline or better conditions following the completion of construction at the Petaluma River Bridge. Successful establishment of baseline or better salt marsh harvest mouse pickleweed habitat should be achieved within three years.

2. A Service and the California Department of Fish and Game approved biologist will be designated for construction activities for Construction Phase B4. The qualified biologist(s) will be on-site during specific construction activities for each project activity that may have adverse effects to the salt marsh harvest mouse. The qualifications of the biologist(s) will be presented to the Service and the California Department of Fish and Game for review and written approval prior to ground-breaking at the project site. The biologist(s) will coordinate through the Resident Engineer, to stop any work that may result in take of these listed animal species. If work is stopped, the biologist(s) will notify the Service and the California Department of Fish and Game by telephone and electronic mail within one working day. The Service contact will be Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Field Office at telephone (916) 414-6600. The California Department of Fish and Game contact is Mr. Scott Wilson at (707) 944-5563.

3. The Resident Engineer will halt work and immediately contact the Service and California Department of Fish and Game approved biologist and the Service and the California Department of Fish and Game in the event that a salt marsh harvest mouse gains access to a construction zone. The Resident Engineer will suspend construction activities in the immediate construction zone for work in Construction Phase B4 that could have adverse effects to the salt marsh harvest mouse until the animal leaves the site voluntarily.

4. All supervisory construction personnel for Construction Phase B4 that are working in areas of potential endangered species habitat will attend an environmental education program delivered by the Service and California Department of Fish and Game approved biologist prior to working on the project site. The program will include an explanation as how to best avoid the accidental take of salt marsh harvest mouse. The Service and California Department of Fish and Game approved biologist(s) will conduct a training session that would be scheduled as a mandatory informational field meeting by the Caltrans Resident Engineer for all construction contractor supervisory personnel. The field meeting will include topics on species identification, life history, descriptions, and habitat requirements during various life stages. Emphasis will be placed on the importance of the habitat and life stage requirements within the context of project maps showing areas where minimization and avoidance measures are being implemented. The program will include an explanation of appropriate federal and state laws protecting endangered species as well as the importance of compliance with Caltrans and various resource agency conditions.

5. To minimize temporary disturbances for work in areas of potential salt marsh harvest mouse habitat, project related vehicle traffic within Construction Phase B4 will be restricted to established roads, construction areas, and other designated areas. These areas also should be included in preconstruction surveys and, to the maximum extent practicable, should be established in locations disturbed by previous activities to prevent further adverse effects. Project related vehicles will observe a 20-mile per hour speed limit within Construction Phase B4, except on County roads, and State and Federal highways. Off-road traffic outside of designated action areas within Construction Phases B2 and B4 will be prohibited.

6. Dust control measures will be implemented within Construction Phase B4, consisting of regular truck watering of constriction access areas and disturbed soil areas with the use of organic soil stabilizers to minimize airborne dust and soil particles generated from graded areas. Regular truck watering will be a requirement of the construction contract. In addition, for disturbed soil areas, an organic tackifier to control dust emissions blowing off of the right-of-way or out of the construction area during construction will be included in the contract special provisions. Watering guildelines for dewatering will be established to

avoid any excessive run-off that may flow into contiguous areas. Any material stockpiles will be watered, sprayed with tackifier or covered, to minimize dust production and wind erosion.

7. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

8. To eliminate an attraction to predators of the salt marsh harvest mouse, all food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a day from the action area.

9. To avoid injury or death of the salt marsh harvest mouse, no firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

10. To prevent harassment, injury or mortality of a salt marsh harvest mouse or destruction of their refuge/nesting areas by dogs or cats, project personnel will not be permitted to have dogs or cats in the action area.

11. Rodenticides and herbicides in the action area will be used in such a manner to prevent primary or secondary poisoning of salt marsh harvest mouse and the depletion of vegetation on which they depend. All uses of such compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other appropriate State and Federal regulations, as well as additional project-related restrictions deemed necessary by the Service or the California Department of Fish and Game.

12. Dedicated fueling and refueling practices will be designated as part of the approved SWPPP. Dedicated fueling areas will be protected from storm water run-on and run-off and will be located at least 50 feet from downstream drainage facilities and water courses. Fueling must be performed on level-grade areas. On site fueling will only be used where it is impractical to send vechicles and equipment off-site for fueling. When fueling must occur on-site, the contractor will designate an area to be used subject to the approval of the Resident Engineer, representing Caltrans. Drip pans or absorbent pads will be used during on-site vehicle and equipment fueling.

13. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of salt marsh harvest mouse habitat and at a minimum of 150 feet from any downslope riparian habitat, aquatic habitat, culvert, or drainage feature.

14. To minimize or avoid the loss of individual salt marsh harvest mice from construction activities in the Petaluma River area, pickleweed vegetation will be hand-removed. Following removal, a special 2-foot high fence consisting of plastic sheeting will be placed 20 feet from the boundaries of construction areas in and adjacent to the pickleweed areas after the vegetation is removed. The fence will be held in place with 2-inch wide and 3-foot long stakes and will be buried in a 6 to 8 inch deep trench to prevent mice from pushing under the fence. These methods will occur with the approval of and in coordination with the California Department of Fish and Game.

15. Prior to commencing construction work for Contract Phase B4 that can have adverse effects to salt marsh harvest mouse, and to the extent practicable, areas outside of the construction zones containing suitable habitat for salt marsh harvest mouse will be delineated with high visibility temporary fencing at least 4 feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto sensitive areas during construction. The fencing will be removed only when all construction equipment is removed from the site. Actions within the action area will be limited to vehicle and equipment operation on existing roads. No construction activities will occur outside the delineated project construction area.

16. Caltrans will minimize effects on potential habitat at Location 4 by restricting construction to within 100 feet of the existing Caltrans ROW. The closest potential habitat for salt marsh harvest mouse was found approximately 150 feet from the existing Caltrans ROW.

17. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans will allow access by the Service and/or California Department of Fish and Game personnel to the project site to inspect project effects to the salt marsh harvest mouse and their habitats. Due to safety concerns, Caltrans requests that Service staff check in with the Resident Engineer prior to accessing the construction site.

18. For work within Construction Phase B4 that could have adverse effects to salt marsh harvest mouse, a Service and California Department of Fish and Game approved biologist will be on-site to monitor the initial ground disturbance activities for the road construction. The biologist will perform a clearance survey immediately prior to the initial ground disturbance. Safety permitting, the Service and California Department of Fish and Game approved biologist(s) will investigate areas of disturbed soil for signs of listed species within thirty (30) minutes following the initial disturbance of that given area.

19. To prevent inadvertent entrapment of salt marsh harvest mouse during construction, all excavated, steep-walled holes or trenches more than 2 feet deep will be covered at the close of each working day by plywood or similar materials. Alternatively, an additional 2-foot high vertical barrier, independent of exclusionary fences, may be used to further prevent the inadvertent entrapment of salt marsh harvest mice. If it is not feasible to cover an excavation or provide an additional 2-foot high vertical barrier, independent of exclusionary fences, one or more escape ramps constructed of earth fill or wooden planks will be installed. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the on-site biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service and/or California Department of Fish and Game will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and electronic mail within one working day.

20. Injured salt marsh harvest mice will be cared for by a licensed veterinarian or other qualified person such as the on-site biologist; dead individuals must be placed in a sealed plastic bag in which a piece of paper is placed that contains the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service and the California Department of Fish and Game will be notified within one (1) working day of the discovery of death or injury to a salt marsh harvest mouse that occurs due to project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Fish and Wildlife Office (916/414-6600), and Dan Crum, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660. The California Department of Fish and Game contact is Mr. Scott Wilson at telephone (707) 944-5563. Sightings of any listed or sensitive animal species should be reported to the California Natural Diversity Database of the California Department of Fish and Game.

21. Caltrans will submit a post-construction compliance report for Construction Phase B4 prepared by the on-site biologist to the Service within sixty (60) calendar days following completion of Construction Phase B4 or within sixty (60) calendar days of any break in construction activity lasting more than sixty calendar days. This report will detail (1) dates that construction occurred; (2) pertinent information concerning the success of the project in implementing avoidance and minimization measures for listed species; (3) an explanation of failure to meet such measures, if any; (4) known project effects on the salt marsh harvest mouse, if any; (5) occurrences of incidental take of this listed species; (6) documentation

of employee environmental education; and (7) other pertinent information. The report will be addressed to the Deputy Assistant Field Supervisor of the Endangered Species Program.

According to the revised project description received by the Service on December 2, 2008, Caltrans plans to implement the following measures during the geotechnical investigation activities associated with construction of the Petaluma Bridge.

1. When accessing the designated temporary staging area, located between the north bank of Petaluma River and the toe of the north approach embankment, a qualified biologist will monitor the site access path taken by the drilling equipment. Along the access path near any salt marsh harvest mouse habitat designated by the biologists, plywood boards (4 feet by 8 feet) will be placed to temporarily form a pathway for the drilling equipment. A steel plate will be used to provide temporary crossing platform of a drainage ditch.

2. Maintain all vehicles and drill rigs will be inspected frequently and maintained to repair leaks.

3. Drip pans or drop cloths will be used to catch drips and spills. Drain and replace motor oil, radiator coolant, or other fluid will be conducted off site. All spent fluids will be collected, stored in labeled separate containers, and recycled whenever possible. All fuels, oils and lubricants will be kept within secondary containment.

4. Perform major maintenance, repair jobs and vehicle and equipment washing will be performed off-site when feasible, or in designated and controlled areas on-site.

5. Vehicles will be washed at an appropriate off-site facility. If equipment must be washed on-site, water will be prevented from entering the storm drain or open channel. Use of soaps, solvents, degreasers, or steam cleaning equipment will be prohibited. Wash water will be directed to an area that will not flow to any storm drain inlets or open channels.

6. Vehicles and heavy equipment will be refueled in one designated location on the site and spills will be cleaned up immediately.

7. A biological monitor will hold daily tail gate meeting prior to start of drilling activities.

8. Plastic sheeting or visqueen will be placed over the drill site to catch spills and drips of drilling fluids.

9. Straw waddle will be placed on top of visqueen to form a temporary dike surrounding the drill hole and circulation tub to contain spills.

10. Absorbents will be made available to clean up any leaks or spills.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area includes all lands associated with the approximately 786.402 acre project footprint and roads (except for County roads, and State and Federal highways) and other areas accessed by project vehicles.

Status of the Species and Environmental Baseline

California Red-Legged Frog

The California red-legged frog was listed as a threatened species on May 23, 1996 (Service 1996). Please refer to the final rule and the *Recovery Plan for the California Red-Legged Frog (Rana aurora draytonii)* (Service 2002) for additional information on this species.

This threatened species is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have lighter centers (Stebbins 2003) and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

Red-legged frogs have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation, allowing the egg mass floats on the surface of the water (Hayes and Miyamoto 1984). Red-legged frogs breed from November through March with earlier breeding records occurring in southern localities (Storer 1925). Individuals occurring in coastal drainages are active year-round (Jennings *et al.* 1992), whereas those found in interior sites are normally less active during the cold season.

The historic range of the red-legged frog extended coastally from the vicinity of Elk Creek in Mendocino County, California, and inland from the vicinity of Redding, Shasta County, California, southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The species historically was documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties. This represents a loss of 70 percent of its former range (Service 2002). Red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the central coast. Within the

remaining distribution of the species, only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. This listed amphibian is believed to be extirpated from the southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (California Department of Fish and Game 2004).

Adult California red-legged frogs prefer dense, shrubby or emergent riparian vegetation closely associated with deep (>2.3 feet), still, or slow-moving water (Hayes and Jennings 1988). However, frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. The largest densities of red-legged frogs currently are associated with deep pools with dense stands of overhanging willows (*Salix* species) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings 1988). Red-legged frogs disperse upstream and downstream of their breeding habitat to forage and seek sheltering habitat.

California red-legged frogs also can be found in disturbed areas such as channelized creeks and drainage ditches in urban and agricultural areas. An adult California red-legged frog recently was observed in a shallow isolated pool on North Slough Creek in the American Canyon area of Napa County (Christine Gaber/PG&E personal communication with Chris Nagano/Service on October 22, 2008). This frog location was surrounded by vineyard development. Another adult California red-legged frog was observed under debris in an unpaved parking lot in a heavily industrial area of Burlingame (Patrick Kobernus communication with Michelle Havens on October 16, 2008). This Burlingame frog was likely utilizing a nearby drainage ditch. Caltrans has also discovered California red-legged frog adults, tadpoles, and egg masses within a storm drainage system within a major cloverleaf intersection of Millbrae Avenue and State Route 101 in a heavily developed area of San Mateo County (Caltrans 2007). California red-legged frog has the potential to persist in disturbed areas as long as they provide at least one or more of their life history requirements.

According to Feller and Kleeman (2007), non-breeding dry season habitat includes several characteristics: 1) sufficient moisture to allow the frogs to survive throughout the non-breeding season that may be up to 11 months long ; 2) sufficient cover to moderate temperatures during the warmest and coldest times of the year; and 3) protection (e.g., deep pools in a stream, or complex cover such as root masses or thick vegetation) from predators such as hawks and owls, herons, and small carnivores.

During other parts of the year, habitat includes nearly any area within 1-2 miles of a breeding site that stays moist and cool through the summer (Fellers 2005). According to Fellers (2005), this can include vegetated areas with coyote bush (*Baccharis pilularis*), California blackberry thickets (*Rubus ursinus*), and root masses associated with willow (*Salix* species) and California bay trees (*Umbellularia californica*). Sometimes the non-breeding habitat used by red-legged frogs is extremely limited in size. For example, non-breeding red-legged frogs have been found in a 6-foot wide coyote bush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for red-legged frogs is potentially all aquatic, riparian, and upland areas within the range of the species and includes any landscape features that

provide cover, such as existing animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

Red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adult frogs are often associated with permanent bodies of water. Some frogs remain at breeding sites all year while others disperse. Dispersal distances are typically less than 0.5 mile (0.8 kilometers), with records of a few individuals moving up to 1-2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005). Dispersing frogs in northern Santa Cruz County traveled distances from 0.25 miles to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003). Fellers and Kleeman (2007) and Bulger et al. (2003) found that California red-legged frog migration corridors can be less "pristine" (e.g., closely grazed fields, plowed agricultural lands) than breeding or non-breeding habitats. Bulger *et al.* (2003) observed that this listed ranid did not avoid or prefer any landscape feature or vegetation type. They tracked individuals that crossed agricultural land, including recently tilled fields and areas with mature crops. The threats facing migrating California red-legged frogs during their movements include being run over by vehicles on roads (Gibbs 1998; Vos and Chardon 1998), degradation of habitat (Vos and Stumpel 1995; Findlay and Houlahan 1997; Gibbs 1998), predation (Gibbs 1998), and dessication (Rothermel and Semlistch 2002; Mazerolle and Desrochers 2003).

Egg masses contain about 2,000 to 5,000 moderate sized (0.08 to 0.11 inches in diameter), dark reddish brown eggs and are typically attached to vertical emergent vegetation, such as bulrushes (*Scirpus* species) or cattails (Jennings *et al.* 1992). Red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Eggs hatch in 6 to 14 days (Jennings 1988). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand results in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3.5 to 7 months after hatching (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1990). Of the various life stages, larvae probably experience the highest mortality rates, with less than 1 percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Sexual maturity normally is reached at 3 to 4 years of age (Storer 1925; Jennings and Hayes 1985). Red-legged frogs may live 8 to 10 years (Jennings *et al.* 1992). Populations of red-legged frogs fluctuate from year to year. When conditions are favorable red-legged frogs can experience extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of

occupied sites. In contrast, red-legged frogs may temporarily disappear from an area when conditions are stressful (e.g., drought).

The diet of red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items. According to their data, vertebrates, such as Pacific tree frogs and California mice (*Peromyscus californicus*) represent over half the prey mass eaten by larger frogs (Hayes and Tennant 1985). Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely nocturnal. The diet of red-legged frogs is not well studied, but their diet is likely similar to other ranid frogs that feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b).

Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and several species of warm water fish including sunfish (*Lepomis* species), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the red-legged frog throughout its range.

Several researchers in central California have noted the decline and eventual disappearance of red-legged frog populations once bullfrogs became established at the same site (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora aurora*), and suggested that bullfrogs could prey on subadult northern red-legged frogs as well. Bullfrogs may also have a competitive advantage over red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Further more, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with red-legged frog reproduction. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; M. Jennings, in litt.1993; R. Stebbins in litt. 1993). Thus bullfrogs are able to prey upon and out-compete red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to red-legged frog habitat has also adversely affected red-legged frogs. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs. The conversion and isolation of perennial pool habitats resulting from urbanization is an ongoing impact to red-legged frogs.

The California red-legged frog may be susceptible to many of the same pathogens, fungi, water mold, bacteria, and viruses have been known to adversely affect tiger salamander species or other amphibians. As with the California tiger salamander, Chytridiomycosis and ranaviruses may be a particular developing concern for California red-legged frog populations. Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric three-spined sticklebacks (*Gasterosteus aculeatus*) in northwestern California. Ingles (1932a, 1932b, and 1933 cited in Fellers 2005) reported four species of trematodes from red-legged frogs, but he later synonymized two of them (found them to be the same as the other two). Nonnative species, such as bullfrogs and nonnative tiger salamanders, are both located within the range of the California red-legged frog and have been identified as potential carriers of these diseases. Human activities can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e. contaminated boots or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in red-legged frogs being more susceptible to the effects of disease. Disease will likely become a growing threat because of the relatively small, fragmented remaining California red-legged frog breeding sites, the many stresses on these sites due to habitat losses and alterations, translocation of infected animals, and the many other potential disease-enhancing anthropogenic changes which have occurred both inside and outside the species' range.

The recovery plan for red-legged frogs identifies eight Recovery Units (Service 2002). The establishment of these Recovery Units is based on the Recovery Team's determination that various regional areas of the species' range are essential to its survival and recovery. The status of the red-legged frog will be considered within the smaller scale of Recovery Units as opposed to the overall range. These Recovery Units are delineated by major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of the range of the California red-legged frog. The goal of the draft recovery plan is to protect the long-term viability of all extant populations within each Recovery Unit. Within each Recovery Unit, core areas have been delineated and represent contiguous areas of moderate to high red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations that, combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitat within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of red-legged frogs. The Marin-Sonoma Narrows Project is within Recovery Unit 3 (North Coast and North San Francisco Bay) (Service 2002).

Project Segments A and C cross through urbanized area with little potential upland red-legged frog habitat but with urban creek crossing that include degraded riparian habitat and non-native predators of this animal. Although urban, Washington and Lynch creeks in Segment C have well developed riparian cover within their confines and provide habitat for California red-legged frogs.

The habitat in and surrounding the action area of Segment B is rural and characterized by rolling oak grasslands and creeks with well-developed riparian systems. The development in Segment B is primarily limited to several large ranches and the dominate land use is cattle grazing. Based on the habitat conditions it appears likely that there is suitable upland and aquatic red-legged frog habitat throughout Segment B. According to Caltrans assessment, potential California red-legged frog habitat on both sides of the roadway that would be affected in Segment B amounts to 206.94 acres. Therefore, the Service has determined it is reasonable to conclude the California red-legged frog inhabits and has the potential to be encountered within 206.94 acres of the action area, based on the biology and ecology of the species, and the presence of suitable habitat.

Salt Marsh Harvest Mouse

The salt marsh harvest mouse was federally listed as endangered in 1970 (Service 1970). Critical habitat has not been proposed or designated. A detailed account of the taxonomy, ecology, and biology of the salt marsh harvest mouse is presented in the *Salt Marsh Harvest Mouse & California Clapper Rail Recovery Plan* (Service 1984) (Recovery Plan) and the references cited therein. The salt marsh harvest mouse is a Fully Protected Species under California law (See California Fish and Game Code Section 4700).

The salt marsh harvest mouse is a rodent endemic to the salt and brackish marshes of the San Francisco Bay Estuary and adjacent tidally influenced areas. The salt marsh harvest mouse closely resembles the western harvest mouse (*R. megalotis*). The salt marsh harvest mouse typically weighs about 0.35 ounce, has a head and body length ranging from 2.7-2.9 inches, a tail length ranging from 2.6-3.2 inches, and a hind foot length of 0.7 inch (Fisler 1965). As stated in the recovery plan, the salt marsh harvest mouse, when compared to the western harvest mouse, have darker ears, belly and back, and a slightly thicker, less pointed and unicolored tail. The salt marsh harvest mouse is further distinguished taxonomically into the northern and southern subspecies, *R. raviventris halicoetes* and *R. raviventris raviventris*, respectively. Of the two subspecies, *R. r. halicoetes* more closely resembles *R. megalotis*, and can be difficult to differentiate in the field; body color and color of ventral hairs as well as the thickness and shape of the tail have been used to distinguish the two.

The salt marsh harvest mouse has evolved to a life in tidal marshes. Specifically, they have evolved to depend mainly on dense pickleweed as their primary cover and food source. However, salt marsh harvest mice may utilize a broader source of food and cover which includes saltgrass (*Distichlis spicata*) and other vegetation typically found in the salt and brackish marshes of this region. In natural systems, salt marsh harvest mice can be found in the middle tidal marsh and upland transition zones. Upland refugia is an essential habitat component during high tide events. Salt marsh harvest mice are highly dependent on cover, and open areas as small as 33 feet wide may act as barriers to movement (Shellhammer 1978, as cited in Service 1984). The salt marsh harvest mouse does not burrow. It has been noted that the northern subspecies may build nests of loose grasses.

As described by Fisler (1965), male salt marsh harvest mice are reproductively active from April through September, but may appear active throughout the year. Females are reproductively active from March to November, and have a mean litter size of approximately four offspring.

The historic range of the species included tidal marshes within the San Francisco and San Pablo bays, east to the Collinsville-Antioch areas. Agriculture and urbanization has claimed much of the former historic tidal marshes, resulting in a 79 percent reduction in the amount of tidal marshes in these areas (Goals Project 1999). At present, the distribution of the northern subspecies occurs along Suisun and San Pablo Bays north of Point Pinole in Contra Costa County and Point Pedro in Marin County. The southern subspecies is found in marshes in Corte Madera, Richmond, and South San Francisco Bay mostly south of the San Mateo Bridge (Highway 92).

The preservation and growth of existing populations of the salt marsh harvest mouse is considered important to assuring the survival of this species. The Recovery Plan identifies essential habitat areas to be preserved or restored throughout the Estuary to meet the recovery objectives for this species. No essential habitat for the salt marsh harvest mouse is identified within the action area in the Recovery Plan.

Although no surveys for salt marsh harvest mice have been conducted within the action area, pickleweed-vegetated tidal wetlands and other potential habitat areas of suitable for the salt marsh harvest mouse occur within the action area at the Petaluma Bridge crossing. Salt marsh harvest mice have been detected in tidal marshes approximately 0.5 mile downstream of the Petaluma Bridge portion of the action area. Given that the salt marsh harvest mouse recovery plan identified four essential habitat areas on the Petaluma River and the species is known throughout the Petaluma Marsh Wildlife Area downstream of the Petaluma Bridge it is likely that salt marsh harvest mice would be found in pickleweed habitat throughout the tidally influenced portions of the Petaluma River system. As noted in the May 2008 Biological Assessment, California Department of Fish and Game biologist Fred Botti stated that the listed mouse may use the pickleweed habitat at the Petaluma Bridge crossing for migration or dispersal. Therefore, given the biology and ecology of this animal, the presence of occupied habitat in other nearby tidal marshes, and recent records, the salt marsh harvest mouse is likely to inhabit the action area.

Effects of the Proposed Action

California Red-Legged Frog

The proposed project could have adverse effects on the threatened California red-legged frog through mortality, injury, harassment, and harm of individual juveniles and adults. According to the August 5, 2008, Caltrans letter, the proposed actions will adversely affect 206.94 acres of California red-legged frog habitat. According to Caltrans, the affects amount to 203.78 acres of permanent effects and 3.16 acres of temporary effects associated with the creation of bioswales.

The proposed project likely will result in adverse effects to the feeding, resting, aestivation, movement, and other essential behaviors of the California red-legged frog. It will result in the loss and degradation of habitat. The primary east-west habitat connectivity in Segment B is at the existing bridge spanned creek crossings. The bridge widening at these locations is unlikely to present any barriers to those movement corridors. Construction and maintenance of properly sized and located culverts likely will minimize this adverse effect of the threatened California red-legged frog (see Rodriguez *et al.* 1996; Yanes *et al.* 1905).

Construction activities associated with the proposed project would remove vegetation and other materials necessary for cover and aestivation, fill or crush burrows or crevices, and potentially reduce the prey base for the California red-legged frog. Because this listed amphibian uses small mammal burrows and soil crevices for shelter, individuals may be crushed, buried, or otherwise injured during construction activities. California red-legged frogs also may be run over by construction equipment or other vehicles accessing the construction areas. Disturbance caused by construction activities may cause frogs to disperse into areas of unsuitable habitat, increase the risk of predation or other sources of mortality. Siltation, fill, or spill of petroleum products or other chemicals could cause loss of prey items in or adjacent to the project area. Construction activities are likely to result in the direct disturbance, displacement, injury, and/or morality of California red-legged frogs. Individuals likely are to be killed or injured by construction equipment or other vehicles accessing the construction site. There is a likelihood of direct injury or mortality to the animal from injury or death due to pet cats or dogs owned by construction related personnel, poisoning by pesticides, injury or death due to predators attracted to food or trash at the site, and harassment from night-lighting, noise, and vibration. Implementation of certain types of erosion control materials, such as plastic netting, could result in the entanglement and death of California red-legged frogs within these materials due to exposure or predators (Bartin and Kinkead 2005; Stuart *et al.* 2001). Disturbance from construction activities may also cause individuals to move into or across areas of unsuitable habitat where they may be prone to higher rates of mortality from vehicles and predation.

Range-wide habitat loss, fragmentation, and degradation from multiple factors are the primary threats to the California red-legged frog (Service 1996, 2004). Loss of natural lands continues to occur further reducing the habitat available for this listed animal. However, the amount of historical and current habitat loss directly attributable to road loss has not been calculated, but the effect of habitat fragmentation on the California red-legged frog is significant. Fragmentation can reduce access to habitat as well as habitat suitability, increase mortality of animals that are moving between habitat patches due to increased risk of predation, and disrupt movements, dispersal, and gene flow. As barriers to movement for the California red-legged frog, roads create smaller patches of habitat and increase patch isolation. Smaller populations of animals are at greater risk of extinction by chance from demographic, genetic, and environmental stochastic events (Wilcox and Murphy 1985; Schoener and Spiller 1992). Isolated populations also have a higher chance of extinction without the demographic and genetic input of immigrants and a lower chance of colonization after extinction (Lande 1988; Sjogren-Gulve 1994).

The short term temporal effect will occur when suitable habitat is lost when riparian and other vegetation vegetation is removed for construction of the highway, and also due to the improved ability of predators to hunt the listed amphibian. Hilty and Merender (2004) found that, in contrast to native species, non-native mammalian predators were more active in narrow and denuded riparian corridors and in large expanses of agricultural land (vineyards) far from core habitat. The increased width of the highway along with higher numbers of vehicles and speed of the cars and trucks likely will discourage or prevent movement by the California red-legged frog.

The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the California red-legged frog are especially vulnerable to roads in the landscape. Van Gelder (1973) and Cooke (1995) have examined the effect of roads on amphibians; and found that because of their activity patterns, population structure, and preferred habitats, aquatic breeding amphibians are more vulnerable to traffic mortality than some other species.

Fahrig *et al.* (1995) found that high traffic two-lane paved roads had a much larger effect on frog abundance than low traffic two-lane roads. Mortality rates for anurans on high traffic roads are higher than on low traffic roads (Hels and Buchwald 2001). Vos and Chardon (1998) found a significant negative effect of road density on the occupation probability of ponds by the moor frog (*Rana arvalis*) in the Netherlands. In addition, incidences of very large numbers of road-killed frogs are well documented (e.g., Asley and Robinson 1996), and studies have shown strong population level effects of traffic density (Carr and Fahrig 2001) and high traffic roads on these amphibians (Van Gelder 1973; Vos and Chardon 1998). Most studies regularly count road kills from slow moving vehicles (Hansen 1982; Rosen and Lowe 1994; Drews 1995; Mallick *et al.* 1998) or by foot (Munguira and Thomas 1992). These studies assume that every victim is observed, which may be true for large conspicuous mammals, but it certainly is not true for small animals, such as the California red-legged frog. Amphibians appear especially vulnerable to traffic mortality because they readily attempt to cross roads, are slow-moving and small, and thus can not easily be avoided by drivers (Carr and Fahrig 2001).

The direction and type of habitat used by dispersing animals is especially important in fragmented environments (Forys and Humphrey 1996). Models of habitat patch geometry predict that individual animals will exit patches at more "permeable" areas (Buechner 1987; Stamps *et al.* 1987). A landscape corridor may increase the patch-edge permeability by extending patch habitat (La Polla and Barrett 1993), and allow individuals to move from one patch to another. The geometric and habitat features that constitute a "corridor" must be determined from the perspective of the animal (Forys and Humphrey 1996).

State Route 101 from Navato to Petaluma is a formidable barrier to California red-legged frog and general wildlife movement. There are existing bridge and culvert crossings that have the potential to provide wildlife passage under State Route 101. As part of the project, Caltrans plans to upsize the diameter of approximately 36 culvert pipes and one reinforced concrete box (RCB). These replacements will include the installation of two 18-inch pipes, twenty 24-inch

pipes, six 30-inch pipes, one 36-inch pipe, two 42-inch pipes, one 43-inch pipe and a 6 foot by 3 foot RCB. In addition, Caltrans will install approximately 41 new culvert pipes, including one new 7 foot by 7 foot cattle pass. These new structures include five 18-inch pipes, fifteen 24-inch pipes, four 30-inch pipes, three 36-inch pipes, one 42-inch pipe, and two 48-inch double pipes. There are also existing crossing structures in Segment B that are not subject to project alteration. Those include two 7- to 10-foot high cattle crossings and eight 2- to 7-foot high RCBs.

The project will provide more opportunity for wildlife passage under State Route 101, however, it is doubtful if frogs will use long corregated culverts across a 80-foot or wider roadway that are not day-lighted, do not have a natural bottom, and do not have regular maintenance to prevent filling with sediment and debris. The dimension of the tunnels is considered one of the most important variables in the design of passage ways for vertebrates (Yanes *et al.* 1995; Rodriguez *et al.* 1996); although no studies have determined a minimum width for the California red-legged frog, passages made for other small vertebrates, such as salamanders, must be wide and tall enough to enable animals to clearly see to the opposite end of the culvert, or there is lighting along the culvert provided by overhead grates. Ng *et al.* (2004) note that culverts typically are installed to accommodate water flow, the installation of such passage ways solely for listed species and wildlife, especially across major roadways, is justified if no other passages or crossings exist and there is suitable habitat. It is also important that the crossing attract target listed species and wildlife; fencing or other measures be incorporated into a wildlife crossing to guide animals to the preferred crossing; the crossing be placed strategically to enhance habitat connectivity; and that the adjacent land use be conducive to long-term habitat protection (Portland State University 2003). The culverts, RCBs, and cattle crossings proposed by Caltrans may not adequately minimize the reduction or elimination of the movement of the California red-legged frog. The long term viability of any designated wildlife crossing is questionable unless crossing locations and the habitat on both sides of the crossing are permanently set aside as open space or have a conservation easement or some other designation that limits development. In addition, hog wire apparently will not be placed on the bottom one foot of the highway perimeter fence to deter frogs from entering the roadway and guide them towards safe crossings. The culverts may not be high enough to allow the animals to see through them to the other side of the roadway, improper placement in areas where the animals will not use them, and the uncertainty of maintenance and silt removal at drainage-associated crossings could eliminate their potential use by the frogs. The lack of hog wire will result in individuals crossing the roadway where they are more likely to be killed by vehicles.

Larger culverts, e.g. at least 72 inches tall, grates placed midway on the culvert to allow lighting to encourage the animals to use them, placement in areas where the animals are moving through, and appropriate, maintenance and silt removal, and the use of properly sized hog wire along the bottom of the highway perimeter fence to guide the California red-legged frog to the culverts, RCBs, and cattle crossings should increase the potential for these animals to move across the State Route 101 right-of-way in areas other than the bridged creek crossings.

Road studies suggest that properly designed passage can significantly reduce wildlife, including frog mortality (Dodd *et al.* 2004). The Town of Amherst in the State of Massachusetts installed two culverts with guiding fences to facilitate spotted salamander (*Ambystoma maculatum*) migration from their wintering burrows during the spring. Before the placement of these culverts under Henry Street, a two-lane street, salamander mortality was high. After installation, approximately 75.9% of animals that reached the tunnel entrances successfully passed through them (Jackson 1996).

The installation of a concrete median will present a definitive barrier to California red-legged frog movement over the road. Within the concrete medians, Caltrans plans to install Type S barriers for wildlife crossing every 20 feet and Type M wildlife crossings would be installed every 0.25 miles. Type S barriers are a type 60 concrete barrier with a 6 inch diameter opening at the base of the barrier for small animal passage. Type M wildlife crossings are a type 60 concrete barrier with a 2-foot break in the barrier, with the break protected by a thrie-beam guard rail to deflect vehicle traffic. Given the amount of traffic on State Route 101 it is unlikely that frogs will be able to successfully cross the road even if they do manage to find these openings.

Though the intent of wildlife culverts and crossings are to ensure safe passage of listed species and wildlife, they are also a benefit to human safety (Aleshire 2007; Ruediger and DiGiorgio undated; Sherwood 2007). Deer-automobile collisions, estimated by the Insurance Information Institute to occur at a rate of 500,000 per year, result in over $1 billion worth of vehicular damages, 29,000 human injuries, and 200 human fatalities each year (Cornell University). Insurance company, State Farm estimates that there were more than 1.2 million claims for damage in crashes with animals during the last half of 2007 and the first half of 2008 (Highway Loss Data Institute 2008). Although most animal strikes do not result in human injury, human deaths resulting from animal collision is increasing (Highway Loss Data Institute 2008). Culverts large enough to accommodate species such as deer (*Odocoileus* species) and mountain lion (*Felis concolor*), while maintaining substrates for the California red-legged frog and smaller wildlife, could reduce roadway collisions for a variety of species. For example, wildlife crossings of the Trans-Canada Highway in Canada's Banff National Park have reduced wildlife road mortality by 80%, and as much as 96% for ungulates (Robbins 2003).

Because their habitats have been fragmented, many endangered and threatened species exist as metapopulations (Verboom and Apeldom 1990; Verboom *et al.* 1991). A metapopulation is a collection of spatially discrete subpopulations that are connected by the dispersal movements of the individuals (Levins 1970; Hanski 1991). For metapopulations of listed species, a prerequisite to recovery is determining if unoccupied habitat patches are vacant due to the attributes of the habitat patch (food, cover, and patch area) or due to patch context (distance of the patch to other patches and distance of the patch to other features). Subpopulations on patches with higher quality food and cover are more likely to persist because they can support more individuals. Large populations have less of a chance of extinction due to stochastic events (Gilpin and Soule 1986). Similarly, small patches will support fewer individuals, increasing the rate of extinction. Patches that are near occupied patches are more likely to be recolonized when local extinction

occurs and may benefit from emigration of individuals via the "rescue" effect (Hanski 1982; Gotelli 1991; Holt 1993; Fahrig and Merriam 1985). For the metapopulation to persist, the rate of patches being colonized must exceed the rate of patches going extinct (Levins 1970). If some subpopulations go extinct regardless of patch context, recovery actions should be placed on patch attributes. Patches could be managed to increase the availability of food and/or cover. Movements and dispersal corridors likely are critical to California red-legged frog population dynamics, particularly because the animals likely currently persist as metapopulations with disjunct population centers. Movement and dispersal corridors are important for alleviating over-crowding and intraspecific competition, and also they are important for facilitating the recolonization of areas where the animal has been extirpated. Movement between population centers maintains gene flow and reduced genetic isolation. Genetically isolated populations are at greater risk of deleterious genetic effects such as inbreeding, genetic drift, and founder effects. The survival of wildlife species in fragmented habitats may ultimately depend on their ability to move among patches to access necessary resources, retain genetic diversity, and maintain reproductive capacity within populations (Hilty and Merenlender 2004; Petit *et al.* 1995; Buza *et al.* 2000).

Most metapopulation or meta-population-like models of patchy populations do not directly include the effects of dispersal mortality on population dynamics (Hanski 1994; With and Crist 1995; Lindenmayer and Possingham 1996). Based on these models, it has become a widely held notion that more vagile species have a higher tolerance to habitat loss and fragmentation than less vagile species. But models that include dispersal mortality predict exactly the opposite: more vagile species should be more vulnerable to habitat loss and fragmentation becase they are more susceptible to dispersal mortality (Fahrig 1998; Casagrandi and Gatto 1999). This prediction is supported by Gibbs (1998), who examined the presence-absence of five amphibian species across a gradient of habitat loss. He found that species with low dispersal rates are better able than more vagile species top persist in landscapes with low habitat cover. Gibbs (1998) postulated that the land between habitat serves as a demographic "drain" for many amphibians. Furthermore, Bonnet *et al.* (1999) found that snake species that use frequent long-distance movements have higher mortality rates than do sedentary species.

The construction activities at the proposed project could result in the introduction of chemical contaminants to the site. Substances used in road building materials or could leach out or wash out of the soil into adjacent habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. A variety of substances could be introduced during accidental spills of materials. Such spills can result from leaks in vehicles, small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Large spills may be partially or completely mitigated by clean-up efforts, depending on the substance. California red-legged frogs using these areas could be exposed to any contaminants that are present at the site. Exposure pathways could include inhalation, dermal contact, direct ingestion, or ingestion of contaminated soil or plants. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. Carcinogenic substances could cause genetic damage resulting in sterility, reduced productivity, or reduced fitness among progeny. Little information

is available on the effects of contaminants on the California red-legged frog. The effects may be difficult to detect. Morbidity or mortality likely would occur after the animals had left the contaminated site, and more subtle effects such as genetic damage could only be detected through intensive study and monitoring.

Preconstruction surveys and the relocation of individual red-legged frogs may reduce injury or mortality. However, the capturing and handling of red-legged frogs to remove them from a work area may result in the harassment, mortality or injury of individuals. Stress, injury, and mortality may occur as a result of improper handling, containment, and transport of individuals. Death and injury of individual red-legged frogs could occur at the time of relocation or later in time subsequent to their release. Although survivorship for translocated red-legged frogs has not been estimated, survivorship of translocated wildlife, in general, is lower because of intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, risk of contracting disease in foreign environment, and increased risk of predation. Improper handling, containment, or transport of individuals would be reduced or prevented by use of a Service-approved biologist, by limiting the duration of handling, limited the distance of translocation, and requiring the proper transport.

Biologists, construction workers, and construction equipment working in different areas and with different species may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytrid fungus may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (e.g., water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001). Implementation of the "Declining Amphibian Populations Task Force Fieldwork Code of Practice" during any aquatic survey activity will likely prevent transfer of diseases through contaminated equipment or clothing.

Construction of roads can facilitate the invasion and establishment by species not native to the area (Gelbard and Belnap 2003) or are native and are better competitors than the California red-legged frog, such as the bullfrog, that could feed on or compete with, the listed amphibian or its food sources. Disturbance and alteration of habitat adjacent to roads may create favorable conditions for non-native plants and animals. These exotic species can spread along roadsides and then into adjacent habitat. Non-native animals may use modified habitats adjacent to road to disperse into California red-legged frog habitat. These animals could compete with the listed ranid for resources such as food or cover, or directly injure or kill the amphibians. Non-native plants and animals may reduce habitat quality for the threatened frog, and reduce the productivity or the local carrying capacity for the animals. Introductions of non-native species could cause California red-legged frogs to alter behavioral patterns by avoiding or abandoning areas near road.

Disturbed areas adjacent to roads provide favorable habitat conditions for a number of non-native plant species. Some of these taxa are aggressively invasive and they can alter natural communities and potentially affect habitat quality. A problematic species within the range of the California red-legged frog is yellow star thistle (*Centaurea melitensis*). Dense stands of this plant can form along roadsides and then spread into adjacent habitat. This plant displaces native vegetation, competes with native plants for resources, and it may be difficult for the animals to move through due the plant's numerous sharp spines. Other species that may disperse along roads and invade adjacent riparian habitats include mustards (*Brassica* species) and Russian thistle (*Salsola tragus*) (Tellman 1997). Disturbed soils and reduced competition from native plants are some of the conditions that facilitate invasion along roads by non-native plant species.

Negative effects to wildlife populations from roads may extend some distance from the actual road, as the proposed project. The phenomenon can result from any of the effects already described in this biological opinion, such as vehicle-related mortality, habitat degradation, and invasive exotic species. Forman and Deblinger (1998) described the area affected as the "road effect" zone. Along a 4-lane road in Massachusetts, they determined that this zone extend for an average of approximately 980 feet to either side of the road for an average total zone width of approximately 1970 feet. However, in places they detected an effect > 0.6 mile from the road. Rudolph *et al* (1999) detected reduced snake abundance up to 2790 feet from roads in Texas. They estimated snake abundance out to 2790 feet, so the effect may have been greater. Extrapolating to a landscape scale, they concluded the effect of roads on snake populations in Texas likely was significant, given that approximately 79% of the land area of the Lone Star State is within 1640 feet of a road. The "road-zone" effects can be subtle. Van der Zandt *et al.* (1980) reported that lapwings (*Vanellus vanellus*) and black-tailed godwits (*Limosa limosa*) feeding at 1575 feet-6560 feet from roads were disturbed by passing vehicles. The heart rate, metabolic rate and energy expenditure of female bighorn sheep (*Ovis canadensis*) increases near roads (MacArthur *et al.* 1979). Trombulak and Frossell (2000) described another type of "road-zone' effect. Heavy metal concentrations from vehicle exhaust were greatest within 66 feet of roads, by elevated levels of metals in both soil and plants were detected at 660 feet of roads. The "road-zone" apparently varies with habitat type and traffic volume. Based on responses by birds, Forman (2000) estimated the effect zone along primary roads of 1000 feet in woodlands, 1197 feet in grasslands, and 2657 feet) in natural lands near urban areas. Along secondary roads with lower traffic volumes, the effect zone was 656 feet. The "road zone" and the California red-legged frog have not been adequately investigated.

The proposed compensation for the effects to 203.78 acres of California red-legged frog habitat will likely be beneficial to this listed species in Marin and/or Sonoma Counties. Caltrans proposes expenditure of the funds to purchase California red-legged frog credits at a Service-approved approved conservation bank, establishment of a Service-approved conservation easement, or obtaining fee title to habitat acquisition.

Caltrans is entertaining the possibility of obtaining a conservation easement at the Lawson's Landing property at Dillon Beach in Marin County. Lawson's Landing property is approximately 940 acres, and is one of the few areas remaining in coastal California with an active dune system that is not under permanent conservation status. The site supports a high proportion of dune slack wetlands with breeding habitat for the California red-legged frog. It has the largest expanse of native coastal scrub vegetation on paleodunes north of Monterey. The beach supports one of the largest wintering populations for the threatened western snowy plover (*Charadrius alexandrinus nivosus*) between San Francisco and the northern end of their range in Washington State. The endangered Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) has been documented in the past as well as the endangered Tidestrom's lupine (*Lupinus tidestromii*) and the potential exists to repatriate these species for their recovery. The dunes and wetlands host numerous other special status plants and invertebrates that are adapted to shifting sands and coastal wetlands. The site not only offers important biological resources, but geological interest, as well as stunning scenic resources. The area contains important habitat for the California red-legged frog, as well as other listed species. Not all of the Lawson's Landing property provides habitat for the California red-legged frog but the establishment of a conservation easement on the California red-legged frog habitat within the Lawson's Landing property likely will provide benefits to several listed species, as well as native wildlife.
There are also several ranchers in Marin and Sonoma Counties that would be willing to sell conservation easements on their land that would allow them to maintain ecologically sustainable grazing while providing in-perpetuity management for the California red-legged frog. Conservation easements would be especially valuable for this listed frog in areas of designated or proposed California red-legged frog critical habitat.

Salt Marsh Harvest Mouse

Construction and other work activities at the Petaluma River Bridge crossing would permanently eliminate about 0.05 acres of pickleweed-vegetated habitat currently available for salt marsh harvest mice. Construction and other work activities in and around the pickleweed habitat near the Petaluma River Bridge crossing could affect individual salt marsh harvest mice through increased disturbance and habitat destruction. Increased levels of disturbance to salt marsh harvest mice would result from noise and vibrations from equipment and other work activities. Operation of equipment and associated loss of habitat would result in displacement of salt marsh harvest mice from protective cover and their territories/home ranges (through noise and vibrations) and/or direct injury or mortality (through crushing). These disturbances likely would disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal, and likely result in the displacement of salt marsh harvest mice from their territory/home range in the areas where their habitat is destroyed. Displaced salt marsh harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Female salt marsh harvest mice are reproductively active from March through November (Fisler 1965), so disturbance during this period could result in abandonment or failure of their litter. Thus, displaced salt marsh harvest mice may suffer from increased predation, competition, mortality, and reduced reproductive success.

Salt marsh harvest mice could be harmed if the habitat area affected by the proposed action is colonized by non-native, invasive plant species. The proposed action could result in the invasion of non-native plant species in the habitat area off the Petaluma River and subsequently into adjacent habitat areas for the salt marsh harvest mouse and California clapper rail. If established in these habitat areas, these non-native plant species could limit the habitat value of these areas for salt marsh harvest mice and California clapper rails by out competing and preventing or limiting the establishment of native wetland plant species. Successful removal of non-native, invasive plant species could prevent, or at least severely reduce the establishment of these undesirable species and ensure that current habitat values are reestablished or increased.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Numerous non-Federal activities continue to negatively affect the California red-legged frog in Marin and Sonoma Counties. Habitats are lost or degraded as a result of road and utility construction and maintenance, overgrazing, agricultural expansion, and water irrigation and storage projects that may not be funded, permitted, or constructed by a Federal agency. Other threats include contamination, poisoning, increased predation, and competition from non-native species associated with human development. Small private actions that may impact listed species, such as conversion of land, small mammal population control, mosquito control, and residential development, may occur without consultation with or authorization by the Service or the California Department of Fish and Game pursuant to their respectively Endangered Species Act.

As urban development continues, it will likely adversely affect upland areas that serve as dispersal and aestivation habitat for red-legged frogs. Continued development and maintenance of roadways to serve expanding urban areas may further fragment and isolate populations of red-legged frogs from other nearby populations. Increased predation associated with domesticated pets or feral animals generally accompanies urban expansion. As urban development encroaches on rural areas, the need increases for mosquito abatement programs that may introduce exotic fish into ponds used for breeding by red-legged frogs, thus impacting the reproductive success of this species.

Increased levels of vehicles and increased vehicle speeds could lead to an increased mortality level for the California red-legged frog. The cumulative local development will result in temporary and permanent habitat fragmentation. The results of fragmentation are inhibition of genetic exchange between populations and impediments to recolonization of habitats from which populations have been extirpated. Small, isolated populations are substantially more vulnerable

to stochastic events (e.g., aberrant weather patterns, fluctuations in availability of food) and may exhibit reduced adaptability to environmental (natural or anthropogenic) changes.

There is a continued demand for new housing and commercial development in Marin and Sonoma Counties and other road and development projects have been recently completed or are planned along the State Route 1, State Route 12, State Route 101, and State Route 116. These developments and further infill will eliminate the habitat connectivity between listed species habitat remaining habitat in the action area vicinity and the local region. Development of adjacent wildlife habitat will continue to result in the loss of not only breeding, resting, and foraging habitat, but the loss of dispersal corridors between breeding populations, thereby further isolating and fragmenting wildlife populations. Additionally, development of small reservoirs or water bodies, such as golf course hazards, and water diversions may occur which may pose further threats such as disruption of dispersal corridors for terrestrial species, and competition or predation from with non-native species such as bullfrogs for aquatic species.

Cumulative effects to the California red-legged frog include continuing and future conversion of suitable breeding, foraging, sheltering, and dispersal habitat resulting from urban development. Additional urbanization can result in road widening and increased traffic on roads that bisect habitat, thereby increasing road-kill while reducing in size and further fragmenting remaining habitats.

Cattle-grazing is a common land use practice in rural Marin and Sonoma Counties. Overgrazing results in degradation and loss of riparian vegetation, increased water temperatures, streambank and upland erosion, and decreased water quality in streams. Livestock operations may also degrade water quality with pesticides and nutrient contamination. However, light to moderate livestock grazing is generally thought to be compatible with continued successful use of rangelands by the red-legged frog and other listed species, provided the grazed areas do not also have intensive burrowing rodent control efforts (T. Jones, in litt. 1993; Shaffer et al. 1993). The shorter vegetation associated with grazed areas may make the habitat more suitable for ground squirrels whose burrows are utilized by red-legged frogs. Rodent control in rural areas in Marin and Sonoma Counties could contribute to the decline of red-legged frogs in the region, as well as other sensitive species that utilize burrows created by burrowing rodents.

Agricultural development, impoundments, and irrigation can reduce stream flows, resulting in the loss of aquatic habitat during the summer for red-legged frogs. Discing is a common practice on agricultural lands which can result in substantial losses of upland habitat for red-legged frogs. Significant conversion of rural, undeveloped land to agricultural land, particularly vineyards, is currently occurring in Sonoma County, resulting in loss of upland habitat for listed species. California red-legged frogs likely are exposed to a variety of pesticides and other chemicals throughout their ranges. This amphibian species could also die from starvation due to the loss of their prey base. Hydrocarbon and other contamination from oil production and road runoff; the application of numerous chemicals for roadside maintenance; urban/suburban landscape maintenance; and rodent and vector control programs may all have negative effects on red-legged

frog populations. In addition, red-legged frogs may be harmed through increased road kill due to the construction and use of new roads and increased traffic in the overall region and collection by amphibian enthusiast and others.

Further habitat fragmentation; additional non-native species introduction; translocation of infected individuals, and increased access to aquatic habitat could facilitate or increase the spread of amphibian diseases within the range of the California red-legged frog. The global mass extinction of amphibians primarily due to chytrid fungus continues to be of significant concern (Norris 2007; Skerratt *et al* 2007).

The global average temperature has risen by approximately 0.6 degrees centigrade during the 20th Century (International Panel on Climate Change 2001, 2007; Adger et al 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (International Panel on Climate Change 2001, 2007; Adger et al. 2007), and that it is "very likely" that it is largely due to increasing concentrations of greenhouse gases (carbon dioxide, methane, nitrous oxide, and others) in the global atmosphere from burning fossil fuels and other human activities (Cayan et al. 2005, EPA Global Warming webpage http://yosemite.epa.gov; Adger et al. 2007). Eleven of the twelve years between 1995 and 2006 rank among the twelve warmest years since global temperatures began in 1850 (Adger et al. 2007). The warming trend over the last fifty years is nearly twice that for the last 100 years (Adger et al. 2007). Looking forward, under a high emissions scenario, the International Panel on Climate Change estimates that global temperatures will rise another four degrees centigrade by the end of this Century; even under a low emissions growth scenario, the International Panel on Climate Change estimates that the global temperature will go up another 1.8 degrees centigrade (International Panel on Climate Change 2001).

The increase in global average temperatures affects certain areas more than others. The western United States, in general, is experiencing more warming than the rest of the Nation, with the 11 western states averaging 1.7 degrees Fahrenheit warmer temperatures than this region's average over the 20th Century (Saunders et al. 2008). California, in particular, will suffer significant consequences as a result of global warming (California Climate Action Team 2006). In California, reduced snowpack will cause more winter flooding and summer drought, as well as higher temperatures in lakes and coastal areas. The incidence of wildfires in the Golden State also will increase and the amount of increase is highly dependent upon the extent of global warming. No less certain than the fact of global warming itself is the fact that global warming, unchecked, will harm biodiversity generally and cause the extinction of large numbers of species. If the global mean temperatures exceed a warming of two to three degrees centigrade above pre-industrial levels, twenty to thirty percent of plant and animal species will face an increasingly high risk of extinction (International Panel on Climate Change 2001, 2007).

The mechanisms by which global warming may push already imperiled species closer or over the edge of extinction are multiple. Global warming increases the frequency of extreme weather events, such as heat waves, droughts, and storms (International Panel on Climate Change 2001,

2007; California Climate Action Team 2006; Lenihan et al. 2003). Extreme events, in turn may cause mass mortality of individuals and significantly contribute to determining which species will remain or occur in natural habitats. As the global climate warms, terrestrial habitats are moving northward and upward, but in the future, range contractions are more likely than simple northward or upslope shifts. Ongoing global climate change (Anonymous 2007; Inkley et al. 2004; Adger et al. 2007; Kanter 2007) likely imperils the California red-legged frog and the resources necessary for its survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitats and/or prey, and/or increased numbers of their predators, parasites, and diseases. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat.

Numerous activities continue to eliminate habitats of salt marsh harvest mice. Habitat loss and degradation affecting this species continues as a result of urbanization, freshwater urban run-off, and contaminant inputs. Salt marsh harvest mice are also affected by increased predation associated with human development, and disturbance of breeding and foraging behavior. All of these non-Federal activities are expected to continue to adversely affect listed species considered in this opinion within the action area.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by FHWA so that they become binding conditions of any grant or permit issued to FHWA as appropriate, in order for the exemption in section 7(o)(2) to apply. FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If FHWA (1) fails to require Caltrans to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect because when California red-legged frogs are not in their breeding ponds, they inhabit the burrows of ground squirrels or other rodents; they may be difficult to locate due to their cryptic appearance and behavior; the juvenile and adult animals may be located a distance from the breeding ponds; the migrations occur on a limited period during rainy nights in the fall, winter, or spring; and the finding of an injured or dead individual is unlikely because of their relatively small body size. Recent project monitoring suggests that California red-legged frogs are difficult to find during preconstruction clearance surveys that include excavation of potential upland salamander refugia in close proximity to breeding ponds and other aquatic habitat. Losses of California red-legged frogs may also be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in water regime at their breeding ponds, or additional environmental disturbances. Due to the difficulty in quantifying the number of California red-legged frogs that will be taken as a result of the proposed action, the Service is quantifying take incidental to the project as all of the California red-legged frogs inhabiting or utilizing the 206.94 acres of habitat identified within Segment B and Washington Creek and Lynch Creek in Segment C. The incidental take is expected to be in the form of harm, harassment, injury, and mortality to adult California red-legged frogs from habitat loss/degradation, construction-related disturbance, and capture and relocation.

The Service anticipates incidental take of the salt marsh harvest mouse will be difficult to detect or quantify because of the variable, unknown size of any resident population over time, and the difficulty of finding killed or injured small mammals. The level of take of salt marsh harvest mice can be anticipated by the loss of available habitat. The Service considers the number of salt marsh harvest mice subject to harassment from noise and vibrations to be impracticable to estimate. Upon implementation of the Reasonable and Prudent Measures, incidental take associated with the proposed project in the form of harm, and harassment of the salt marsh harvest mouse caused by habitat loss and construction activities will become exempt from the prohibitions described under section 9 of the Act.

Upon implementation of the following reasonable and prudent measures incidental take associated with the proposed action described above for the California red-legged frog and salt marsh harvest mouse will become exempt from the prohibitions described under section 9 of the Act.

Effect of the Take

The Service determined that this level of anticipated take is not likely to result in jeopardy to the California red-legged frog or the salt marsh harvest mouse. There is no designated or proposed critical habitat for the listed frog in the action area and critical habitat has not been designated for the salt marsh harvest mouse.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the California red-legged frog and the salt marsh harvest mouse. FHWA will be responsible for compliance with these measures which they will entrust Caltrans to implement:

1. FHWA will ensure the conservation measures in the project description as described in the May 2008, Biological Assessment, the August 27, 2008 revised project description, and this biological opinion will be implemented.

2. FHWA will ensure adverse effects to the California red-legged frog and the salt marsh harvest mouse will be minimized.

3. FHWA will ensure their compliance with this biological opinion.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, with implementation under the direction of Caltrans, FHWA shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure one (1):

   a. FHWA shall minimize the potential for harm, harassment, or killing of federally listed wildlife species resulting from project related activities by implementation of the conservation measures as described in the May 2008, Biological Assessment, the August 27, 2008 revised project description, and appearing in the *Project Description* of this biological opinion.

   b. FHWA/Caltrans shall include Special Provisions that include the Conservation Measures and the Terms and Conditions of this biological opinion in the solicitation for bid information. In addition, Caltrans shall educate and inform contractors involved in the project as to the requirements of the biological opinion.

   c. Caltrans and FHWA have proposed to provide 1:1 compensation for the effects to 203.78 acres of California red-legged frog habitat. Acceptable compensation shall be satisfied through in-perpetuity preservation of high quality red-legged frog habitat consisting of a breeding and/or significant dispersal habitat between breeding populations or a biological equivalent site similar to Lawson's Landing through

purchase of bank credits and/or acquisition of a conservation easement or fee title. Purchase of the site shall be reviewed and approved by the Service.

If a compensation bank is proposed in lieu of acquisition it shall be a Service-approved bank.

An approved ecologically-based conservation easement shall include restricted public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a property analysis. The management plan shall include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities should be implemented, how often and to what level monitoring of the site shall occur, and a action/contingency plan to address potential management issues.

Proposed habitat acquisition shall also be accompanied by a Service-approved conservation easement that shall include restricted public access, a management plan, and an in-perpetuity endowment based on a property analysis.

Caltrans will demonstrate measurable progress in proving the Service approved compensation prior to initiating construction in Segment B in Phase 1, not no later than initiating construction on Phase 2.

d. Wildlife crossings established in Segment B shall be reviewed and approved by the Service.

e. FHWA/Caltrans shall prepare a relocation plan for moving California red-legged frogs that will be submitted to the Service for review and approval at least thirty (30) calendar days prior to the date of groundbreaking.

2. The following Terms and Conditions implement Reasonable and Prudent Measure two (2):

a. The Resident Engineer or their designee shall be responsible for implementing the conservation measures and Terms and Conditions of this biological opinion and shall be the point of contact for the project. The Resident Engineer or their designee shall maintain a copy of this biological opinion onsite whenever construction is taking place. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking at the project. Prior to ground breaking, the Resident Engineer must submit a letter to the Service verifying that they posses a copy of this biological opinion and have read the Terms and Conditions.

b. The Caltrans biologist shall have oversight over implementation of all the Terms and Conditions in this biological opinion, and shall have the authority to stop project

activities, through communication with the Resident Engineer or their designee, if any of the requirements associated with these Terms and Conditions are not being fulfilled. If biologist/construction liaison has requested a stop work due to take of any of the listed species the Service and the California Department of Fish and Game will be notified within one (1) working day via email or telephone.

c. Only Service-approved biologist(s) who are familiar with the biology and ecology of the California red-legged frog shall capture or handle this listed species.

d. To control erosion during and after implementation of the project, the applicant will implement erosion control BMPs. Erosion control measures and BMPs, which retain soil or sediment, runoff from dust control, and hazardous materials on the construction site and prevent these from entering aquatic habitat, will be placed, monitored, and maintained throughout the construction operations. These measures and BMPs may include, but are not limited to, silt fencing, sterile hay bales, vegetative strips, hydroseeding, and temporary sediment disposal.

e. Nets or bare hands may be used to capture California red-legged frogs. Service-approved biologists will not use soaps, oils, creams, lotions, repellents, or solvents of any sort on their hands within two hours before and during periods when they are capturing and relocating red-legged frogs. To avoid transferring disease or pathogens between aquatic habitats during the course of surveys or handling of red-legged frogs, Service-approved biologists will follow the Declining Amphibian Populations Task Force's "Code of Practice." Service-approved biologists will limit the duration of handling and captivity of red-legged frogs. While in captivity, individual frogs shall be kept in a cool, moist, aerated environment, such as a bucket containing a damp sponge. Containers used for holding or transporting adults shall not contain any standing water. California red-legged frogs should not be moved outside their functional population in order to reduce translocation stress and the spread of disease.

f. Biologists shall take precautions to prevent introduction of amphibian diseases to the action area by disinfecting equipment and clothing as directed in the October 2003, California tiger salamander survey protocol titled, Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander and the recommended equipment decontamination procedures within the Service's California Red-Legged Frog Survey Guidance. Both items are available at the Service's Sacramento office website (http://www.fws.gov/sacramento/es/protocol.htm). Disinfecting equipment and clothing is especially important when biologists are coming to the action area to handle salamanders or frogs after working in other aquatic habitats.

g. All California red-legged frogs encountered in the action area should be relocated to a Service-approved location. The relocation site must be approved for the Marin Sonoma Narrows Project prior to ground breaking.

h. An outline of the employee environmental awareness program shall be submitted to the Deputy Assistant Field Supervisor of the Endangered Species Program at the Sacramento Fish and Wildlife Office within twenty (20) working days prior to the start of construction. Documentation of the training, including individual signed affidavits, will be kept of file and available on request.

i. Permanent and temporary disturbances and other types of project-related disturbance to the habitats of the California red-legged frog and the salt marsh harvest mouse shall be minimized to the maximum extent practicable by Caltrans. To minimize temporary disturbances, all project-related vehicle traffic shall be restricted to established roads, construction areas, and other designated areas. These areas also should be included in pre-construction surveys and, to the maximum extent possible, should be established in locations disturbed by previous activities to prevent further adverse effects.

j. Areas disturbed by project activities will be recontoured to pre-project conditions and reseeded with an appropriate erosion-control mixture. The seed mixture will include appropriate native grasses and forbs. Areas that will be subjected to ongoing maintenance are not areas of temporary effects even if they are restored within one year following the initial disturbance.

k. Construction activities shall not occur adjacent to the pickleweed wetland on the north side of the Petaluma River during high tide events of eight feet or greater (as determined by NAVD88 vertical datum) when salt marsh harvest mice might seek refuge outside of the adjacent inundated tidal marsh. Activities shall not resume until the water level has dropped below the eight foot NAVD88 elevation.

3. The following Terms and Conditions implement Reasonable and Prudent Measure three (3):

a. The following shall be implemented for staging, storage sites, vehicle parking, and access associated with the project:

1. Caltrans shall require as part of the construction contract that all contractors comply with the Act in the performance of the work as described in the project description of this biological opinion and conducted within the action area.

2. If a staging, storage, access, or vehicle parking area that is in compliance with the Act is not available, the agency with jurisdiction and the contractor would be responsible for compliance with the Act.

c. Caltrans shall report to the Service any information about take or suspected take of listed wildlife species not authorized by this biological opinion. Caltrans must notify the Service via electronic mail and telephone within 24 hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. The individual animal shall be preserved, as appropriate, and held in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program, Sacramento Fish and Wildlife Office at (916) 414-6600, and Resident Agent-in-Charge Dan Crum of the Service's Law Enforcement Division at (916) 414-6660.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases.

The Service requests notification of the implementation of any conservation recommendations in order to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats. We propose the following conservation recommendations:

1. FHWA, Caltrans, Transportation Authority of Marin, and Sonoma County Transportation Authority should assist the Service in implementing recovery actions identified in the *Recovery Plan for the California Red-legged Frog* (Service 2002).

2. Caltrans should consider participating in the planning for a regional habitat conservation plan for the California red-legged frog, salt marsh harvest mouse, other listed species, and sensitive species.

3. FHWA, Caltrans, Transportation Authority of Marin, and Sonoma County Transportation Authority should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the California red-legged frog, salt marsh harvest mouse, and other listed species. Such banking systems also could possibly be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where

appropriate. Efforts should be made to preserve habitat along roadways in association with wildlife crossings.

4. Roadways can constitute a major barrier to critical wildlife movement. Therefore, FHWA, Caltans, Transportation Authority of Marin, and Sonoma County Transportation Authority should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by California red-legged frog, other listed animals, and wildlife. Photographs, plans, and other information in to the biological assessments if "wildlife friendly" crossings are incorporated into projects. Efforts should be made to establish upland culverts designed specifically for wildlife movement rather than accommodations for hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

5. FHWA and Caltrans should continue to pursue multifaceted compensation packages such as the one developed for the proposed U.S. Interstate 580/Isabel Avenue Interchange Construction Project on future formal consultations with the Service.

6. Caltrans should continue to develop and implement their Early Statewide Biological Mitigation Planning Project that has been developed by the University of California at Davis, Road Ecology Center through Caltrans funding.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed and/or proposed species or their habitats, the Service requests notification of the implementation of these recommendations.

REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the proposed State Route 101 Marin-Sonoma Narrows HOV Widening Project, Marin and Sonoma Counties, California. As provided in 50 CFR §402.16 and in the terms and conditions of this biological opinion, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the final project design exceeds the described action area in the May 2008 Biological Assessment; (2) the amount or extent of incidental take is exceeded; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (4) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (5) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning this opinion on the proposed State Route 101 Marin-Sonoma Narrows HOV Widening Project, Marin and Sonoma Counties, California, please contact John Cleckler or Ryan Olah at the letterhead address or at (916) 414-6600.

Sincerely,

for Susan K. Moore
Field Supervisor

cc:
Larry Vinzant, Cesar Perez, Federal Highway Administration, Sacramento, California
Dale Jones, California Department of Transportation, Sacramento, California
Jim Richards, John Yeakel, Kevin Melanephy, California Department of Transportation, Oakland, California
Corinna Lu, CH2M Hill, Oakland, California
Scott Wilson, Melissa Escaron, California Department of Fish and Game, Yountville, California
Guy Preston, Preston Engineering Management Consulting, Ashland, Oregon
Bill Gamlen, Transportation Authority of Marin, San Rafael, California
John Maitland, Seana Gause, Sonoma County Transportation Authority, Santa Rosa, California

Literature Cited

Adger, N., P.Aggarwal, S. Agrawala, J.Alcamo, A. Allali, O. Anisimov, N. Arnell, M. Boko, O.Canziani, T. Carter, G. Cassa, U. Confalonieri, R. Cruz, E.de Alba Alcaraz, W. Eastreling, C. Field, A. Fischlin, B. Fitzharris, C.G. Garcia, C. Hanson, H. Harasawa, K. Hennessy, S.Huq, R. Jones, L. K. Bogataj, D. Karoly, R. Kliein, Z. Kundzewicz, M. Lal, R. Lasco, G. Love, X. Lu, G. Magrin, L.J. Mata, R. McLean, B. Menne, G. Midgley, N. Mimura, M.Q. Mirza, J. Moreno, L. Mortsch, I. Niang-Diop, R. Nichols, B. Novaky, L. Nurse, A. Nyon, M. Oppenheimer, J. Palutikof, M. Parry, A. Patwardhan, P. R. Lankao, C. Rosenzweig, S. Schneider, S. Semenov, J. Smith, J. Stone, J van Ypersele, D. Vaughan, C. Vogel, T. Wilbanks, P.Wong, S. Wu, and G. Yohe. 2007. Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Climate Change 2007: Climate change impacts, adaptation and vulnerability. Brussels, Belgium.

Aleshire, P. 2007. Safe Crossing. High Country News November 12, 2007.

Anonymous. 2007. Global warming is changing the World. Science 316:188-190.

Buechner, M. 1987. Conservation in insular parks: simulation models of factors affecting the movement of animals across park boundaries. Biological Conservation 41:57-76.

Bulger, J. B., N. J. Scott Jr., and R. B. Seymour. 2003. Terrestrial activity and conservation of adult California red-legged frogs *Rana aurora draytonii* in coastal forests and grasslands. Biological Conservation 110:85-95.

California Department of Transportation (Caltrans). 2007. Biological assessment for the restoration of the hydraulic capacity of the Cowan Storm Drain Canal within the U.S. Highway 101/Millbrae Avenue Interchange. EA 3A0400. December 2007. Caltrans District 4, Oakland, California.

California Climate Action Team. 2006. Climate Action Team Final Report to the Governor and Legislature. http://www.climatechange.ca.gov/climate_action_team/index.html.

Cayan, D.A., L. Leurs, M. Hanemann, G. Franco, and B. Croes. 2006. Sceanrios of climate change in California: an overview. A report from the California Climate Change Center, California Energy Commission and the California Environmental Protection Agency, Sacramento, California.

Carr, L.W., and L. Fahrig. 2001. Effect of road traffic on two amphibian species of differing vagility. Conservation Biology 15: 1071-1078.

Casagrandi, R., and M. Gatto. 1999. A mesoscale approach to extinction in fragmented habitats. Nature 400: 560-562.

Cornell University. Management of Wildlife Damage in Suburban and Rural Landscapes. http://wildlifecontrol.info/ne1005. Accessed December 2007.

Dodd, C. K. Jr., W. J. Barichivich, and L. L. Smith. 2004. Effectiveness of a barrier wall and culverts in reducing wildlife mortality on a heavily traveled highway in Florida. Biological Conservation 118 (2004) 619-631.

Drews, C. 1995. Road kills of animals by public traffic in Mikumi National Park, Tanzania, with notes on baboon mortality. African Journal of Ecology 33: 89-100.

Emlen, S. T. 1977. "Double clutching" and its possible significance in the bullfrog. Copeia 1977(4):749-751.

Fahrig, L. 1998, When does fragmentation of breeding habitat affect population survival? Ecological Modeling 105: 273-292.

Fahrig, L., and G. Merriam. 1985. Habitat patch connectivity and population survival. Ecology 66:1762-1768

Fahrig, L., J.H. Pedlar, S.E. Pope, P.D. Taylor, and J. F. Wegner. 1995. Effect of road traffic on amphibian density. Biological Conservation 73: 177-182.

Fellers, G. 2005. *Rana draytonii* Baird and Girard, 1852b California red-legged frog. Pages 552-554 *in* M. Lannoo (editor). Amphibian declines the conservation status of United States species. University of California Press. Berkeley, California.

Fellers, G. M. and P. M. Kleeman. 2007. California Red-Legged Frog (*Rana draytonii*) movement and habitat use: implications for conservation. Journal of Herpetology 41(2): 271-281

Findlay, C.S. and J. Houlahan. 1997. Anthropogenic correlates of species richness in southeastern Ontario wetlands. Conservation Biology 11: 1000-1009.

Fisler, G. F. 1965. Adaption and speciation in harvest mice of the marshes of San Francisco Bay. Univ. Calif. Publ. Zool. 77:1-108.

Forman, R. T., L.E. Alexander. 1998. Roads and their major ecological effects. Annual Review of Ecology and Systematics 29:207-231.

Gibbs, J.P. 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. Journal of Wildlife Management 62: 584-589.

Goals Project. 1999. Baylands ecosystem habitat goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco, California, and San Francisco Bay Regional Water Quality Control Board, Oakland, California. 209 pp. plus appendices.

Hanski, I. 1982. Dynamics of regional distribution: the core and satellite hypothesis. Oikos 38:210-221.

_____ 1991. Single species metapopulation systematics: concepts, models and observations. Biological Journal of the Linnean Society 42:3-16.

_____ 1994. A practical model of metapopulation dynamics. Journal of Animal Ecology 63: 151-162.

Hayes, M. P., and M. R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): implications for management. Pages 144-158 *in* R. Sarzo, K. E. Severson, and D. R. Patton (technical coordinators). Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. United States Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station, Fort Collins, Colorado. General Technical Report (RM-166): 1-458.

Hayes, M. P. and D. M. Krempels. 1986. Vocal sac variation among frogs of the genus *Rana* from western North America. Copeia 1986(4):927-936.

Hayes, M. P. and M. M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R. a. draytonii*. Copeia 1984(4):1018-1022.

Hayes, M. P., and M. R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). Southwestern Naturalist 30(4): 601-605.

Hels, T. and E. Buchwald. 2001. The effect of road kills on amphibian populations. Biological Conservation 99: 331-340.

Highway Loss Data Institute. 2008. Collisions with deer and other animals spike in November; fatal crashes up 50% since 2000. October 30, 2008, news release. Available at http://www.iihs.org/news/2008/iihs_news_103008.pdf.

IFPC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change

[Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (editors)]. Cambridge University Press, Cambridge, United Kingdom and New York, New York. 881 pp. Available at http://www.ipcc.ch/.

_____ 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Alley, R., T. Berntsen, N.L. Bindoff, Z. Chen, A. Chidthaisong, P. Friedlingstein, J. Gregory, G. Hegerl, M. Heimann, B. Hewitson, B. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, M. Manning, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, D. Qin, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, S. Solomon, R. Somerville, T.F. Stocker, P. Stott, R.F. Stouffer, P. Whetton, R.A. Wood, D. Wratt. 21 pp. Available at http://www.ipcc.ch/.

Ingles, L.G. 1932a. Four new species of *Heamatoloechus* (Trematoda) from California. University of California Publications in Zoology 37: 189-201.

_____ 1932b. *Cephalogonimus brevicirrus*, a new species of trematoda from the intestine of *Rana aurora* from California. University of California Publications in Zoology 37:203-210.

_____ 1933. Studies on the structure and life history of *Ostiolum oxyorchis* (Ingles) from the California red-legged frog *Rana aurora draytonii*. University of California Publication in Zoology 39:135-162.

Inkley, D.B., M.G. Anderson, A.R. Blaustein, V.R. Burkett, B. Felzer, B. Griffin, J. Price, and T.L. Root. 2004. Global climate change and wildlife in North America. Wildlife Society Technical Review 04-2.

Jackson, S.D. 1996. Underpass systems for amphibians. 4 pages. In G.L. Evink, P. Garrett, D. Zeigler and J. Berry (editors) Trends in Addressing Transportation Related Wildlife Mortality, proceedings of the transportation related wildlife mortality seminar. State of Florida Department of Transportation, Tallahassee, Florida. FL-ER-58-96.

Jennings, M. R. 1988. Natural history and decline of native ranids in California. Pages 61-72 *in* H. F. De Lisle, P. R. Brown, B. Kaufman, and B. McGurty (editors). Proceedings of the Conference On California Herpetology. Southwestern Herpetologists Society, Special Publication 4:1-143.

Jennings, M. R., and M. P. Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): The inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetological Review 31(1):94-103.

_____ 1990. Final report of the status of the California red-legged frog (*Rana aurora draytonii*) in the Pescadero Marsh Natural Preserve. Final report prepared for the California Department of Parks and Recreation, Sacramento, California, through Agreement (4-823-9018). Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California. 30 pages.

Jennings, M. R., M. P. Hayes, and D. C. Holland. 1992. A petition to the U.S. Fish and Wildlife Service to place the California red-legged frog (*Rana aurora draytonii*) and the western pond turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants. 21 pages.

Kanter, J. 2007. Scientists detail climate changes, Poles to Tropics. New York Times. April 10, 2007.

Kruse, K. C. and M. G. Francis. 1977. A predation deterrent in larvae of the bullfrog, *Rana catesbeiana*. Transactions of the American Fisheries Society 106(3):248-252.

Kupferberg, S. J. 1996a. Hydrologic and geomorphic factors affecting conservation of a river-breeding frog (*Rana boylii*). Ecological Applications 6: 1322-1344.

_____ 1996b. The ecology of native tadpoles (*Rana boylii* and *Hyla regilla*) and the impacts of invading bullfrogs (*Rana catesbeiana*) in a northern California river. PhD dissertation. University of California, Berkeley, California.

Lenihan, J. M., R. Drapek, D. Bachelet, R. P. Neilson. 2003. Climate Change Effects on Vegetation Distribution, Carbon, and Fire in California. Ecological Applications 13(6): 1667-1681.

Lindenmayer, D.B., and H.P. Possingham. 1996. Modeling the interrelationships between habitat patchiness, dispersal capability and metapopulation persistence of the endangered species, Leadbeater's possum, in southeastern Australia. Landscape Ecology 11:79-105.

Mao, J., D. E. Green, G. M. Fellers, and V. G. Chincar. 1999. Molecular characterization of iridoviruses isolated from sympatric amphibians and fish. Virus Research 6: 45-52.

Mallick, S.A., G.J. Hocking, and M.M. Driessen. 1998. Road-kills of the eastern barred bandicoot (*Perameles gunnii*) in Tasmania: an index of abundance. Wildlife Research 25: 139-145.

Munguira, M.L. and J.A. Thomas. 1992. Use of road verges by butterfly and moth populations, and the effect of roads on adult dispersal and mortality. Journal of Applied Ecology 29: 316-329.

Ng, S.J., J.W. Dole, R.M. Savajot, S.R.D. Riley, and T.J. Valone. 2004. Use of highway undercrossings by wildlife in southern California. Biological Conservation 115: 499-507.

Portland State University. 2003. Wildlife crossing, rethinking road design to improve safety and reconnect habitat. Prepared for Metro. Portland State University Planning Workshop. June 2003.

Robbins, E. 2003. No more road kill: What it takes to make highways friendly to animals. Planning 69(2): 33-34.

Rodriguez, A., G. Crema, and M. Delibes. 1996. Use of non-wildlife passages across a high speed railway by terrestrial vertebrates. Journal of Applied Ecology 33: 1527-1540.

Rosen, P.C. and C.H. Lowe. 1994. Highway mortality of snakes in the Sonoran desert of southern Arizona. Biological Conservation 68: 143-148.

Rothermel, R.B. and R. D. Semlitsch. 2002. An experimental investigation of landscape resistance of forest versus old-field habitats to emigrating juvenile amphibians. Conservation Biology 16: 1324-1332.

Rubbo, M.J., and J.M. Kiesecker. 2005. Amphibian breeding distribution in an urbanized landscape. Conservation Biology 19: 504-511.

Ruediger, B., and M. DiGiorgio. Undated. Safe passage. A user's guide to developing effective highway crossings for carnivores and other wildlife. Southern Rockies Ecosystem Project.

Saunders, S., C. Montgomery, and T. Easley. 2008. Hotter and drier: The West's changing climate. The Rocky Mountain Climate Ortganization, and Natural Resources Defense Council. New York, New York.

Schoener, T.W. and D. A. Spiller. 1992. Is extinction rate related to temporal variability in population size? An empirical answer for orb spiders. The American Naturalist 139: 1176-1207.

Sherwood, A. 2007. As cars hit more animals on roads, toll rises. New York Times December 22, 2007.

Sjogren-Gulve, P. 1994. Distribution and extinction patterns within a northern metapopulation of the pool frog, *Rana lessonae*. Ecology 75: 1357-1367.

Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston, Massachusetts.

Storer, T. I. 1925. A synopsis of the amphibia of California. University of California Publications in Zoology 27:1-1-342.

_____ 1933. Frogs and their commercial use. California Department of Fish and Game 19(3)203-213.

Stuart, J. M., M. L. Watson, T. L. Brown, and C. Eustice. 2001. Plastic netting: an entanglement hazard to snakes and other wildlife. Herpetological Review 32(3): 162-164.

Twedt, B. 1993. A comparative ecology of *Rana aurora* Baird and Girard and *Rana catesbeiana* Shaw at Freshwater Lagoon, Humboldt County, California. Unpublished. Master of Science thesis. Humboldt State University, Arcata, California. 53 pages plus appendix.

U.S. Fish and Wildlife Service (Service). 1970. United States List of Endangered Native Fish and Wildlife. October 13, 1970. Fed. Reg. 35(199): 16047-16048

_____ 1984. Salt Marsh Harvest Mouse and California Clapper Rail Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon. 141 pages.

_____ 1996. Endangered and threatened wildlife and plants; determination of threatened status for the California red-legged frog. **Federal Register** 61:25813-25833.

_____ 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). Portland, Oregon. 173 pages.

_____ 2004. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the California red-legged frog (*Rana aurora draytonii*), proposed rule. **Federal Register** 69:19620-19642.

Van der Zande, A.N., W.J. ter Keurs, and W.J. Van der Weijden.. 1980. The impact of roads on the densities of four bird species in an open field habitat - evidence of a long-distance effect. Biological Conservation 18: 299-321.

Van Gelder, J.J. 1973. A quantitative approach to the mortality resulting from traffic in a population of *Bufo bufo* L. Oecologia 13:93-95.

Verboom, B., J., K. Lankester, and J.A. Metz. 1991. Linking local and regional dynamics in stochastic metapopulation models. Biological Journal Linnean Society 42:39-55.

Vos, C.C. and J.P. Chardon. 1998. Effects of habitat fragmentation and road density on the distribution pattern of the moor frog, *Rana arvalis*. Journal of Applied Ecology 35: 44-56.

Vos, C.C. and A.H.P. Stumpel. 1995. Comparison of habitat-isolation parameters in relation to fragmentation distribution patterns in the tree frog (*Hyla arborea*). Landscape Ecology 11: 203-214.

Wilcox, B.A. and D.D. Murphy. 1985. Conservation strategy: the effects of fragmentation on extinction. The American Naturalist 125: 879-887.

With, K.A. and T. O. Crist. 1995. Critical thresholds in species' responses to landscape structure. Ecology 76: 2246-2459.

Wright, A. H. and A. A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Comstock Publishing Company, Inc., Ithaca, New York. 640 pages.

Yanes, M., J.M. Velasco, and Francisco Suarez. 1995. Permeability of roads and railways to vertebrates: the importance of culverts. Biological Conservation 71: 217-222.

5. Structures Foundation Report

FINAL FOUNDATION REPORT
REDWOOD LANDFILL OVERCROSSING/ROUTE 101 (WIDEN)
(BRIDGE NO. 27-0115)
MARIN COUNTY, CALIFORNIA
04-MRN-101 EA 264071

For

BKF ENGINEERS
4670 Willow Road Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.

2360 Qume Drive, Suite A
San Jose, CA 95131
(408) 452-9000

March 14, 2012 Job No. 208140.RLF

TABLE OF CONTENTS

PAGE

INTRODUCTION **1**

PROPOSED CONSTRUCTION **1**

PURPOSE AND SCOPE **2**

SITE CONDITIONS **2**

FIELD EXPLORATION AND LABORATORY TESTING **3**

GEOLOGY **4**

SUBSURFACE CONDITIONS **4**

EARTHQUAKE CONSIDERATIONS **5**

Seismic Sources 5
Seismic Design Criteria 6
Seismic Hazards/Liquefaction Impact 7

FINDINGS AND RECOMMENDATIONS **8**

General 8
Foundations 9
Lateral Pile Capacity 12
Lateral Earth Pressures 14
Approach Embankment Slope Stability and Settlement 14
Corrosion 16
Plan Review 17
Construction Observation 17

INVESTIGATION LIMITATIONS **17**

REFERENCES **19**

PROJECT LOCATION MAP ..... Plate 1
SITE PLAN ..... Plate 2
GEOLOGIC MAP ..... Plate 3
FAULT MAP ..... Plate 4
COMPARISON OF ARS CURVES ..... Plate 5A
RECOMMENDED DESIGN ARS CURVE ..... Plate 5B

Appendix A

Log of Test Borings (Br. No. 27-0115)

As-Built Log of Test Boring (Br. No. 27-0115, Caltrans 2002)

Appendix B

Laboratory Test Data

Appendix C

C-1: SHAFT Results

C-2: ARS Online Data

C-3: Slope Stability

C-4: Settlement of Approach Fills

Appendix D

Caltrans Comments and Responses

FINAL FOUNDATION REPORT
REDWOOD LANDFILL OVERCROSSING/ROUTE 101 (WIDEN)
(BRIDGE NO. 27-0115)
MARIN COUNTY, CALIFORNIA
04-MRN-101 EA 264071

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed widening of the Redwood Landfill Overcrossing (Widen, Br. No. 27-0115) at Route 101, hereinafter referred to as "PROJECT", in Marin County, California. The work was performed in general accordance with the scope of work outlined in our proposal to BKF Engineers. The general location of the project site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. These recommendations should not be used for direct bidding purposes and cost estimate.

PROPOSED CONSTRUCTION

The project consists of widening the existing bridge along Redwood Landfill Road, crossing over Route 101 (Br. No. 27-0115). The existing structure was constructed in 2006. The existing bridge is a two-span cast-in-place concrete box girder structure, approximately 253 feet – 6 inches long and 34 feet – 4 inches wide. There is a single lane of traffic in the westbound and eastbound directions.

The westbound lane will be widened from one lane to two lanes. After the widening, the Redwood Landfill Overcrossing will be 44 feet – 4 inches wide. The widened section of the bridge will be supported on 24" Cast-In-Drilled-Hole (CIDH) piles to match the existing foundation. The existing structure already has approach embankments in-place. Additional embankment, to about 30 feet high, will be added to accommodate the widening.

Our recommendations presented in this report are based on the above information. Any major deviation should be reported to PARIKH for further consideration.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general subsurface conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the site, including available as-built Log of Test Borings (LOTB) for the existing structure (Br. No. 27-0115); site reconnaissance; drilling one soil boring; obtaining representative soil samples and logging soil materials encountered in the drilled boring; laboratory testing of the collected soil samples; performing engineering analyses based on the field and laboratory data; including as-built information; and preparation of this foundation report for the overcrossing structure (Br. No. 27-0115).

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction. Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

The existing Redwood Landfill Road/Route 101 interchange was completed in 2006. The existing interchange is a partial cloverleaf interchange with Redwood Landfill Road Overcrossing carrying a lane of traffic each way. The proposed improvement includes widening the existing overcrossing. The existing land surrounding the bridge and its proposed widening is in a rural area. The area within the project limits is on rolling terrain. The slopes in the vicinity of the abutments are standard 2H:1V slide slope and 1.5H:1V end slope. The slopes are generally covered with light vegetation. Based on the topographic information provided, the existing grade along Route 101 below the bridge is at approx. Elev. 53 to 55 feet, and the existing approach

embankment is at approx. Elev. 77 to 79 feet.

FIELD EXPLORATION AND LABORATORY TESTING

Based on the preliminary plans, discussions with the designers, and readily available geotechnical data in the area, one (1) exploratory boring (Boring A-09-001) was drilled near Abutment 3 area to a maximum depth of 50 feet below the existing ground surface. The approximate boring location together with the as-built boring locations (based on Miller Pacific Engineering Group, 2002) is shown on the LOTB sheet and Plate 2.

The boring was advanced using a truck-mounted rig using hollow stem auger drilling method. Selected samples were obtained from 2.0-inch O.D. & 1.4-inch I.D. (Standard Penetration) and 3.0-inch O.D. & 2.5-inch I.D. (Modified California) samplers at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. When correlating standard penetration data, the blow counts for the Modified California sampler may be converted to equivalent SPT blow counts by multiplying by a factor of 0.65. The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation. The descriptions of the materials encountered in the field exploration are shown on the Log of Test Boring (LOTB) sheet in Appendix A.

Laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils. The laboratory test methods and test results are presented on plates included in Appendix B. Laboratory test results for moisture content and gradation size of the soil samples are presented on the LOTB in Appendix A. Results of laboratory tests are presented in Appendix B.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring location explored. The abrupt stratum changes shown on the log may be gradational

and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

GEOLOGY

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map and Map Database of Parts of Marin, San Francisco, Alameda, Contra Costa and Sonoma Counties, California by M.C. Blake, J.R., R.W. Graymer, and D.L. Jones, in 2000. Based on the geologic map, the subsurface soil at the project site consists of mainly alluvium (Qal) and may range to Franciscan Complex (fsr-mélange) to metamorphic rocks (Kjfm). A geologic map of the general project area is shown on Plate 3. The descriptions of the main geologic units are as follow:

Qal – Alluvium (Sand, gravel, silt, and clay; loose to soft and friable) (Quaternary).

fsr – A tectonic mixture of variable sheared shale and sandstone containing (1) hard tectonic inclusions largely of greenstone, chert, graywacke, and their metamorphosed equivalents, plus exotic high-grade metamorphic rocks and serpentinite and (2) variable resistant masses of graywacke, greenstone, and serpentinite up to several miles in longest dimension, and including minor discrete masses of limestone too small to be shown.

KJfm – Variably sheared, containing blueschist minerals; chiefly metagraywacke with slight to moderate metamorphic fabric, but includes much metagreenstone, metachert, and minor amounts of metaconglomerate (Cretaceous and Jurassic).

The characteristics of the rocks (fsr and KJfm) are that they are chaotic mixtures of strong blocks within a weaker matrix. The term bimrock (block in matrix rocks) has recently gained currency for this rock characteristic.

SUBSURFACE CONDITIONS

The subsurface conditions are based on the as-built LOTB sheet (Miller Pacific, 2002) and the boring drilled in July 2009 (Parikh 2009).

Based on the as-built and current boring data, the subsoils consist of 5 to 11 feet of medium dense

silty sand and very stiff sandy lean clay overlying rock. Sandstone was encountered at the two abutment locations approximately 5 to 11 feet below grade (elevations ranging from 39 to 52 feet) and shale was encountered 9 feet below grade (Elev. 42 feet) at the bent location. The rock materials are part of the Franciscan Mélange and may be classified as bimrocks (see "Geology" section for definition of bimrocks).

The as-built boring data indicates that organic material was encountered in the upper 2 feet of the top soil. Generally, the topsoils are stripped during earthwork preparation as a standard earthwork practice.

Groundwater was encountered during drilling in only one boring (Boring D) drilled by Miller Pacific Engineering Group in 2002. Groundwater in Boring D was encountered within sandstone rock. Groundwater was not encountered in the two other borings drilled by Miller Pacific Engineering Group in 2002, nor in the boring drilled by Parikh in 2009. According to the Foundation Report by Miller Pacific Engineering Group, Boring D was converted to a groundwater monitoring well and groundwater was measured 20 days after drilling at Elev. 31.5 ft (9.6 m), approximately 18.7 feet (5.7 m) below grade. It is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface/subsurface flow and perched water conditions, ground surface run-off, and other factors that were not existent at the time of investigation. For design purpose, we have assumed groundwater 15 feet below grade to account for seasonal fluctuation.

Detailed descriptions of the materials encountered in the exploratory boring are presented in Appendix A, "Log of Test Borings".

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project is located in a seismically active part of Northern California. Many faults exist in the area, which are capable of producing earthquakes which may cause strong ground shaking at the site.

Information on the major faults in the area as determined by 2007 Caltrans Deterministic PGA

Map is summarized in the following table. These maximum earthquake magnitudes (Mmax) noted in the following table represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure. A fault map is shown on Plate 4.

Fault	Fault Type	Distance from Site (miles)	Maximum Earthquake Magnitude (Mmax)
Rodgers Creek Fault	Right Lateral Strike Slip	5.6	7.1
San Andreas Fault zone (North Coast section)	Right Lateral Strike Slip	14.5	7.9

In addition, there is the Burdell Mountain Fault Zone, which is not shown on the 2007 Caltrans Deterministic PGA Map. It is discussed extensively in the Geotechnical Design and Materials Report (GDMR) for the MSN B1 project in Sections 4.4 (Regional Geology and Seismicity) and 7.4.2 (Fault Rupture). In section 7.4.2, it is noted that the Burdell Mountain Fault Zone crosses a portion of the Southwest Frontage Road between Sta. 247+20 and Sta. 268+50 ("FR2" Line). The limits of the Burdell Mountain Fault Zone are shown on Sheet D-2 of Appendix D in the GDMR. Based on this, the fault zone is not in the vicinity of the Redwood Landfill Overcrossing.

Seismic Design Criteria

Caltrans has updated the 1996 Seismic Hazard map with the new 2007 Caltrans Deterministic PGA Map and the Caltrans ARS Online (Ver. 1.0) for the development of response spectra for design. The development of the design ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 30 m/100 feet (V_{S30}), and other site parameters, such as fault characteristics, and site-to-fault distances. Based on the 2007 Caltrans Deterministic PGA Map and ARS Online tool, the Rodgers Creek Fault (Mmax = 7.1, RLSS, at 9.0 km) and the San Andreas Fault zone (North Coast section) (Mmax = 7.9, RLSS, at 23.4 km) are considered for design.

The new design methods incorporate both deterministic and probabilistic seismic hazards to produce the Design Response Spectrum. According to the Design Manual, we have also reviewed and compared the probabilistic response spectrum from 2008 USGS Deaggregation Hazard (beta)

website for the 5% in 50 years probability of exceedance (or 975 year return period).

The average shear wave velocity in the top 100 feet of the project site (V_{S30}) was determined to be 400 m/sec, based on information from boring A-09-001 in the vicinity of the overcrossing. Deterministic and Probabilistic ARS curves for the project site (38.1630º N/122.5751º W) using the online web tool and a V_{S30} of 400 m/sec are presented in Plate 5A. A comparison of the curves presented in Plate 5A indicates that the Online Probabilistic curve would govern. Per the procedures of the Design Manual, an ARS curve was established using the USGS Interactive Deaggregation Tool (Beta). The 'Deaggregation' ARS curve is also presented in Plate 5A. Comparison of the ARS curve using the USGS Interactive Deaggregation Tool (Beta) with the Online Probabilistic ARS indicates the 'Deaggregation' ARS curve to be higher. However, per the procedures in the Design Manual (Section 1.1.1.6, item h) "for sites with $V_{S30} > 300$ m/sec, it is acceptable to use ARS Online for generating probabilistic spectrum". The ARS Online Probalistic Spectrum was thus established as the recommended Design ARS Curve. Calculations for the establishment of the Design ARS Curve are presented in Appendix C.

The recommended Design ARS Curve is presented again in Plate No. 5B for convenience. Peak Ground Acceleration (PGA) at the site, based on the recommended Design ARS Curve is 0.634g.

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture; ground shaking; and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic information, the possibility of the site experiencing strong ground shaking may be considered significant.

Liquefaction Potential

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows (blow counts) to drive a sampler), and decreasing fines

content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004).

Based on the available boring information, the subsurface soil conditions of the project site generally consist of firm to hard sandy clay and medium dense silty sand underlain by weathered sandstone/shale (Franciscan Mélange). No groundwater was encountered in the boring drilled by Parikh in 2009. Boring D in the as-built LOTB indicated that groundwater was encountered at Elev. 31.5 feet (9.6 meters), a depth of 18.7 feet (5.7 m) below grade, within the sandstone. For design purpose, we have assumed groundwater 15 feet below grade to account for seasonal fluctuation. Since the material below the groundwater depth consists of sandstone/shale material, which encountered refusal and blow counts greater than 100, the potential for liquefaction is considered low. Therefore, post liquefaction settlement should be minimal and thus, downdrag forces are not considered in the foundation design.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the planned project provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed project according to the plans provided by Biggs Cardosa Associates, Inc. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that materials have changed so that we may modify or amend our recommendations.

Foundations

For the proposed structure, Caltrans standard 24-inch diameter cast-in-drilled-hole (CIDH) concrete piles are recommended for foundation support. Pertinent foundation design information provided by Biggs Cardosa Associates, Inc. (structural designer), including Foundation Design Data and Foundation Loads, are presented in the following tables.

FOUNDATION DESIGN DATA (provided by Structural Designer)

Support No.	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in.)	No. of Piles per Support
					B	L		
Abut 1	WSD	24" CIDH	71.3	61.7	10	52.0	1	17
Bent 2	LRFD	24" CIDH	54.0	44.0	34	46.0	1	42
Abut 3	WSD	24" CIDH	69.7	60.0	10	52.0	1	17

FOUNDATION LOADS (provided by Structural Designer)

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	1960	140	1680	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	5340	N/A	4820	7370	250	N/A	N/A	4820	390	N/A	210
Abut 3	2170	140	1880	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Consistent with the current Caltrans requirements Working Stress Design (WSD) is used for the abutment foundations and Load and Resistant Factor Design (LRFD) is used for the foundations for Bent 2 for the bridge. The abutment foundations are evaluated for Service-I limit state loads per AASHTO LRFD Bridge Design Specifications – 4th Edition and current Caltrans Amendments per Caltrans November 2003 Bridge Design Specifications for foundations, using Working Stress Design (WSD) methods. The Bent 2 foundations are evaluated for the foundation design data and loading conditions using AASHTO LRFD Bridge Design Specifications–4th Edition and current Caltrans Amendments.

Estimation of the pile capacities was made using the site-specific subsurface conditions for the loads computed above and other pertinent information provided by the Structural Designer. The

computer program SHAFT developed by Ensoft, Inc. was used for the computations. The program computes capacities for drilled shafts (CIDH piles) based on procedures proposed by O'Neil and Reese (1999). The procedures utilize an α factor (α=0.55) for "Clay" and a β factor for "Sand" where β is a function of depths below ground surface and independent of soil friction angle The SHAFT program also computes the pile settlement and associated mobilization of shaft and end-bearing resistance, consistent with the O'Neil and Reese (1999) procedures.

Based on the load demand and subsoil information, the recommended specified pile tip elevations are shown in the following tables per Memo-To-Designers 3-1.

Abutment Foundations Design Recommendations

Support Location	Pile Type	Cut off Elev. (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elevations (ft)	Specified Tip Elevation (ft)
			Total	Permanent				
Abut 1	24-in CIDH	61.7	1960	1680	140	280	(a) 43.3 (c) 31.7	31.7
Abut 3	24-in CIDH	60.0	2170	1880	140	280	(a) 34.7 (c) 33.7	33.7

Notes:
1. Design Tip Elevation for the Abutments are controlled by the following demands: (a) Compression; (c) Lateral Load
2. For piles constructed to the specified tip elevation, the "top of pile deformations" under service loads are less than 1 inch for all cases.

Bent Foundations Design Recommendations

Support Location	Pile Type	Cut off Elev. (ft)	LRFD Service-I Limit State Load (kips) per Support	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)
				Strength Limit		Extreme Event			
				Comp. Φ=0.7	Tension Φ=0.7	Comp. Φ=1	Tension Φ=1		
Bent 2	24-in CIDH	44.0	5340	250	-	390	210	(a-I) 13.0 (a-II) 12.0 (b-II) 26.0 (c) 12.1	12.0

Notes:
1. Design Tip Elevation for the bent is controlled by the following demands: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Limit), (b-II) Tension (Extreme Limit), (c) Lateral Load
2. For piles constructed to the specified tip elevation, the "top of pile deformations" under service loads are less than 1 inch for all cases.

Pile Data Table

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)
		Compression	Tension		
Abut 1	24-in CIDH	280	-	(a) 43.3 (c) 31.7	31.7
Bent 2	24-in CIDH	390	210	(a) 12.0 (b) 26.0 (c) 12.1	12.0
Abut 3	24-in CIDH	280	-	(a) 34.7 (c) 33.7	33.7

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension (c) Lateral Load
2. For piles constructed to the specified tip elevation, the "top of pile deformations" under service loads are less than 1 inch for all cases.

Per SHAFT analyses results, for piles constructed to the specified tip elevation in the Pile Data tables, the "top of pile deformations" under service loads are less than 1 inch for all cases. Therefore, design tip elevations for 1 inch settlements are not provided.

Construction Considerations. Caltrans standard specifications and standard special provisions (SSP) for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH piles. It is anticipated that groundwater will be encountered during construction and "dry" condition as per the standard specifications Section 49-4 could not be maintained.

Vertical inspection pipes for acceptance testing should be provided in all CIDH piles that are 24 inches in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control groundwater. The acceptance test should include Gamma- Gamma Logging and may also include crosshole sonic logging. Gamma-Gamma Logging should be performed in accordance with California Test 233 Standard (CT233) to check the homogeneity of CIDH piles. CT233 defines pile rejection criteria based on the statistical principles of mean and three standard deviations to analyze the homogeneity of a pile. Anomalies detected should be evaluated by the designer for their significance and potential impact on design and to see if mitigation plans are required. Details of the acceptance testing and Gamma-Gamma Logging are contained in Caltrans SSP and CT233.

Due to the potential presence of granular material and groundwater, raveling or caving is expected which may require additional drilling and cleaning effort and may increase the concrete volume

for the piles. Hard and difficult drilling should be expected when drilling in the "bimrocks" material. This includes drilling through large rocks that would be difficult to penetrate and clean out. It is prudent to make the contractor aware of these conditions so that he takes appropriate steps to comply with the standards and maintain the integrity of the CIDH piles. The use of temporary steel casing should be anticipated at all times to maintain the integrity of the piles. It is also recommended that the specifications set certain criteria for qualifications and previous work experience requirements to pre-qualify the potential contractors. The intent is to help select qualified contractors to reduce construction issues.

All piles excavations should be observed by the geotechnical engineer or the regulatory agency prior to the placement of reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

Lateral Pile Capacity

The structural designer performed the lateral load analyses for the piles using LPILE Program (V. 5). The design tip elevations for lateral loads provided by the Structural Engineer have been provided in the previous tables. The recommended geotechnical parameters for LPILE analysis are summarized in the following tables.

Abutment 1

Approx. Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Soil Strength	K (pci	E_{50} (in/in)	Effect Unit Wt. (pci)
Above 50	Highway Fill (Stiff Clay)	3 (Stiff Clay w/o Water)	Su = 10.42 psi	---	0.007	0.0723
50 to 35	Sandstone	7 (Silt)	c = 3.47 psi ϕ = 38 deg	0 (LPILE V.5, use default values)	0 (LPILE V.5, use default values)	0.0752
Below 35	Sandstone	7 (Silt)	c = 3.47 psi ϕ = 40 deg	0 (LPILE V.5, use default values)	0 (LPILE V.5, use default values)	0.0405

Bent 2

Approx. Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Soil Strength	K (pci)	E_{50} (in/in)	Effect Unit Wt. (pci)
Above 48	Firm Sandy Clay	1 (Soft Clay)	Su = 5.21 psi	---	0.010	0.0694
42 to 48	Stiff Sandy Clay	3 (Stiff Clay w/o Water)	Su = 10.42 psi	---	0.007	0.0723
35 to 42	Shale	3 (Stiff Clay w/o Water)	Su = 27.78 psi	---	0.004	0.0723
Below 35	Shale	3 (Stiff Clay w/o Water)	Su = 27.78 psi	---	0.004	0.0376

Abutment 3

Approx. Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Soil Strength	K (pci)	E_{50} (in/in)	Effect Unit Wt. (pci)
Above 50	Highway Fill (Stiff Clay)	3 (Stiff Clay w/o Water)	Su = 10.42 psi	---	0.007	0.0723
47.5 to 50	Firm to Stiff Sandy Clay	3 (Stiff Clay w/o Water)	Su = 6.94 psi	---	0.0085	0.0723
45 to 47.5	Very Stiff Sandy Clay	3 (Stiff Clay w/o Water)	Su = 24.31 psi	---	0.005	0.0723
38.5 to 45	Hard Sandy Clay	3 (Stiff Clay w/o Water)	Su = 31.25 psi	---	0.004	0.0723
Below 38.5	Sandstone	7 (Silt)	c = 3.47 psi ϕ = 40 deg	0 (LPILE V.5, use default values)	0 (LPILE V.5, use default values)	0.0376

Notes

1. When performing LPILE analysis, for group efficiency, use *p*-multiplier of 0.6 for pile spacing of 3D; 0.8 for pile spacing of 4D; and 0.4 for pile spacing of 2D. Use a *y*-multiplier of 1.0 for all cases.
2. The K and E_{50} values in the tables above are for standard piles typically less then 2 ft in diameter. For pile size larger than 2 ft in diameter, the K values should be scaled up by multiplying a factor of $\sqrt{(D/2')}$, and the E_{50} values may be scaled down by dividing a factor of $\sqrt{(D/2')}$.

Generally, abutment piles are designed for service loads only, whereas bent piles are governed by seismic loading conditions. A maximum pile head deflection of 1/4 inch is recommended for

service condition for abutment piles. For seismic loading condition of the bent piles, a maximum pile head deflection up to about one to two inches is generally tolerable and acceptable for pile design.

Lateral Earth Pressures

Abutment retaining walls and wing walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

	Applied Lateral Earth Pressure
Active Condition	36 pcf Equivalent Fluid Pressure (EFP) for engineered fill
At-Rest Condition	55 pcf Equivalent Fluid Pressure (EFP) for engineered fill
Passive Resistance	5 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet high or greater); for activated height less than 5.5 feet modify proportionally, i.e. 5 x (H/5.5) ksf per SDC v. 1.4. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive pressure is required.

Cantilever walls which are free to rotate at least 0.004 radians may be assumed flexible for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.3 and 0.5 may be used to determine the additional earth pressure resulting from the surcharge for cantilever walls and rigid walls, respectively.

Approach Embankment Slope Stability and Settlement

The new approach embankments will abut existing embankments for the Redwood Landfill Overcrossing. Based on the plans provided by the designer, a sliver fill will be placed on top and adjacent to the existing fill. Maximum vertical thickness of new fill at any location will be on the order of 7 feet. The new embankments will have slopes of 1.5H:1V on the ends and 2H:1V or flatter on the sides, similar to existing slopes. The underlying soils are stiff to hard clays up to 20 feet overlying rock. Groundwater was not encountered in the borings drilled in the vicinity of the approach embankments.

Embankment Settlements

Settlements of the new fill for the widening will occur due to self weight of the fill, in addition to compressive settlements of the underlying existing fill and native clay soils. Based on available field information, settlement of the new fill due to self weight will be on the order of 0.4 to 0.6 inches (0.5 to 0.75 percent of the height of new fill). Some settlement will occur concurrently with the fill placement, depending on the characteristics of the fill material and the rate of placement. Total settlement calculations based on immediate (elastic) settlement is 0.42 inches where the new fill is placed over 20 feet of existing fill and 0.13 inches where the new fill is placed over no existing fill, with a maximum differential settlement of 0.29 inches. The calculations are shown in Appendix C. It is expected that the settlement will be rapid and essentially all settlement should occur by the end of fill placement.

As indicated in the 'Subsurface Conditions' section, groundwater was encountered in only one out of four borings and it was encountered within the sandstone. It was thus inferred that groundwater is unlikely to rise above the rock into the overlying soils. Compression of the soil by expulsion of the water (e.g. consolidation settlements) was therefore deemed unrealistic. Compression of the clays and consequent settlements of the native soil would therefore be due to elastic compression and would essentially be instantaneous.

Settlements were calculated based on elastic compression of the underlying layers due to the load from 7 feet of new fill. Settlements were computed for the Abutment 3 location, based on the subsurface conditions indicated by Boring D, which indicated 11 feet of firm to hard clay. A shear strength of 1500 psf was assumed for the existing fill. Modulus of Elasticity of the various compressible layers was based on existing correlations, which considered the shear strength of the soils and the plasticity characteristics. The calculations are presented in Appendix C.

Per the calculations, settlements range from approximately 0.42 inches at locations underlain by 20 feet of existing fill overlying native soils to 0.13 inches at locations where there is no underlying existing fill over the native soil. The expected settlements are therefore small and likely to occur rapidly. The differential settlements will therefore not be significant. Additionally, the CIDH piles for the bridge foundation are socketed in rock and therefore will not be affected by settlements due to placement of the new fill. A 30-day settlement period is recommended for

earthwork prior to the pavement and pile construction to see that essentially all settlement has occurred prior to construction of the bridge and adjacent pavements.

Static and Seismic Slope Stability

Based on the ARS curve, the design PGA at the site is 0.63g. For slope stability under seismic condition (pseudo-static analyses), we have used the Caltrans guidelines (Guidelines for Structures Foundation Reports manual, Ver. 2.0, 2009), which recommends that the seismic factor equal to one third of the horizontal peak acceleration and not exceeding 0.2g. Therefore, a seismic coefficient (k) of 0.2g was used for pseudo-static analysis. Slope stability analyses performed using the SLOPE/W computer program indicated a factor of safety of :

- 2.45 under static loading using total stress strength parameters for the fill
- 1.59 under seismic loading for total stress strength parameters for the fill
- 1.55 under static loading for effective stress strength parameters for the fill
- 1.16 under seismic loading for effective stress strength parameters for the fill

Corrosion

Corrosion tests were performed on samples retrieved for the roadway design package. Chemical tests were performed on a soil sample retrieved within the interchange. A summary of the corrosion test results is presented below.

SUMMARY OF CORROSION TEST RESULTS

Boring No.	Station & Offset	Depth (ft)	Min. Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
A-09-129	"N2" Sta. 335+00, 280 Lt	4.5	5360	5.18	1.9	13.4

Based on the data, the site subsoil is considered non-corrosive per Caltrans corrosion design guidelines (Caltrans Bridge Design Specifications (September 2003) – Section 8.22.1). Due to the low pH in the soil, Type II modified or Type V cement type may be used for the concrete substructures. Refer to Table 8.22.2 in the Caltrans Bridge Design Specifications for the minimum cementatious material content.

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations is encountered this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our

conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Lam Tran, P.E. 78164
Senior Staff Engineer

Partha Sircar, P.E., C54619
Senior Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

S:\ONGOING PROJECTS\208140\REDWOOD LANDFILL OC-101REDWOOD LANDFILL OC- FOUNDATION

REFERENCES

1. Bray, J. D., Sancio, R. B., Reimer, M. F., and Durganoglu, T. "Liquefaction Susceptibility of Fine Grained Soils" Proc., 11th Inter. Confc. on Soil Dynamics and Earthquake Engg. And 3rd Inter. Confc. On Earthquake Geotech. Engg., Berkeley, CA, January 7-9, 2004

2. Caltrans as-built Log of Test Boring for Redwood Landfill Overcrossing (2002) (Br. No. 27-0115)

3. California Department of Transportation, May 2006, Bridge Design Specifications

4. California Department of Transportation, May 2006, Standard Plans.

5. California Department of Transportation, May 2006, Standard Specifications

6. Caltrans Deterministic PGA Map (2007)

7. Caltrans Geotechnical Services Design Manual (Version 1.0) dated August 2009

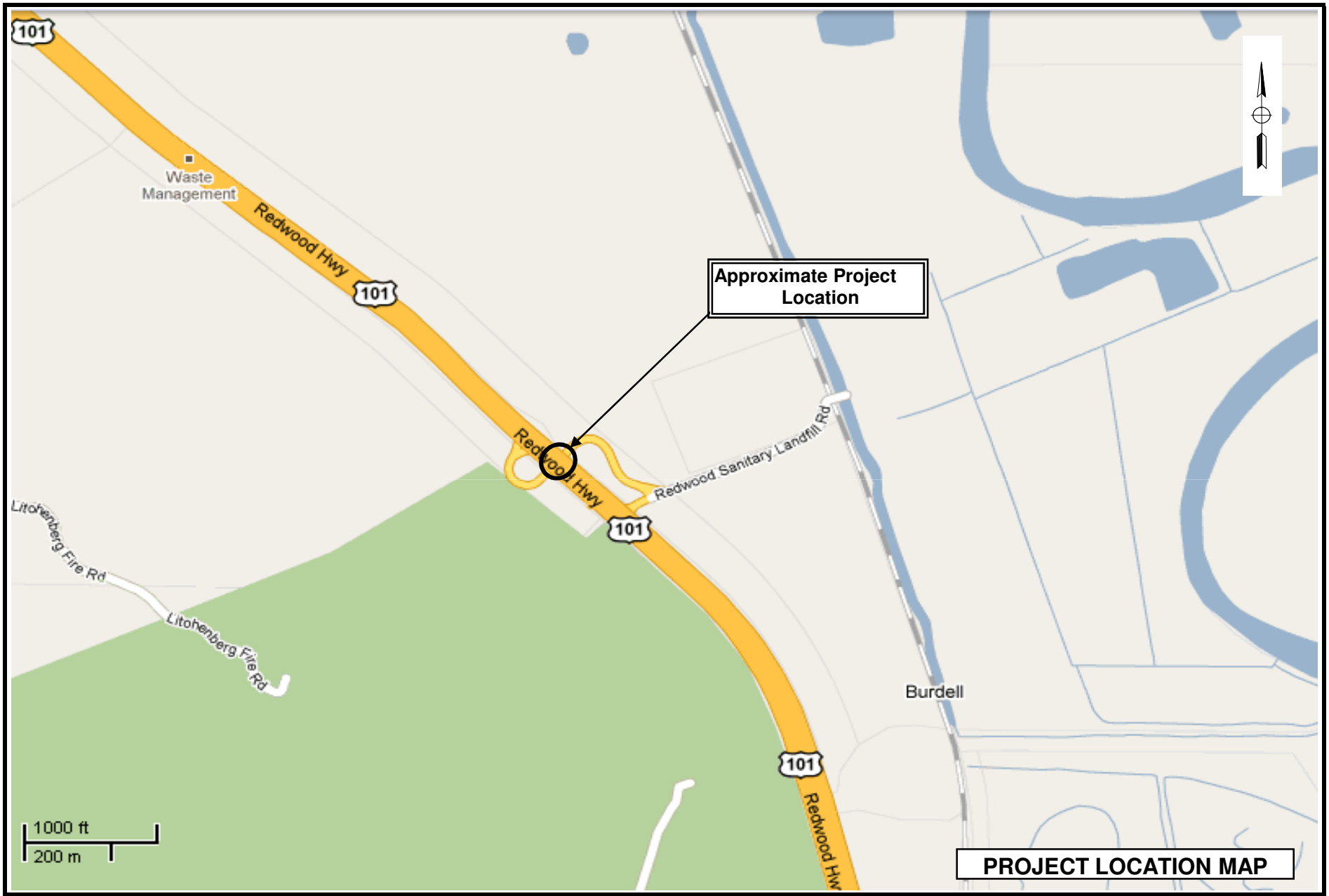
8. Caltrans Memo to Designer 3-1, July 2008

9. Geologic map and Map Database of Parts of Marin, San Francisco, Alameda, Contra Costa and Sonoma Counties, California, by M.C. Blake J.R., R.W. Graymer and D.L. Jones (Digital database by Adam Soule & R.W. Graymer, 2000)

10. LPILE Program, Version 5, Analysis of Laterally Load Piles, ENSOFT, Inc.

11. SHAFT Program, Version 5, Analysis of Axial Capacity, ENSOFT, Inc.

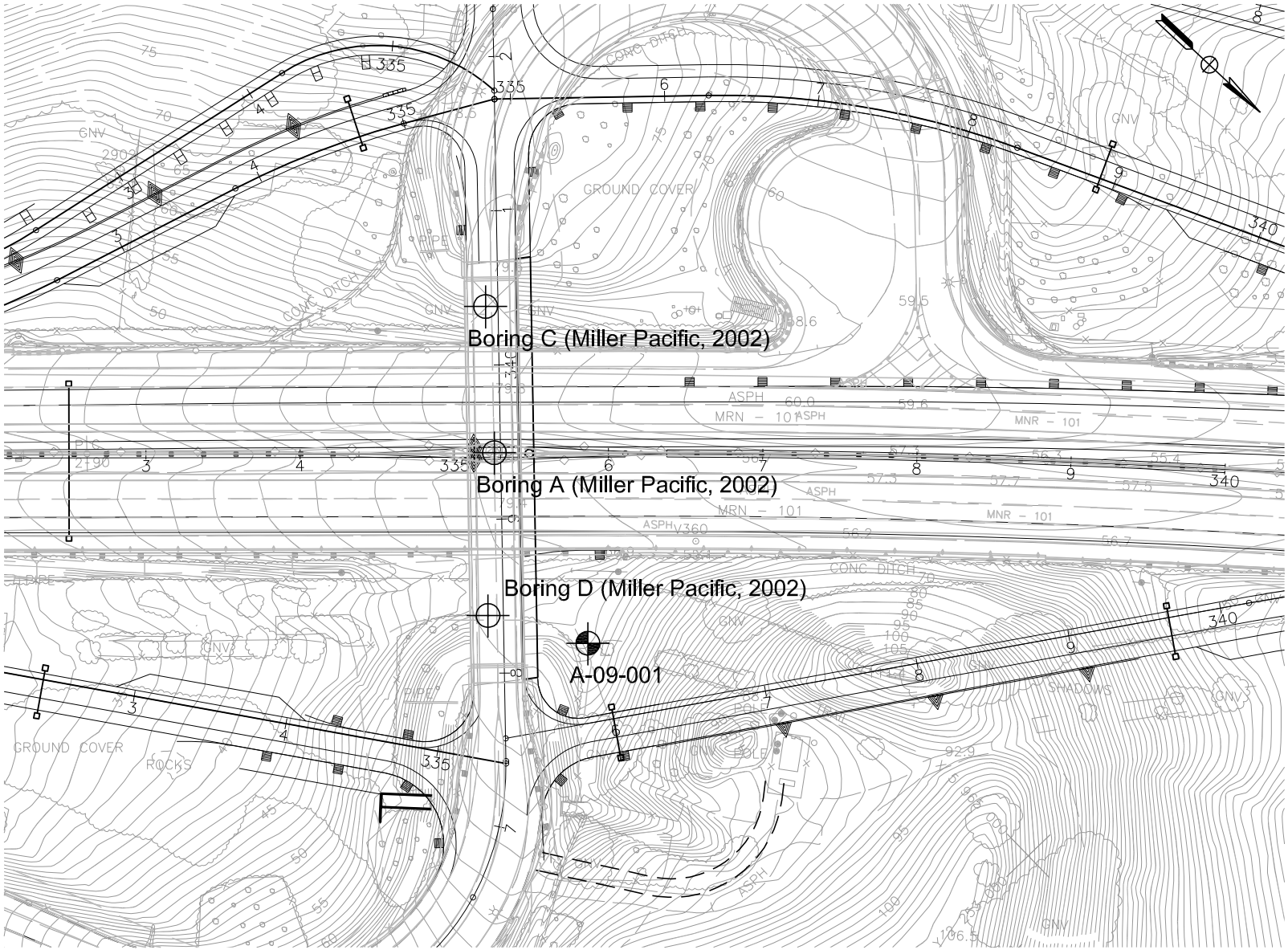
12. Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Liam Finn, W.D., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.S.C., Marcuson, W.F., III, Martin, G.R., Mitchell, J.K., Moriwaki, Power, M.S., Robertson, P.K., Seed, R.B., Stokoe, K.H., II, 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, " Journal of Geotechnical and Geoenvironmental Engineering, ASCE, V. 127, No. 10.



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RLF	PLATE NO.: 1



Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SCALE: 1 inch = 100 feet

SITE PLAN

LEGEND

A-09-001
Approx. Boring Location

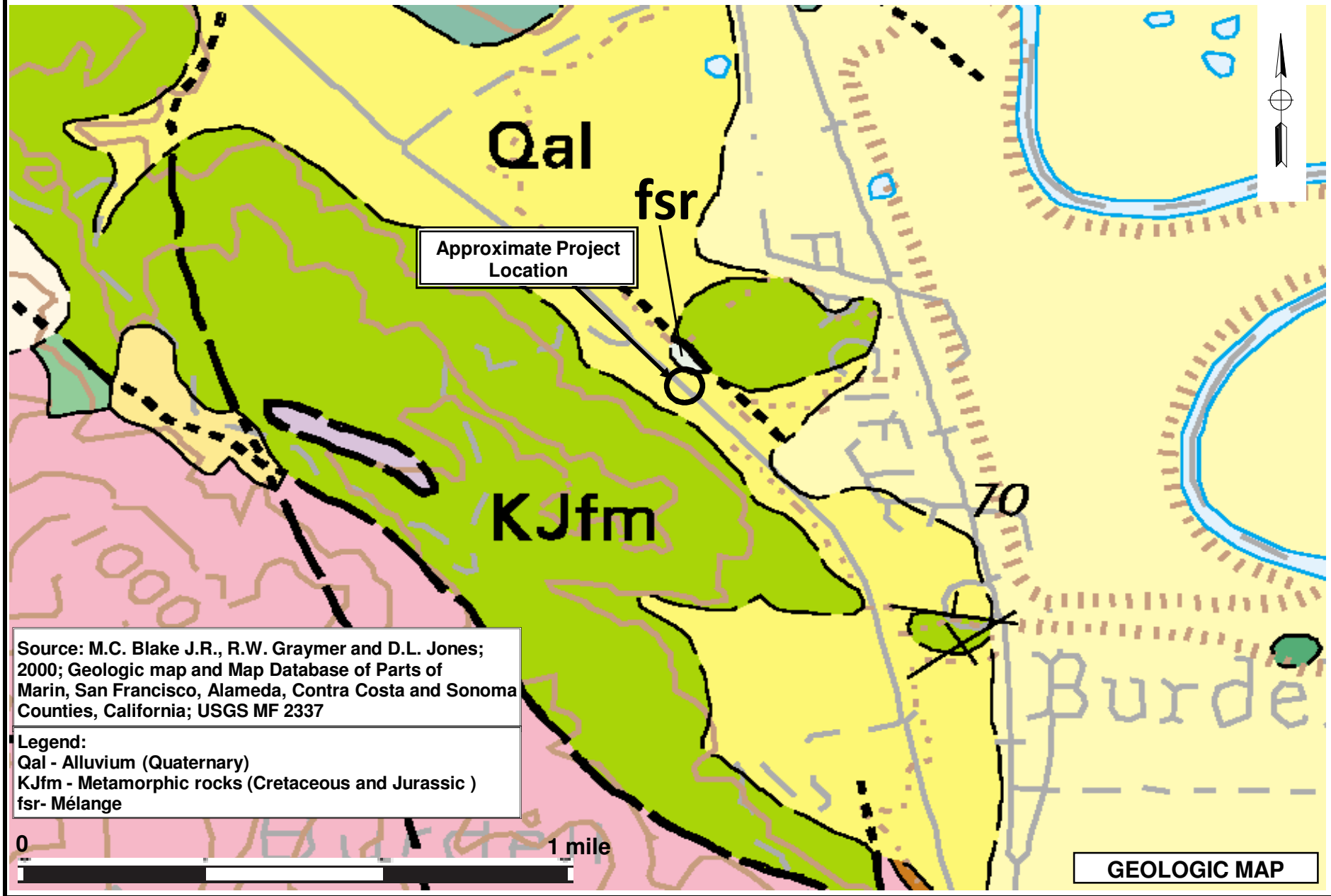
Boring A
Approx. As-built Boring Location (Miller Pacific)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.RLF

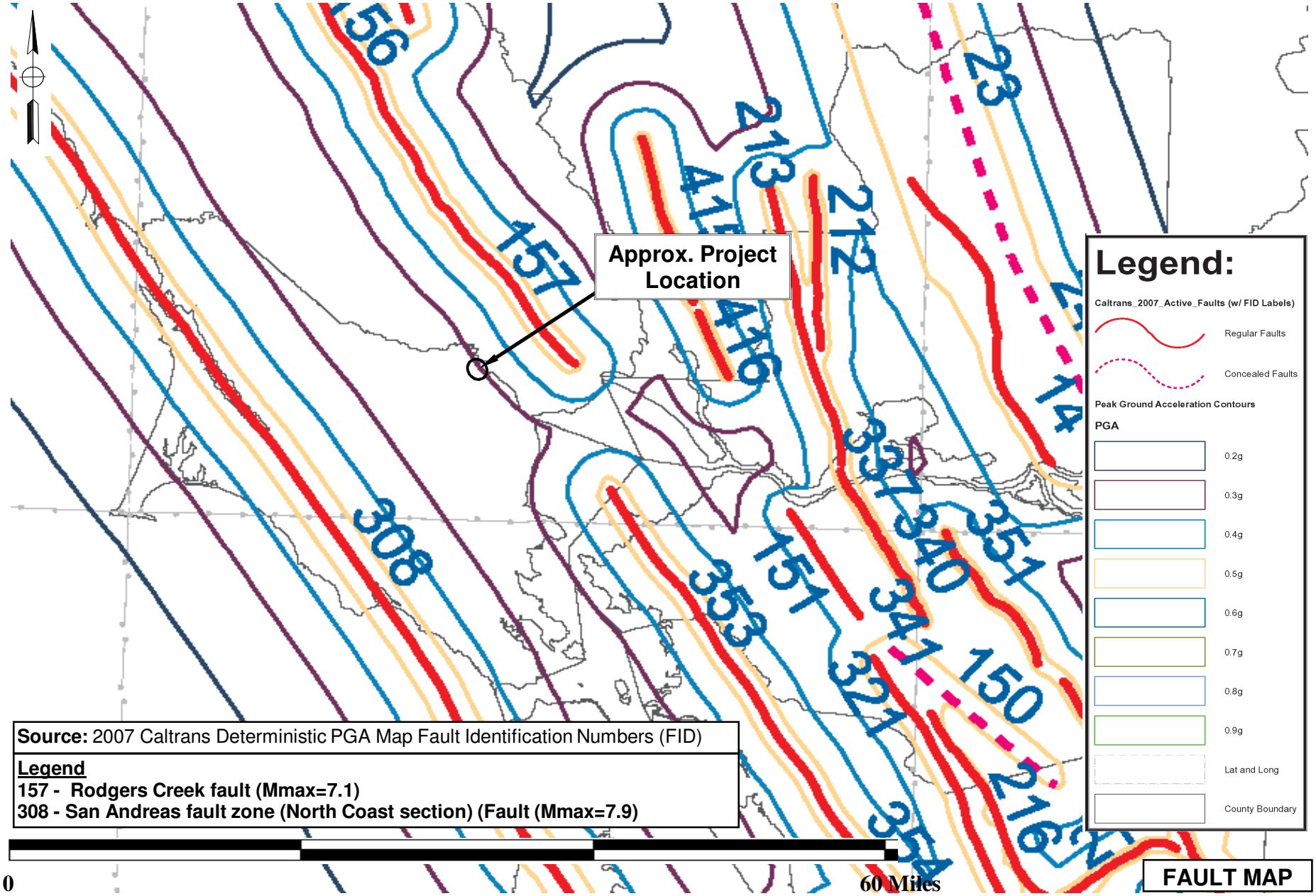
PLATE NO. 2



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RLF	PLATE NO.: 3



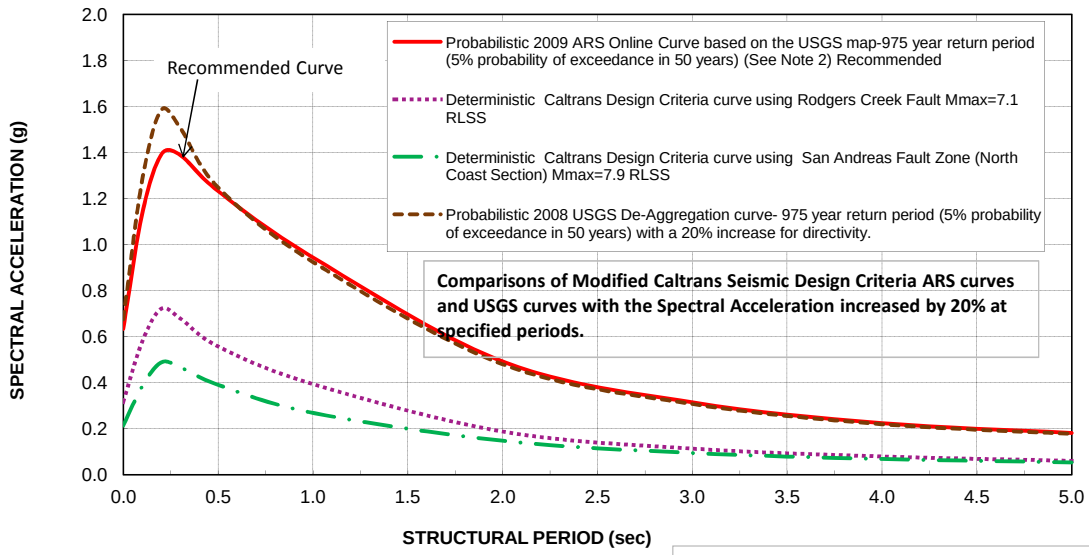
FAULT MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RLF | **PLATE NO.: 4**

ARS DESIGN CURVE



Period (sec)	Probabilistic 2009 ARS Online Curve	Deterministic Rodgers Creek Fault	Deterministic San Andreas Fault Zone	Probabilistic 2008 USGS De-Aggregation
0	0.634	0.316	0.213	0.674
0.1	1.135	0.578	0.384	1.279
0.2	1.391	0.72	0.488	1.584
0.3	1.39	0.679	0.467	1.507
0.5	1.233	0.557	0.391	1.248
1	0.945	0.394	0.269	0.924
2	0.493	0.188	0.148	0.480
3	0.315	0.114	0.095	0.307
4	0.225	0.08	0.069	0.220
5	0.182	0.061	0.054	0.177

NOTES :

1) ARS Curves based on 2009 Caltrans Deterministic PGA Map and ARS Online Report

Modification factors: Near-fault amplications of 20% increase for T ≥ 1.0 sec, no modification for T ≤ 0.5 sec and linear interpolation for 0.5 sec < T < 1.0 sec.

Basin depths : $Z_{1.0}$ =216 m; $Z_{2.5}$ =2000 m

2) Caltrans ARS Online Probabilistic Curve for Vs=400 m/s for exceedance in 50 years (975 years return period) is the recommended ARS Curve. The ARS Online Probabilistic Curve deviates from the USGS 2008 Deaggreation Curve by less than 10% for T≥ 0.5 sec, and Vs >300 m/s

3) Probabilistic ARS Curve using 2008 USGS Seismic Hazard Map adjusted per 2008 USGS Deaggregation (Beta) tool for Vs=400 m/s for 5% exceedance in %50 years (975-years return period)

COMPARISON OF ARS CURVES

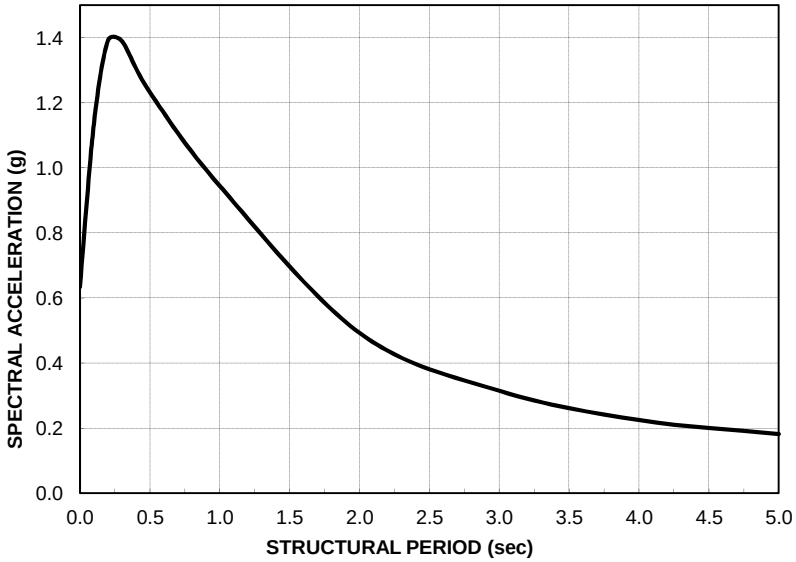
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RLF

PLATE NO.: 5A

RECOMMENDED ARS DESIGN CURVE
REDWOOD LANDFILL OVERCROSSING



Spectral Data

Period (sec)	Caltrans 2009 ARS Online Probabilistic Spectral Accel.(g)
0.00	0.634
0.10	1.135
0.20	1.391
0.30	1.390
0.50	1.233
1.00	0.945
2.00	0.493
3.00	0.315
4.00	0.225
5.00	0.182

1) Recommended ARS Curve based on 2009 Caltrans Deterministic PGA Map and ARS Online Report..

2) Caltrans ARS Online Probabilistic Curve for Vs=400 m/s for exceedance in 50 years (975 years return period) is the recommended ARS Curve. The ARS Online Probabilistic Curve deviates from the USGS 2008 Deaggreation Curve by less than 10% for $T \geq 0.5$ sec.

3) Modification factors: Near-fault amplications of 20% increase for $T \geq 1.0$ sec, no modification for $T \leq 0.5$ sec and linear interpolation for $0.5 \text{ sec} < T < 1.0$ sec., and Vs >300 m/s

4)Basin depths: $Z_{1.0}$ =216 m ; $Z_{2.5}$ =2000 m

RECOMMENDED ARS DESIGN CURVE

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RLF

PLATE NO.: 5B

APPENDIX A

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 10/3/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CALIFORNIA 94901

PARIKH CONSULTANTS, INC.
2360 OUME DRIVE, SUITE A
SAN JOSE, CA 95131

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

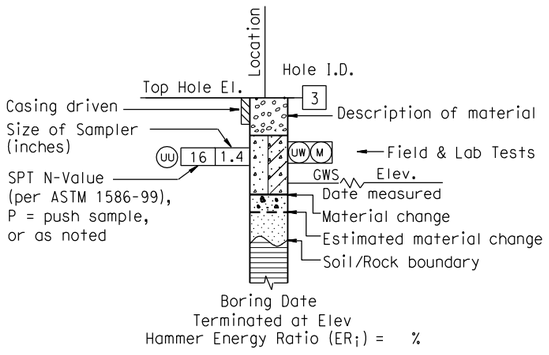
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring (hollow or solid stem bucket)
Size	R	Rotary drilled boring (conventional)
	RW	Rotary drilled with self-casing wire-line
	RC	Rotary core with continuously-sampled, self-casing wire-line
	P	Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD	Hand driven (1-inch soil tube)
	HA	Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778)
[ ]	O	Other (note on LOTB)

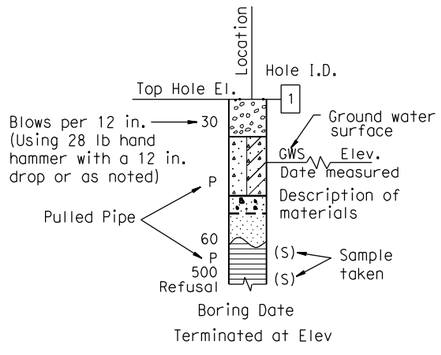
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

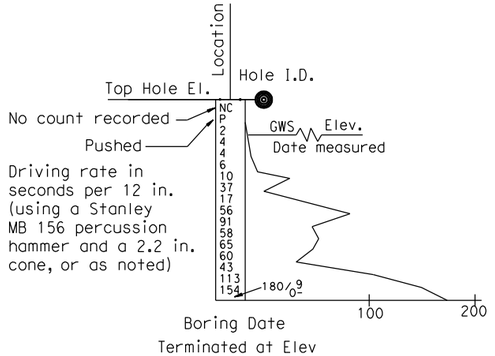
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



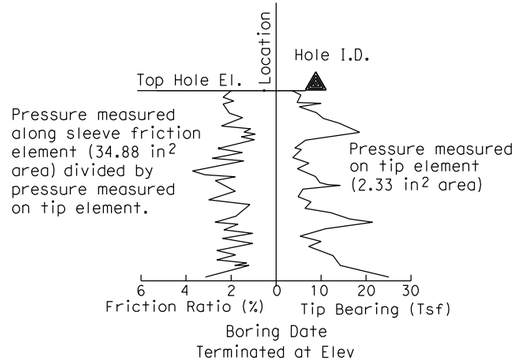
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	L. S. BHANGOO/ V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR, PROJECT ENGINEER	BRIDGE NO. 27-0115	REDWOOD LANDFILL OVERCROSSING (WIDEN)
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: APRIL 2009			POST MILES 25.5	LOG OF TEST BORINGS 1 OF 5

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING 06/16/11 EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
10/3/11				19	23

...\270115-z-ltb01.dgn 10/14/2011 10:47:15 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 10/3/11 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CALIFORNIA 94901

PARIKH CONSULTANTS, INC.
2360 OUME DRIVE, SUITE A
SAN JOSE, CA 95131

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: O. GOUTHIER
CHECKED BY: P. SIRCAR

L. S. BHANGOO/ V. SANTOS
FIELD INVESTIGATION BY:
DATE: APRIL 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO. 27-0115
POST MILES 25.5

REDWOOD LANDFILL OVERCROSSING (WIDEN)
LOG OF TEST BORINGS 2 OF 5

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING 06/16/11 EARLIER REVISION DATES

REVISION DATES				SHEET	OF
10/3/11				20	23

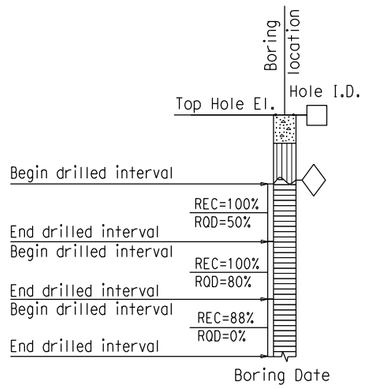
...\270115-z-ltb02.dgn 10/14/2011 10:47:58 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4"}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 10/3/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CALIFORNIA 94901

PARIKH CONSULTANTS, INC.
2360 OUME DRIVE, SUITE A
SAN JOSE, CA 95131

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features: Chemical Weathering-Discoloration and/or oxidation — Body of Rock	Diagnostic features: Chemical Weathering-Discoloration and/or oxidation — Fracture Surfaces	Diagnostic features: Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Diagnostic features: Texture and Solutioning — Texture	Diagnostic features: Texture and Solutioning — Solutioning	General Characteristics
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY: O. GOUTHIER

CHECKED BY: P. SIRCAR

L. S. BHANGOO/ V. SANTOS
FIELD INVESTIGATION BY:
DATE: APRIL 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO. 27-0115
POST MILES 25.5

REDWOOD LANDFILL OVERCROSSING (WIDEN)
LOG OF TEST BORINGS 3 OF 5

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331
CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING 06/18/07 EARLIER REVISION DATES

REVISION DATES				SHEET	OF
10/3/11				21	23

...\270115-z-ltb03.dgn 10/14/2011 10:48:37 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 10/3/11 DATE

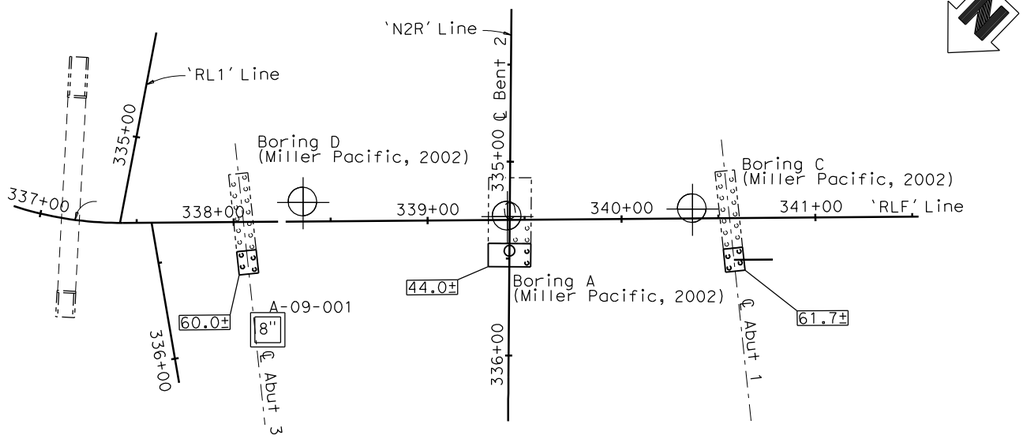
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CALIFORNIA 94901

PARIKH CONSULTANTS, INC.
2360 OUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=40'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

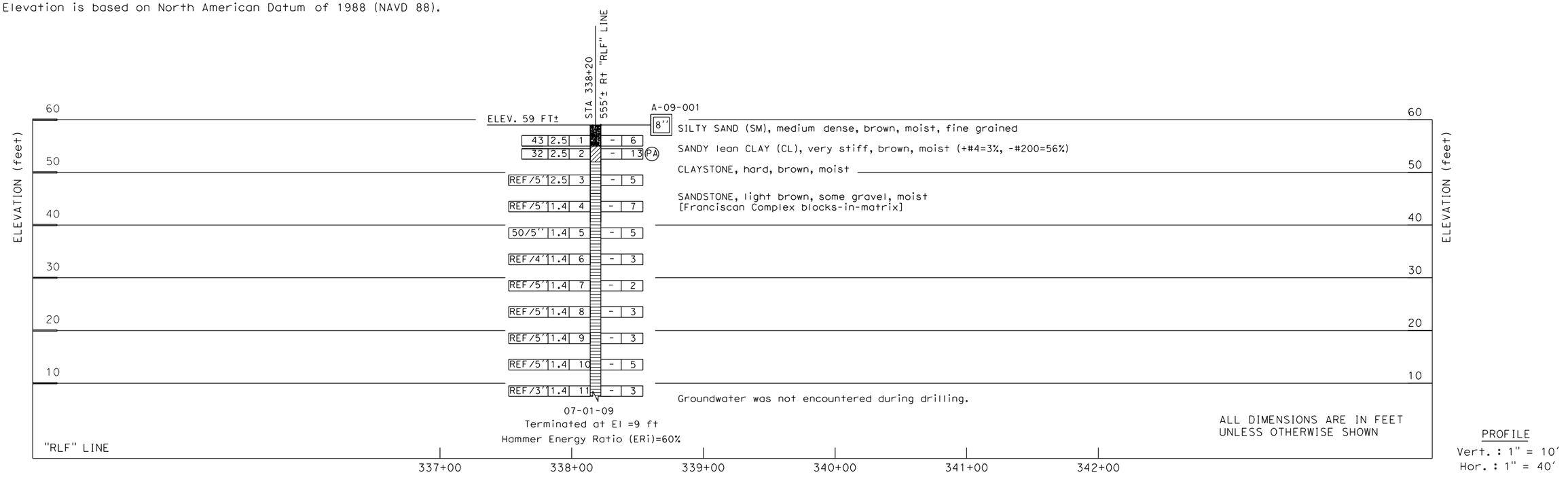
BENCH MARK AND DATUM

Monument	Coordinates North	Coordinates East	Elev (NAVD 88)	Description/Location
122	2250516.483	5966847.011	33.86	Mag Nail and shiner "HV 22" at N2 307+99.48 59.81 Rt
125	2252038.592	5965712.883	26.53	Mag Nail and shiner "HV 25" at N2 326+91.55 63.12 Rt

BASIS OF SURVEY CONTROL:

A. Horizontal Datum:
Coordinates, bearings & distances are based on the California Coordinate System of 1983 (CCS 83), Zone 3 (1991.35 HPGN). All distances are in feet. Multiply by 1.00004621 to obtain ground distances.

B. Vertical Datum:
Elevation is based on North American Datum of 1988 (NAVD 88).



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 40'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	L. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. 27-0115	REDWOOD LANDFILL OVERCROSSING (WIDEN)
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JULY 2009		PROJECT ENGINEER	POST MILES 25.5	LOG OF TEST BORINGS 4 OF 5

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF
10/3/11				22	23

...\270115-z-ltb04.dgn 10/14/2011 10:49:17 AM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	MRN	101	40.5/41.2		

4/4/05
GEOTECHNICAL PROFESSIONAL

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER MICHAEL MORISOLI No. 2541 Exp. 12/31/04 GEOTECHNICAL STATE OF CALIFORNIA

MILLER PACIFIC ENGINEERING GROUP
165 N. REDWOOD DR., SUITE 120
SAN RAFAEL, CALIFORNIA 94903

WASTE MANAGEMENT
8950 REDWOOD HIGHWAY
P.O. BOX 793
NOVATO, CALIFORNIA 94945

NOTES:

1. 61 mm samples were taken using a Modified California split barrel sampler with an inside diameter (I.D.) of 61 mm and an outside daimeter (O.D.) of 76 mm.
2. A CME automatic hammer was used to advance the sampler using a 63.5 Kg hammer with a 762 mm drop.

DIVISION OF ENGINEERING SERVICES – GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
04	Mrn	101	25.5		

REGISTERED CIVIL ENGINEER 10/3/11 DATE

REDWOOD LANDFILL OVERCROSSING (WIDEN)

LOG OF TEST BORINGS 5 OF 5

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA — CU: 03240, EA: 264071 — BRIDGE No. 27-0115 — Sheet 23 of 23

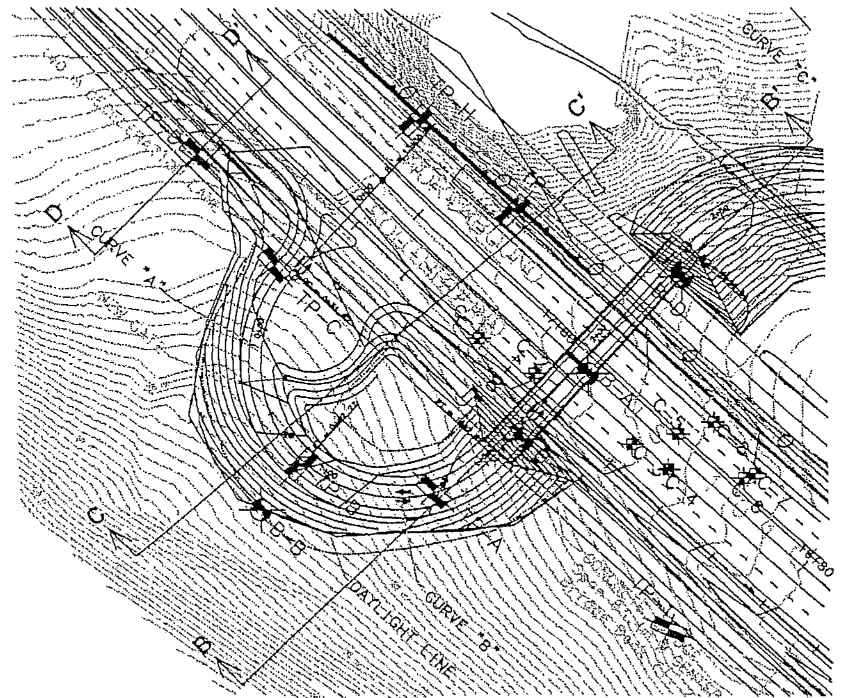
PROFESSIONAL ENGINEER REGISTERED GARY PARIKH No. G.E. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "N2" LINE
TB-A	335+30	211 ft Left
B-C	335+15	85 ft Left
B-A	335+15	0 ft C.L
B-D	335+15	140 ft Right

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.



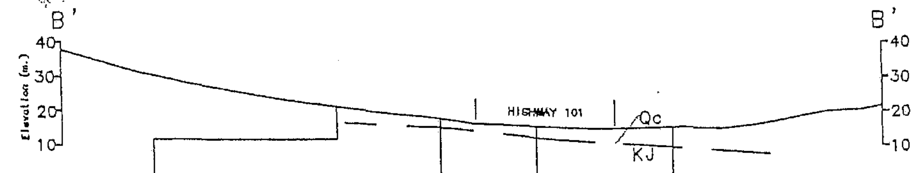
PLAN

SCALE 0 10 20 30 40 50 METERS

BENCHMARK:
Vertical Datum is NAVD 88 (meters). Benchmark is MRN-28, Elevation 8.725m As published by CALTRANS 03/07/01. Basis of bearing for this control schedule is N12 11'07"W between Monuments MRN-28 & GPS Point 207.

REFERENCE: DKS Associates Redwood Landfill Access Bridge, Alternate 2, 11/01

CSW Stuber-Stroeh Engineering Group, Inc. Construction Control Hard Copy, 12/14/04



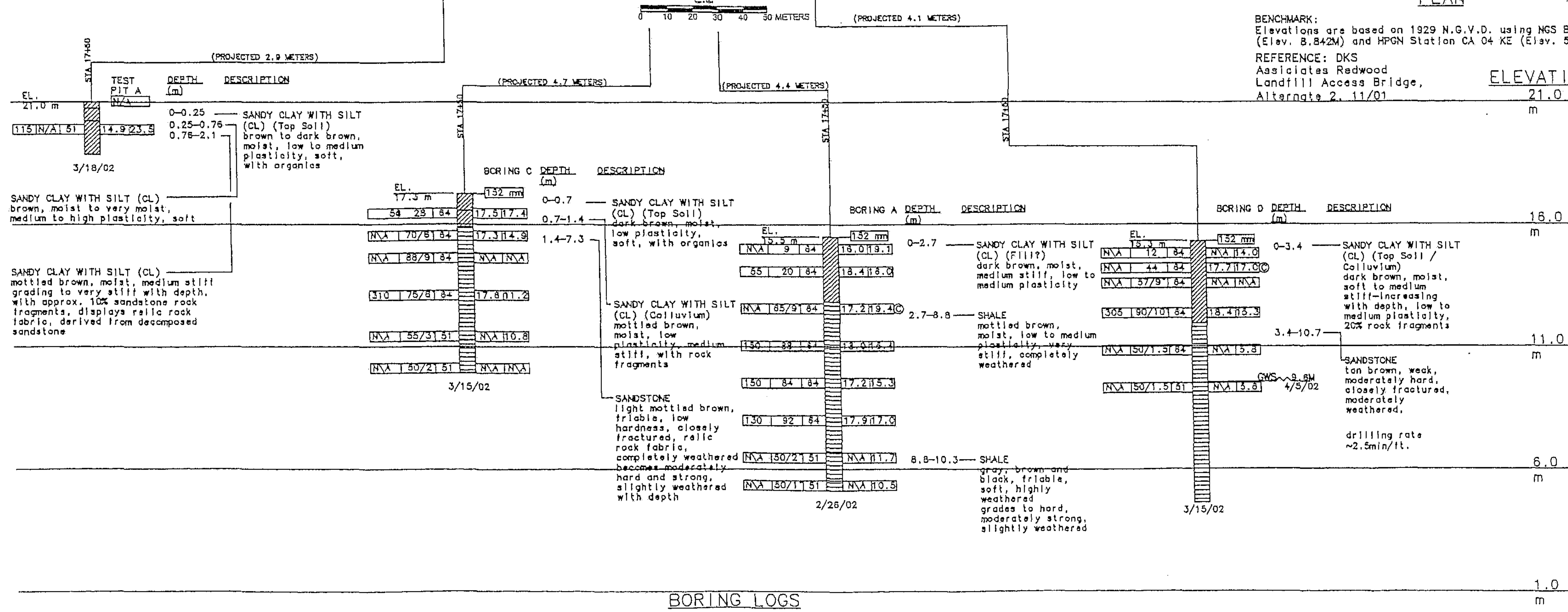
PROFILE: SECTION B-B'

SCALE 0 10 20 30 40 50 METERS

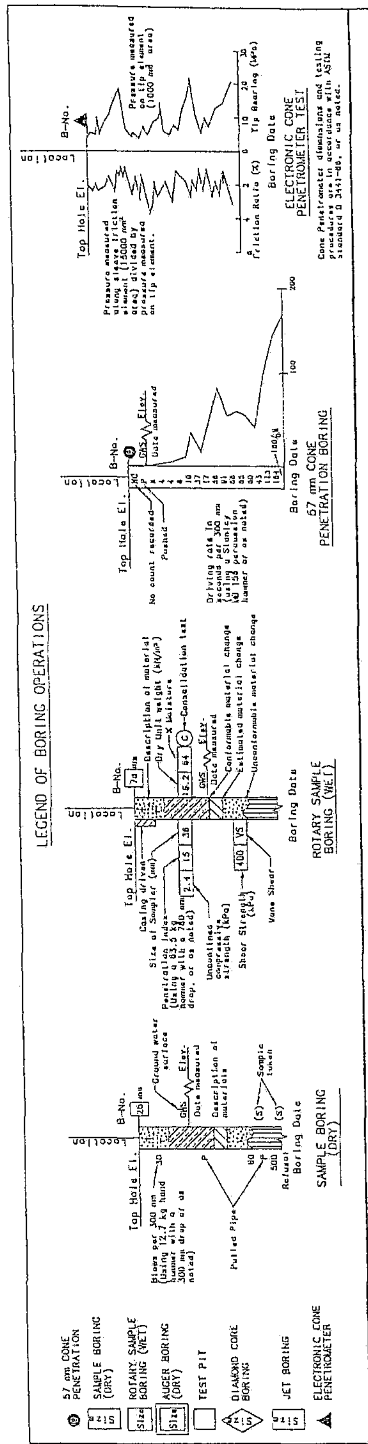
GEOLOGIC LEGEND: Qc = COLLUVIUM
KJ = FRANCISCAN COMPLEX, PREDOMINENTLY SANDSTONE

PLAN

BENCHMARK:
Elevations are based on 1929 N.G.V.D. using NGS BM N474 (Elev. 8.842M) and HPGN Station CA 04 KE (Elev. 5.459M)
REFERENCE: DKS Assiciates Redwood Landfill Access Bridge, Alternate 2, 11/01



BORING LOGS



SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT	DESIGN BY		CHARLES I. PERRY FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MICHAEL P. MORISOLI PROJECT ENGINEER	BRIDGE NO. 27-0115 KILOMETER POST 41.1(25.5)	REDWOOD LANDFILL OVERCROSSING
SIGN OFF DATE	CHECKED BY	MICHAEL P. MORISOLI	DATE:				LOG OF TEST BORINGS

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) 12/7/4/1/05

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths In "Log of Test Borings", Appendix A.

Grain Size Classification

Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on "Grain Size Distribution Curves", Plate B-2, Appendix B.

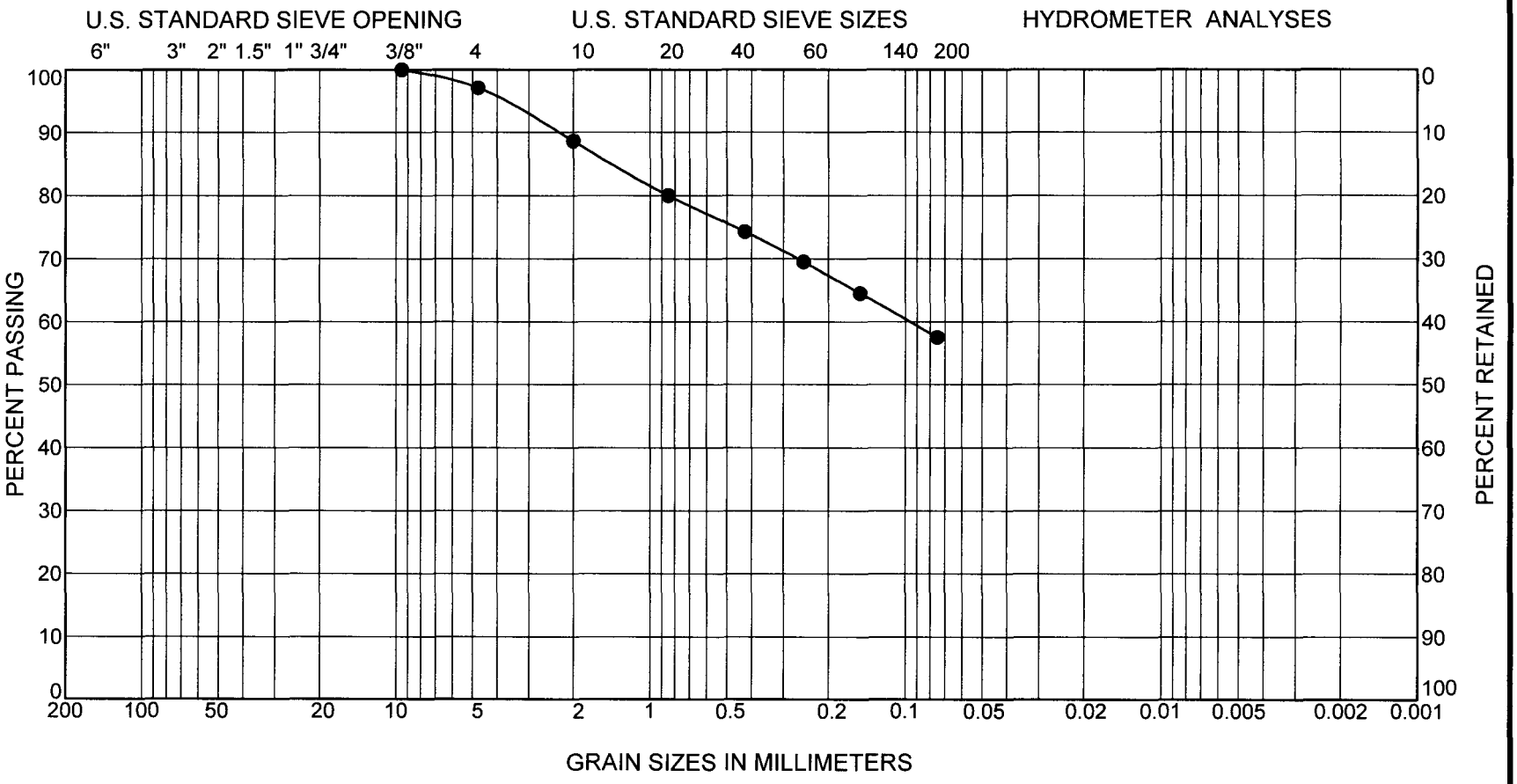
Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The test results are presented on Plate B-3, Appendix B.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-001	MC-2	4.5	●			SANDY LEAN CLAY (CL)

JOB NO: 208140.GDR

REDWOOD LANDFILL OVERCROSSING (WIDEN)
MARIN COUNTY, CALIFORNIA

PLATE NO: B-2

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B129 #2@4.5'. (A-09-129)
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113591.

EVALUATION FOR SOIL CORROSION

Soil pH	5.18	
Minimum Resistivity	5.36 ohm-cm (x1000)	
Chloride	13.4 ppm	00.00134 %
Sulfate	1.9 ppm	00.00019 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

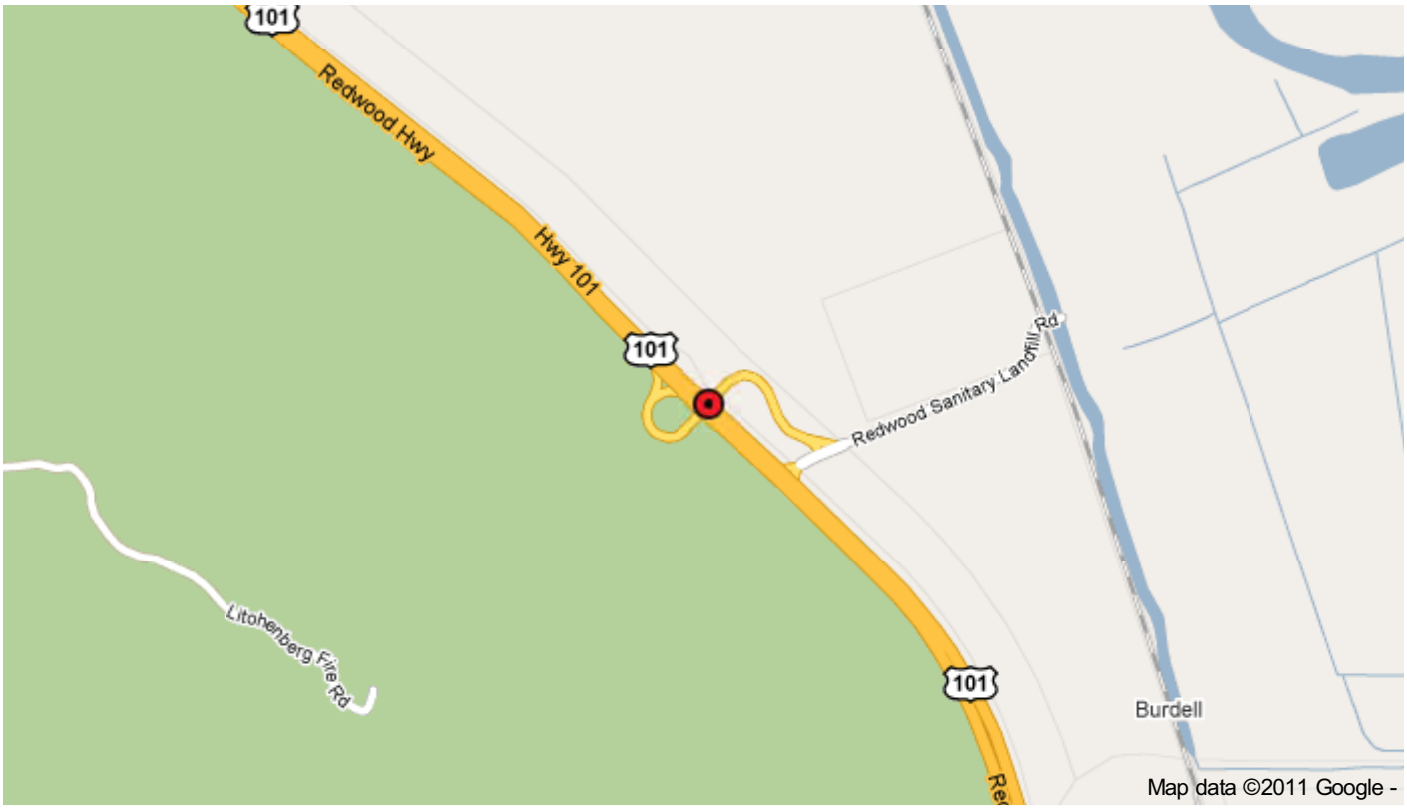
RECEIVED
JUL 31 2009
By

PLATE NO.: B-3

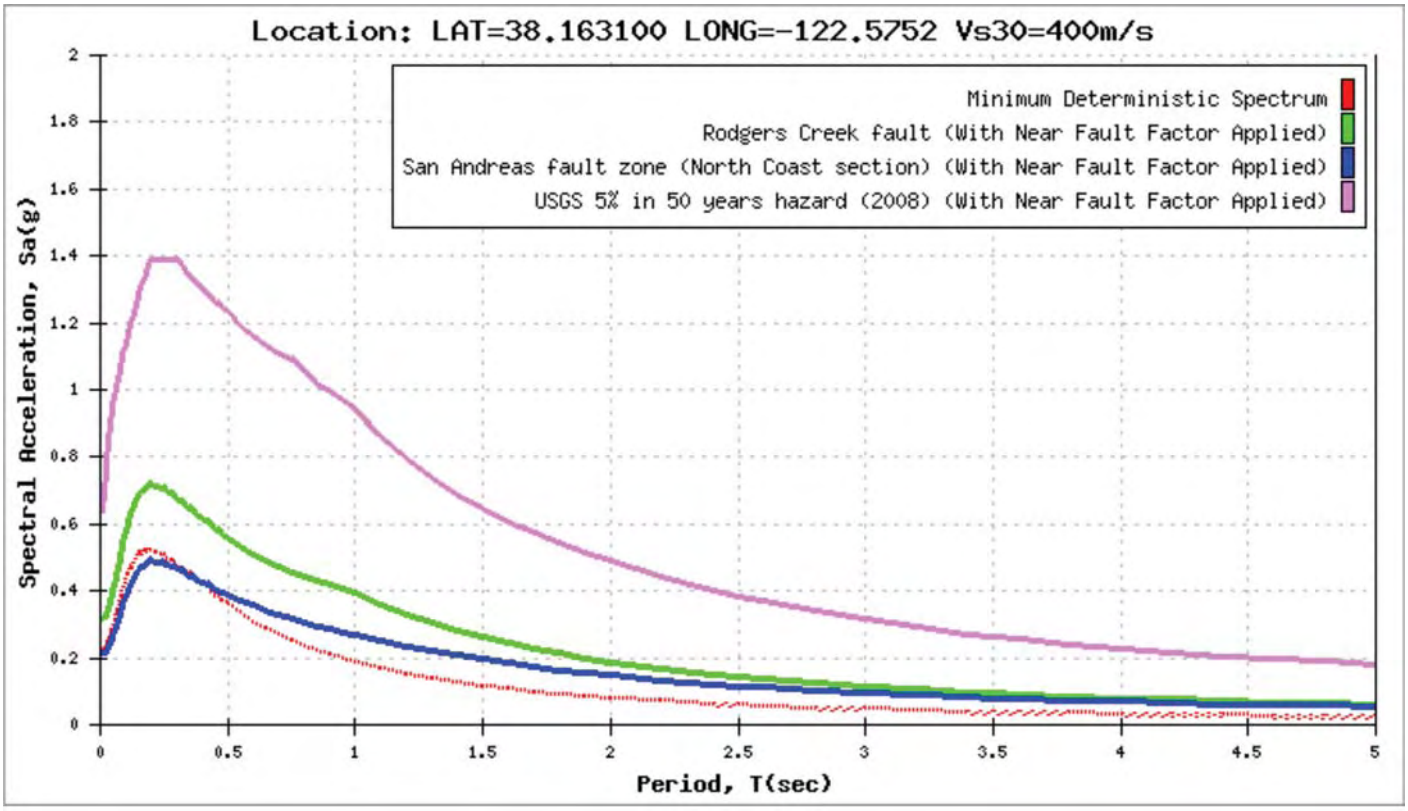
APPENDIX C

ARS ONLINE

SELECT SITE LOCATION



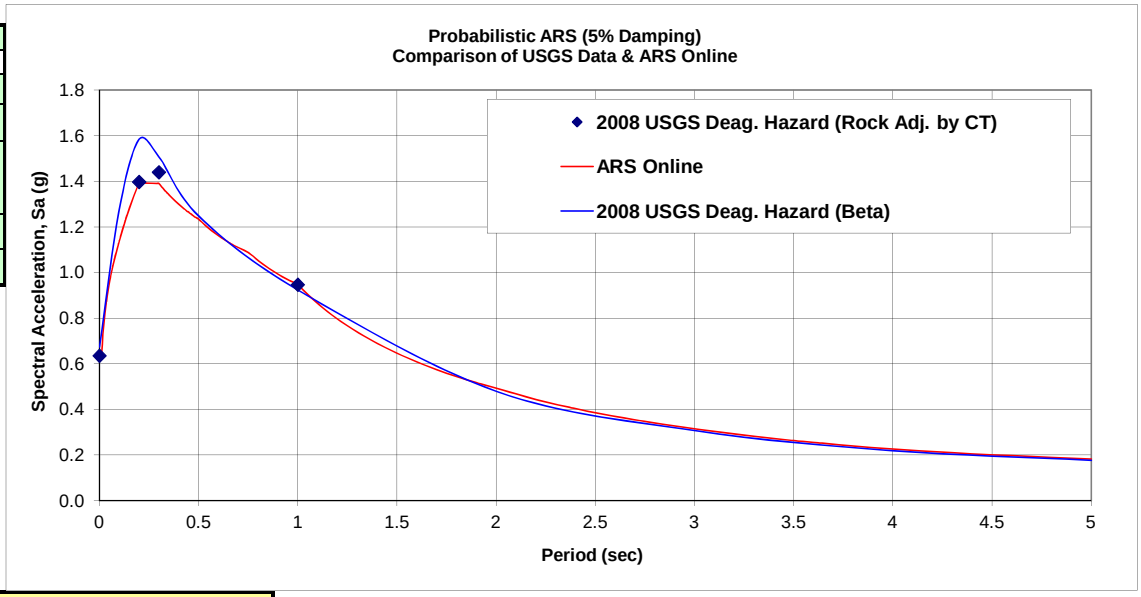
CALCULATED SPECTRA



Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.1631	-122.5752
V_{S30} (m/s) =	400
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	6.5
$Z_{1.0}$ (m) =	216
$Z_{2.5}$ (km) =	2



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.634	1	1	0.634
0.02	0.755	1	1	0.755
0.022	0.774	1	1	0.774
0.025	0.799	1	1	0.799
0.029	0.83	1	1	0.83
0.03	0.837	1	1	0.837
0.032	0.851	1	1	0.851
0.035	0.87	1	1	0.87
0.036	0.877	1	1	0.877
0.04	0.9	1	1	0.9
0.042	0.912	1	1	0.912
0.044	0.922	1	1	0.922
0.045	0.928	1	1	0.928
0.046	0.933	1	1	0.933
0.048	0.943	1	1	0.943
0.05	0.953	1	1	0.953
0.055	0.976	1	1	0.976
0.06	0.998	1	1	0.998
0.065	1.018	1	1	1.018
0.067	1.026	1	1	1.026
0.07	1.037	1	1	1.037
0.075	1.056	1	1	1.056
0.08	1.073	1	1	1.073
0.085	1.09	1	1	1.09
0.09	1.106	1	1	1.106
0.095	1.121	1	1	1.121
0.1	1.135	1	1	1.135
0.11	1.168	1	1	1.168
0.12	1.198	1	1	1.198
0.13	1.226	1	1	1.226
0.133	1.234	1	1	1.234
0.14	1.253	1	1	1.253
0.15	1.279	1	1	1.279
0.16	1.303	1	1	1.303
0.17	1.327	1	1	1.327
0.18	1.349	1	1	1.349
0.19	1.371	1	1	1.371
0.2	1.391	1	1	1.391
0.22	1.391	1	1	1.391
0.24	1.391	1	1	1.391
0.25	1.391	1	1	1.391
0.26	1.391	1	1	1.391
0.28	1.39	1	1	1.39

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.613	1.000	1.036	1.000	0.635	0.634	0.2%
0.2	1.526	1.000	0.916	1.000	1.397	1.391	0.5%
0.3	1.283	1.000	1.123	1.000	1.440	1.39	3.5%
1	0.505	1.200	1.563	1.000	0.947	0.945	0.2%

Max % Difference = **3.5%**

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.6742	1.000	1.000	0.674	0.634	6.0%
0.1	1.2788	1.000	1.000	1.279	1.135	11.2%
0.2	1.584	1.000	1.000	1.584	1.391	12.2%
0.3	1.5072	1.000	1.000	1.507	1.39	7.8%
0.5	1.248	1.000	1.000	1.248	1.233	1.2%
1	0.7703	1.200	1.000	0.924	0.945	2.2%
2	0.3998	1.200	1.000	0.480	0.493	2.8%
3	0.256	1.200	1.000	0.307	0.315	2.5%
4	0.183	1.200	1.000	0.220	0.225	2.5%
5	0.1477	1.200	1.000	0.177	0.182	2.7%

Max % Difference = **2.8%**

0.29	1.39	1	1	1.39
0.3	1.39	1	1	1.39
0.32	1.369	1	1	1.369
0.34	1.35	1	1	1.35
0.35	1.341	1	1	1.341
0.36	1.332	1	1	1.332
0.38	1.315	1	1	1.315
0.4	1.299	1	1	1.299
0.42	1.284	1	1	1.284
0.44	1.27	1	1	1.27
0.45	1.264	1	1	1.264
0.46	1.257	1	1	1.257
0.48	1.244	1	1	1.244
0.5	1.233	1	1	1.233
0.55	1.17	1	1.02	1.194
0.6	1.116	1	1.04	1.161
0.65	1.069	1	1.06	1.133
0.667	1.054	1	1.067	1.124
0.7	1.027	1	1.08	1.109
0.75	0.989	1	1.1	1.088
0.8	0.94	1	1.12	1.052
0.85	0.896	1	1.14	1.021
0.9	0.856	1	1.16	0.993
0.95	0.82	1	1.18	0.968
1	0.788	1	1.2	0.945
1.1	0.72	1	1.2	0.864
1.2	0.664	1	1.2	0.796
1.3	0.616	1	1.2	0.739
1.4	0.574	1	1.2	0.689
1.5	0.538	1	1.2	0.646
1.6	0.506	1	1.2	0.608
1.7	0.478	1	1.2	0.574
1.8	0.453	1	1.2	0.544
1.9	0.431	1	1.2	0.517
2	0.411	1	1.2	0.493
2.2	0.37	1	1.2	0.443
2.4	0.336	1	1.2	0.403
2.5	0.321	1	1.2	0.385
2.6	0.307	1	1.2	0.369
2.8	0.283	1	1.2	0.34
3	0.262	1	1.2	0.315
3.2	0.243	1	1.2	0.292
3.4	0.227	1	1.2	0.272
3.5	0.219	1	1.2	0.263
3.6	0.212	1	1.2	0.255
3.8	0.199	1	1.2	0.239
4	0.188	1	1.2	0.225
4.2	0.179	1	1.2	0.215
4.4	0.171	1	1.2	0.205
4.6	0.164	1	1.2	0.197
4.8	0.157	1	1.2	0.189
5	0.151	1	1.2	0.182

PROJECT NAME **REDWOOD LANDFILL OVERCROSSING**
PROJECT NO. **2008-140-RLF**
BORING NO. **A-09-001**

SOIL GROUPS

1. GRAVELS, SANDS AND NONPLASTIC SILTS $Vs=100.5(N_{60})^{0.29}$
2. CLAYS AND PLASTIC SILTS $Vs=86.9(N_{60})^{0.333}$
3. ROCK $Vs=109(N_{60})^{0.319}$

HAMMER ENERGY 0.6

Depth (ft)		Thickness, D (ft)	Soil Type	Sample Type	N	N_{60}	Vs (m/s)	Vs (ft/s)	D/V	Vs30 (m/s)
0	4	4	1	MC	43	28.0	264.0	865.9	0.005	413.2
4	6.5	2.5	2	MC	32	20.8	238.7	783.1	0.003	
6.5	100	93.5	3	SPT	75	75.0	432.1	1417.2	0.066	

A shear wave velocity of 400 m/s was used for the ARS curve

SITE DATA

Shear Wave Velocity, V_{S30}:	400 m/s
Latitude:	38.163100
Longitude:	-122.575200
Depth to Vs = 1.0 km/s:	216 m
Depth to Vs = 2.5 km/s:	2.00 km

DETERMINISTIC

Rodgers Creek fault

Fault ID:	157
Maximum Magnitude (MMax):	7.1
Fault Type:	RLSS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	12.00 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	8.96 km
Rjb:	8.95 km
Rx:	8.96 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.316	1.000	1.000	0.316
0.02	0.321	1.000	1.000	0.321
0.022	0.325	1.000	1.000	0.325
0.025	0.331	1.000	1.000	0.331
0.029	0.339	1.000	1.000	0.339
0.03	0.341	1.000	1.000	0.341
0.032	0.346	1.000	1.000	0.346
0.035	0.355	1.000	1.000	0.355
0.036	0.358	1.000	1.000	0.358
0.04	0.369	1.000	1.000	0.369
0.042	0.375	1.000	1.000	0.375
0.044	0.381	1.000	1.000	0.381
0.045	0.384	1.000	1.000	0.384
0.046	0.387	1.000	1.000	0.387
0.048	0.393	1.000	1.000	0.393
0.05	0.400	1.000	1.000	0.400
0.055	0.418	1.000	1.000	0.418

0.06	0.437	1.000	1.000	0.437
0.065	0.456	1.000	1.000	0.456
0.067	0.463	1.000	1.000	0.463
0.07	0.474	1.000	1.000	0.474
0.075	0.492	1.000	1.000	0.492
0.08	0.510	1.000	1.000	0.510
0.085	0.527	1.000	1.000	0.527
0.09	0.545	1.000	1.000	0.545
0.095	0.561	1.000	1.000	0.561
0.1	0.578	1.000	1.000	0.578
0.11	0.605	1.000	1.000	0.605
0.12	0.629	1.000	1.000	0.629
0.13	0.650	1.000	1.000	0.650
0.133	0.656	1.000	1.000	0.656
0.14	0.669	1.000	1.000	0.669
0.15	0.685	1.000	1.000	0.685
0.16	0.695	1.000	1.000	0.695
0.17	0.703	1.000	1.000	0.703
0.18	0.710	1.000	1.000	0.710
0.19	0.715	1.000	1.000	0.715
0.2	0.720	1.000	1.000	0.720
0.22	0.715	1.000	1.000	0.715
0.24	0.709	1.000	1.000	0.709
0.25	0.705	1.000	1.000	0.705
0.26	0.700	1.000	1.000	0.700
0.28	0.691	1.000	1.000	0.691
0.29	0.685	1.000	1.000	0.685
0.3	0.679	1.000	1.000	0.679
0.32	0.668	1.000	1.000	0.668
0.34	0.655	1.000	1.000	0.655
0.35	0.649	1.000	1.000	0.649
0.36	0.643	1.000	1.000	0.643
0.38	0.630	1.000	1.000	0.630
0.4	0.618	1.000	1.000	0.618
0.42	0.605	1.000	1.000	0.605
0.44	0.592	1.000	1.000	0.592
0.45	0.586	1.000	1.000	0.586
0.46	0.580	1.000	1.000	0.580
0.48	0.568	1.000	1.000	0.568
0.5	0.557	1.000	1.000	0.557
0.55	0.521	1.000	1.020	0.531
0.6	0.490	1.000	1.040	0.509
0.65	0.462	1.000	1.060	0.490
0.667	0.454	1.000	1.067	0.484
0.7	0.438	1.000	1.080	0.473
0.75	0.416	1.000	1.100	0.458

0.8	0.395	1.000	1.120	0.443
0.85	0.376	1.000	1.140	0.429
0.9	0.359	1.000	1.160	0.416
0.95	0.343	1.000	1.180	0.405
1	0.328	1.000	1.200	0.394
1.1	0.300	1.000	1.200	0.360
1.2	0.276	1.000	1.200	0.331
1.3	0.255	1.000	1.200	0.306
1.4	0.236	1.000	1.200	0.284
1.5	0.220	1.000	1.200	0.263
1.6	0.204	1.000	1.200	0.245
1.7	0.190	1.000	1.200	0.228
1.8	0.177	1.000	1.200	0.213
1.9	0.166	1.000	1.200	0.199
2	0.156	1.000	1.200	0.188
2.2	0.139	1.000	1.200	0.167
2.4	0.125	1.000	1.200	0.150
2.5	0.119	1.000	1.200	0.143
2.6	0.113	1.000	1.200	0.136
2.8	0.104	1.000	1.200	0.124
3	0.095	1.000	1.200	0.114
3.2	0.088	1.000	1.200	0.105
3.4	0.082	1.000	1.200	0.098
3.5	0.079	1.000	1.200	0.094
3.6	0.076	1.000	1.200	0.091
3.8	0.071	1.000	1.200	0.085
4	0.067	1.000	1.200	0.080
4.2	0.063	1.000	1.200	0.075
4.4	0.059	1.000	1.200	0.071
4.6	0.056	1.000	1.200	0.067
4.8	0.053	1.000	1.200	0.064
5	0.051	1.000	1.200	0.061

San Andreas fault zone (North Coast section)

Fault ID:	308
Maximum Magnitude (MMax):	7.9
Fault Type:	RLSS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	11.00 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	23.38 km
Rjb:	23.37 km
Rx:	23.38 km
Fnorm:	0

Frev: 0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.213	1.000	1.000	0.213
0.02	0.216	1.000	1.000	0.216
0.022	0.219	1.000	1.000	0.219
0.025	0.222	1.000	1.000	0.222
0.029	0.227	1.000	1.000	0.227
0.03	0.228	1.000	1.000	0.228
0.032	0.232	1.000	1.000	0.232
0.035	0.237	1.000	1.000	0.237
0.036	0.239	1.000	1.000	0.239
0.04	0.246	1.000	1.000	0.246
0.042	0.250	1.000	1.000	0.250
0.044	0.254	1.000	1.000	0.254
0.045	0.256	1.000	1.000	0.256
0.046	0.258	1.000	1.000	0.258
0.048	0.262	1.000	1.000	0.262
0.05	0.266	1.000	1.000	0.266
0.055	0.278	1.000	1.000	0.278
0.06	0.290	1.000	1.000	0.290
0.065	0.302	1.000	1.000	0.302
0.067	0.307	1.000	1.000	0.307
0.07	0.314	1.000	1.000	0.314
0.075	0.326	1.000	1.000	0.326
0.08	0.338	1.000	1.000	0.338
0.085	0.350	1.000	1.000	0.350
0.09	0.362	1.000	1.000	0.362
0.095	0.373	1.000	1.000	0.373
0.1	0.384	1.000	1.000	0.384
0.11	0.404	1.000	1.000	0.404
0.12	0.421	1.000	1.000	0.421
0.13	0.437	1.000	1.000	0.437
0.133	0.441	1.000	1.000	0.441
0.14	0.450	1.000	1.000	0.450
0.15	0.462	1.000	1.000	0.462
0.16	0.470	1.000	1.000	0.470
0.17	0.476	1.000	1.000	0.476
0.18	0.481	1.000	1.000	0.481
0.19	0.485	1.000	1.000	0.485
0.2	0.488	1.000	1.000	0.488
0.22	0.487	1.000	1.000	0.487
0.24	0.484	1.000	1.000	0.484
0.25	0.482	1.000	1.000	0.482
0.26	0.479	1.000	1.000	0.479

0.28	0.474	1.000	1.000	0.474
0.29	0.471	1.000	1.000	0.471
0.3	0.467	1.000	1.000	0.467
0.32	0.459	1.000	1.000	0.459
0.34	0.450	1.000	1.000	0.450
0.35	0.445	1.000	1.000	0.445
0.36	0.441	1.000	1.000	0.441
0.38	0.432	1.000	1.000	0.432
0.4	0.423	1.000	1.000	0.423
0.42	0.416	1.000	1.000	0.416
0.44	0.410	1.000	1.000	0.410
0.45	0.406	1.000	1.000	0.406
0.46	0.403	1.000	1.000	0.403
0.48	0.397	1.000	1.000	0.397
0.5	0.391	1.000	1.000	0.391
0.55	0.371	1.000	1.003	0.373
0.6	0.354	1.000	1.006	0.356
0.65	0.339	1.000	1.010	0.342
0.667	0.334	1.000	1.011	0.338
0.7	0.325	1.000	1.013	0.329
0.75	0.313	1.000	1.016	0.318
0.8	0.300	1.000	1.019	0.306
0.85	0.289	1.000	1.023	0.296
0.9	0.279	1.000	1.026	0.286
0.95	0.269	1.000	1.029	0.277
1	0.260	1.000	1.032	0.269
1.1	0.243	1.000	1.032	0.250
1.2	0.227	1.000	1.032	0.235
1.3	0.213	1.000	1.032	0.220
1.4	0.201	1.000	1.032	0.207
1.5	0.190	1.000	1.032	0.196
1.6	0.178	1.000	1.032	0.184
1.7	0.168	1.000	1.032	0.173
1.8	0.159	1.000	1.032	0.164
1.9	0.150	1.000	1.032	0.155
2	0.143	1.000	1.032	0.148
2.2	0.129	1.000	1.032	0.133
2.4	0.117	1.000	1.032	0.121
2.5	0.112	1.000	1.032	0.116
2.6	0.108	1.000	1.032	0.111
2.8	0.099	1.000	1.032	0.103
3	0.092	1.000	1.032	0.095
3.2	0.086	1.000	1.032	0.089
3.4	0.080	1.000	1.032	0.083
3.5	0.078	1.000	1.032	0.080
3.6	0.075	1.000	1.032	0.078

3.8	0.071	1.000	1.032	0.073
4	0.067	1.000	1.032	0.069
4.2	0.064	1.000	1.032	0.066
4.4	0.061	1.000	1.032	0.062
4.6	0.058	1.000	1.032	0.060
4.8	0.055	1.000	1.032	0.057
5	0.053	1.000	1.032	0.054

PROBABILISTIC

Probabilistic Model
USGS Seismic Hazard Map(2008) 975 Year Return Period

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.634	1.000	1.000	0.634
0.02	0.755	1.000	1.000	0.755
0.022	0.774	1.000	1.000	0.774
0.025	0.799	1.000	1.000	0.799
0.029	0.830	1.000	1.000	0.830
0.03	0.837	1.000	1.000	0.837
0.032	0.851	1.000	1.000	0.851
0.035	0.870	1.000	1.000	0.870
0.036	0.877	1.000	1.000	0.877
0.04	0.900	1.000	1.000	0.900
0.042	0.912	1.000	1.000	0.912
0.044	0.922	1.000	1.000	0.922
0.045	0.928	1.000	1.000	0.928
0.046	0.933	1.000	1.000	0.933
0.048	0.943	1.000	1.000	0.943
0.05	0.953	1.000	1.000	0.953
0.055	0.976	1.000	1.000	0.976
0.06	0.998	1.000	1.000	0.998
0.065	1.018	1.000	1.000	1.018
0.067	1.026	1.000	1.000	1.026
0.07	1.037	1.000	1.000	1.037
0.075	1.056	1.000	1.000	1.056
0.08	1.073	1.000	1.000	1.073
0.085	1.090	1.000	1.000	1.090
0.09	1.106	1.000	1.000	1.106
0.095	1.121	1.000	1.000	1.121
0.1	1.135	1.000	1.000	1.135
0.11	1.168	1.000	1.000	1.168
0.12	1.198	1.000	1.000	1.198
0.13	1.226	1.000	1.000	1.226
0.133	1.234	1.000	1.000	1.234

0.14	1.253	1.000	1.000	1.253
0.15	1.279	1.000	1.000	1.279
0.16	1.303	1.000	1.000	1.303
0.17	1.327	1.000	1.000	1.327
0.18	1.349	1.000	1.000	1.349
0.19	1.370	1.000	1.000	1.370
0.2	1.391	1.000	1.000	1.391
0.22	1.391	1.000	1.000	1.391
0.24	1.391	1.000	1.000	1.391
0.25	1.391	1.000	1.000	1.391
0.26	1.390	1.000	1.000	1.390
0.28	1.390	1.000	1.000	1.390
0.29	1.390	1.000	1.000	1.390
0.3	1.390	1.000	1.000	1.390
0.32	1.369	1.000	1.000	1.369
0.34	1.350	1.000	1.000	1.350
0.35	1.341	1.000	1.000	1.341
0.36	1.332	1.000	1.000	1.332
0.38	1.315	1.000	1.000	1.315
0.4	1.299	1.000	1.000	1.299
0.42	1.284	1.000	1.000	1.284
0.44	1.270	1.000	1.000	1.270
0.45	1.263	1.000	1.000	1.263
0.46	1.257	1.000	1.000	1.257
0.48	1.244	1.000	1.000	1.244
0.5	1.233	1.000	1.000	1.233
0.55	1.170	1.000	1.020	1.194
0.6	1.116	1.000	1.040	1.161
0.65	1.069	1.000	1.060	1.133
0.667	1.054	1.000	1.067	1.124
0.7	1.027	1.000	1.080	1.109
0.75	0.989	1.000	1.100	1.088
0.8	0.940	1.000	1.120	1.052
0.85	0.896	1.000	1.140	1.021
0.9	0.856	1.000	1.160	0.993
0.95	0.820	1.000	1.180	0.968
1	0.787	1.000	1.200	0.945
1.1	0.720	1.000	1.200	0.864
1.2	0.664	1.000	1.200	0.796
1.3	0.616	1.000	1.200	0.739
1.4	0.574	1.000	1.200	0.689
1.5	0.538	1.000	1.200	0.646
1.6	0.506	1.000	1.200	0.608
1.7	0.478	1.000	1.200	0.574
1.8	0.453	1.000	1.200	0.544
1.9	0.431	1.000	1.200	0.517

2	0.411	1.000	1.200	0.493
2.2	0.370	1.000	1.200	0.443
2.4	0.336	1.000	1.200	0.403
2.5	0.321	1.000	1.200	0.385
2.6	0.307	1.000	1.200	0.369
2.8	0.283	1.000	1.200	0.340
3	0.262	1.000	1.200	0.315
3.2	0.243	1.000	1.200	0.292
3.4	0.227	1.000	1.200	0.272
3.5	0.219	1.000	1.200	0.263
3.6	0.212	1.000	1.200	0.255
3.8	0.199	1.000	1.200	0.239
4	0.188	1.000	1.200	0.225
4.2	0.179	1.000	1.200	0.215
4.4	0.171	1.000	1.200	0.205
4.6	0.164	1.000	1.200	0.197
4.8	0.157	1.000	1.200	0.189
5	0.151	1.000	1.200	0.182

MINIMUM DETERMINISTIC SPECTRUM

Period	SA
0.01	0.223
0.02	0.226
0.022	0.229
0.025	0.233
0.029	0.238
0.03	0.240
0.032	0.244
0.035	0.250
0.036	0.253
0.04	0.261
0.042	0.266
0.044	0.270
0.045	0.272
0.046	0.275
0.048	0.279
0.05	0.284
0.055	0.299
0.06	0.314
0.065	0.329
0.067	0.335
0.07	0.343

0.075	0.358
0.08	0.372
0.085	0.386
0.09	0.400
0.095	0.413
0.1	0.426
0.11	0.447
0.12	0.465
0.13	0.481
0.133	0.485
0.14	0.495
0.15	0.507
0.16	0.512
0.17	0.516
0.18	0.519
0.19	0.521
0.2	0.523
0.22	0.514
0.24	0.506
0.25	0.501
0.26	0.496
0.28	0.485
0.29	0.480
0.3	0.475
0.32	0.463
0.34	0.452
0.35	0.446
0.36	0.441
0.38	0.430
0.4	0.420
0.42	0.407
0.44	0.395
0.45	0.389
0.46	0.383
0.48	0.372
0.5	0.362
0.55	0.333
0.6	0.307
0.65	0.286
0.667	0.279
0.7	0.267
0.75	0.250
0.8	0.235
0.85	0.221
0.9	0.208
0.95	0.197

1	0.187
1.1	0.168
1.2	0.152
1.3	0.138
1.4	0.126
1.5	0.116
1.6	0.106
1.7	0.098
1.8	0.091
1.9	0.084
2	0.079
2.2	0.069
2.4	0.062
2.5	0.058
2.6	0.055
2.8	0.050
3	0.045
3.2	0.042
3.4	0.038
3.5	0.037
3.6	0.036
3.8	0.033
4	0.031
4.2	0.029
4.4	0.027
4.6	0.026
4.8	0.024
5	0.023

Envelope Data

Period	**SA**
0.01	0.634
0.02	0.755
0.022	0.774
0.025	0.799
0.029	0.830
0.03	0.837
0.032	0.851
0.035	0.870
0.036	0.877
0.04	0.900
0.042	0.912
0.044	0.922
0.045	0.928
0.046	0.933

0.048	0.943
0.05	0.953
0.055	0.976
0.06	0.998
0.065	1.018
0.067	1.026
0.07	1.037
0.075	1.056
0.08	1.073
0.085	1.090
0.09	1.106
0.095	1.121
0.1	1.135
0.11	1.168
0.12	1.198
0.13	1.226
0.133	1.234
0.14	1.253
0.15	1.279
0.16	1.303
0.17	1.327
0.18	1.349
0.19	1.370
0.2	1.391
0.22	1.391
0.24	1.391
0.25	1.391
0.26	1.390
0.28	1.390
0.29	1.390
0.3	1.390
0.32	1.369
0.34	1.350
0.35	1.341
0.36	1.332
0.38	1.315
0.4	1.299
0.42	1.284
0.44	1.270
0.45	1.263
0.46	1.257
0.48	1.244
0.5	1.233
0.55	1.194
0.6	1.161
0.65	1.133

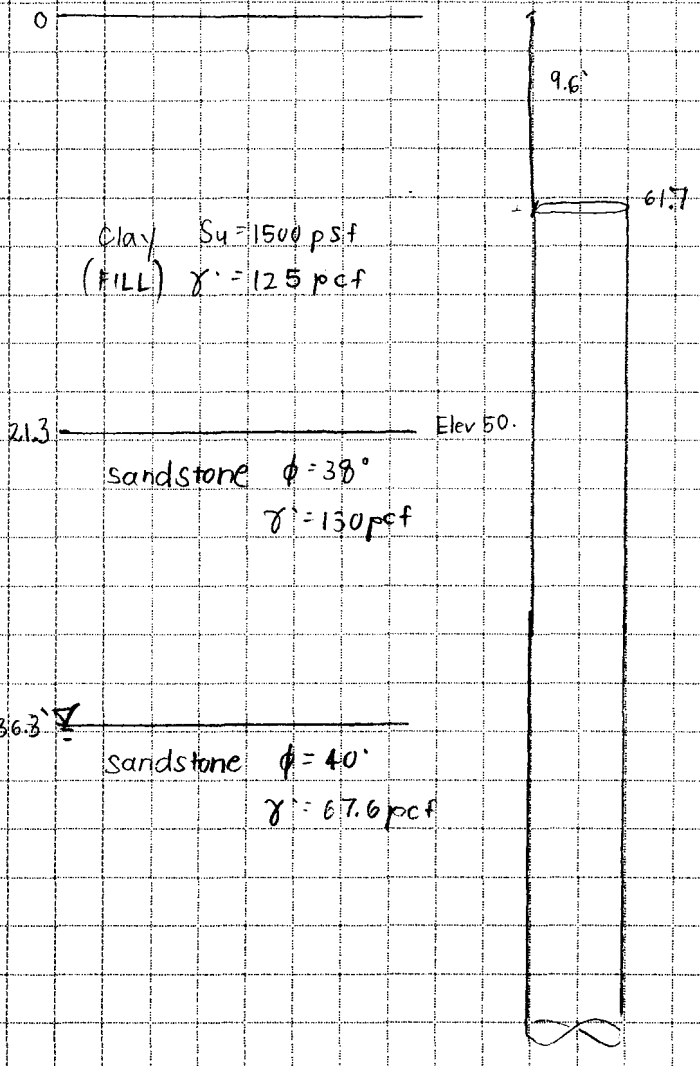
0.667	1.124
0.7	1.109
0.75	1.088
0.8	1.052
0.85	1.021
0.9	0.993
0.95	0.968
1	0.945
1.1	0.864
1.2	0.796
1.3	0.739
1.4	0.689
1.5	0.646
1.6	0.608
1.7	0.574
1.8	0.544
1.9	0.517
2	0.493
2.2	0.443
2.4	0.403
2.5	0.385
2.6	0.369
2.8	0.340
3	0.315
3.2	0.292
3.4	0.272
3.5	0.263
3.6	0.255
3.8	0.239
4	0.225
4.2	0.215
4.4	0.205
4.6	0.197
4.8	0.189
5	0.182

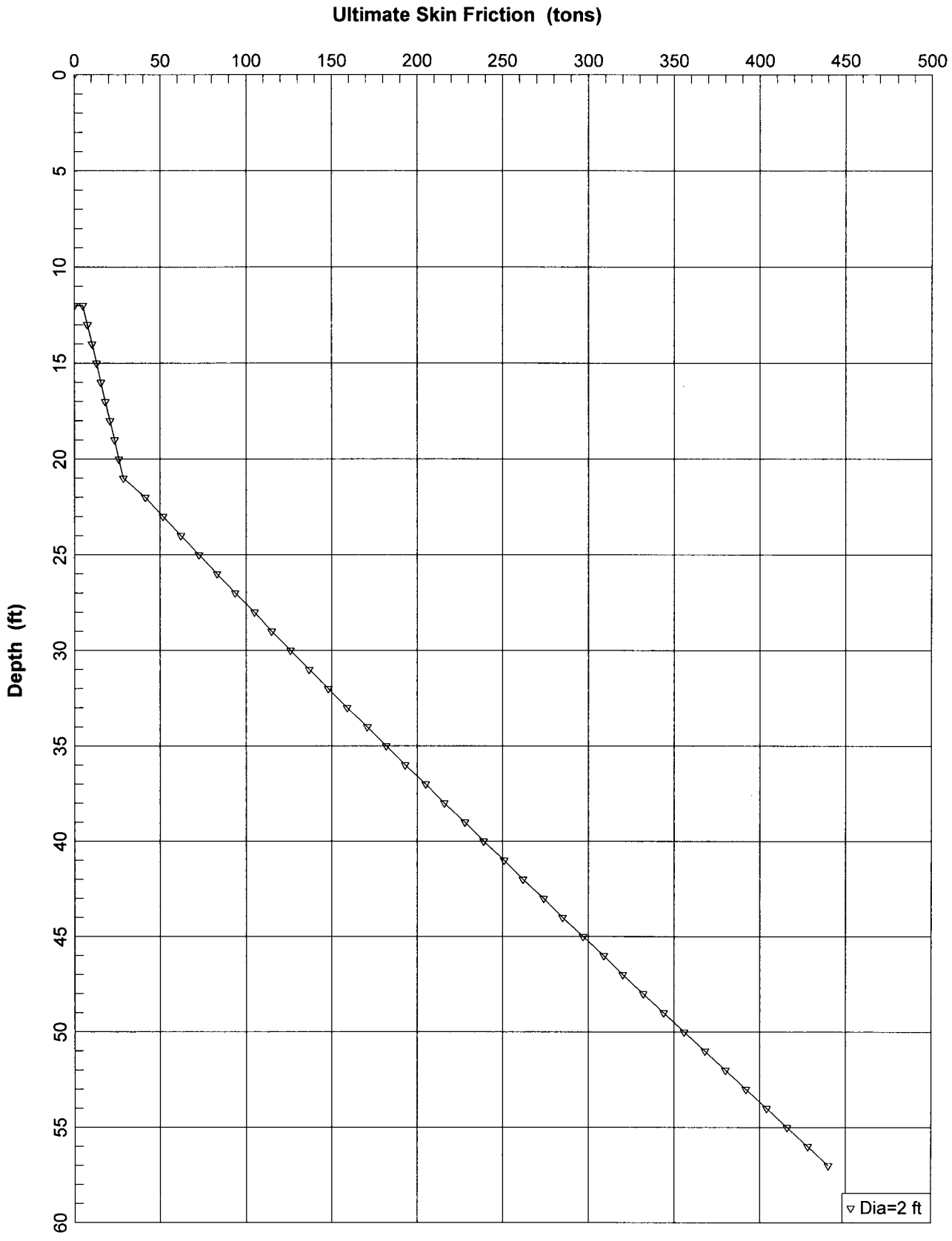
SHAFT

PARIKH
Practicing in the Geosciences

JOB 208140 Redwood Landfill OC (Abut 1)
SHEET NO _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

2' ϕ CIDH F.G. = 71.3' Cutoff elev = 61.7' X = -2.5'





REDWOOD LANDFILL OVERCROSSING (WIDEN) - ABUTMENT 1

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

REDWOOD LANDFILL OVERCROSSING (WIDEN) - ABUTMENT 1

TOTAL LOAD = 200.0 TONS

NUMBER OF LAYERS = 3

WATER TABLE DEPTH = 36.3 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00

SOIL INFORMATION

LAYER NO 1----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.600E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.213E+02

LAYER NO 2----GRAVEL

AT THE TOP

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.000E+00
POISSION RATIO OF GRAVEL	= 0.300E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.750E+02
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03

MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.213E+02

AT THE BOTTOM

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.000E+00
POISSION RATIO OF GRAVEL	= 0.300E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.750E+02
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.363E+02

LAYER NO 3----GRAVEL

AT THE TOP

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.000E+00
POISSION RATIO OF GRAVEL	= 0.300E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.750E+02
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.363E+02

AT THE BOTTOM

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.000E+00
POISSION RATIO OF GRAVEL	= 0.300E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.750E+02
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	= 2.000	FT.
DIAMETER OF BASE	= 2.000	FT.
END OF STEM TO BASE	= 0.000	FT.
ANGLE OF BELL	= 0.000	DEG.
IGNORED TOP PORTION	= 9.600	FT.
IGNORED BOTTOM PORTION	= 0.000	FT.
AREA OF ONE PERCENT STEEL	= 4.524	SQ.IN.
ELASTIC MODULUS, Ec	= 0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	= 0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
APPLIED TO THE ULTIMATE BASE RESISTANCE;

QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
11.0	1.28	2.59	18.77	21.36	8.85	7.29	16.68
12.0	1.40	5.18	19.10	24.29	11.55	8.44	17.39
13.0	1.51	7.78	19.44	27.22	14.26	9.59	17.99
14.0	1.63	10.37	19.78	30.14	16.96	10.74	18.50
15.0	1.75	12.96	20.11	33.07	19.66	11.89	18.95
16.0	1.86	15.55	20.45	36.00	22.37	13.04	19.34
17.0	1.98	18.15	20.79	38.93	25.07	14.19	19.68
18.0	2.09	20.74	37.03	57.77	33.08	20.64	27.58
19.0	2.21	23.33	56.56	79.89	42.18	28.18	36.13
20.0	2.33	25.92	66.64	92.56	48.13	32.58	39.77
21.0	2.44	28.51	67.21	95.73	50.92	33.81	39.17
22.0	2.56	41.34	67.77	109.10	63.93	39.12	42.62
23.0	2.68	51.66	68.30	119.96	74.43	43.43	44.82
24.0	2.79	62.07	68.82	130.89	85.01	47.77	46.87
25.0	2.91	72.57	69.32	141.89	95.68	52.14	48.77
26.0	3.03	83.15	69.81	152.97	106.42	56.53	50.56
27.0	3.14	93.82	70.29	164.11	117.25	60.96	52.23
28.0	3.26	104.56	70.76	175.32	128.15	65.41	53.81
29.0	3.37	115.39	71.21	186.60	139.12	69.89	55.29
30.0	3.49	126.29	71.65	197.94	150.17	74.40	56.70
31.0	3.61	137.27	72.08	209.35	161.30	78.94	58.03
✓32.0	3.72	148.33	72.50	220.83	172.49	83.50	59.30
33.0	3.84	159.46	72.84	232.30	183.74	88.06	60.49
34.0	3.96	170.66	73.09	243.76	195.03	92.63	61.61
35.0	4.07	181.94	73.30	255.24	206.37	97.21	62.67
36.0	4.19	193.28	73.51	266.79	217.78	101.82	63.68
37.0	4.31	204.66	73.71	278.38	229.23	106.44	64.65
38.0	4.42	216.08	73.91	290.00	240.72	111.07	65.58
39.0	4.54	227.54	74.11	301.65	252.24	115.72	66.47
40.0	4.65	239.03	74.31	313.34	263.80	120.38	67.31
41.0	4.77	250.55	74.50	325.06	275.39	125.06	68.13
42.0	4.89	262.11	74.70	336.81	287.01	129.74	68.91
43.0	5.00	273.71	74.89	348.60	298.67	134.45	69.66
44.0	5.12	285.34	75.07	360.42	310.37	139.16	70.39
45.0	5.24	297.01	75.26	372.27	322.09	143.89	71.09
46.0	5.35	308.71	75.45	384.15	333.86	148.63	71.76
47.0	5.47	320.44	75.63	396.07	345.65	153.39	72.42
48.0	5.59	332.21	75.81	408.02	357.48	158.15	73.05
49.0	5.70	344.01	75.99	420.00	369.34	162.94	73.66
50.0	5.82	355.85	76.17	432.02	381.24	167.73	74.25
51.0	5.93	367.72	76.35	444.06	393.17	172.54	74.82
52.0	6.05	379.62	76.52	456.14	405.13	177.35	75.38
53.0	6.17	391.55	76.69	468.25	417.12	182.19	75.92
54.0	6.28	403.52	76.87	480.39	429.14	187.03	76.45
55.0	6.40	415.52	77.04	492.56	441.20	191.89	76.96
56.0	6.52	427.56	77.20	504.76	453.29	196.76	77.46
57.0	6.63	439.62	77.37	516.99	465.41	201.64	77.94

LOAD SETTLEMENT RELATIONSHIP

LOAD (TON)	SETTLEMENT (IN.)
0.449E+02	0.266E-01
0.898E+02	0.532E-01
0.135E+03	0.798E-01
0.180E+03	0.106E+00

0.224E+03	0.133E+00
0.269E+03	0.160E+00
0.314E+03	0.186E+00
0.359E+03	0.213E+00
0.404E+03	0.239E+00
0.449E+03	0.266E+00
0.466E+03	0.537E+00
0.483E+03	0.808E+00
0.501E+03	0.108E+01
0.518E+03	0.135E+01
0.518E+03	0.162E+01

PARIKH

Practicing in the Geosciences

JOB 208140 Redwood Landfill OC (Bent 2)
SHEET NO _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

2'ϕ CIDH F.G. 54.0' Cutoff elev 44.0'

0 ——— 5'

Soft Clay S_u = 750 psf γ = 120 pcf

6 ———

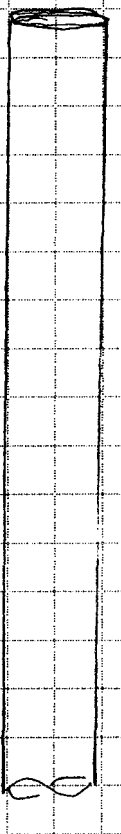
clay S_u = 1500 psf γ = 125 pcf

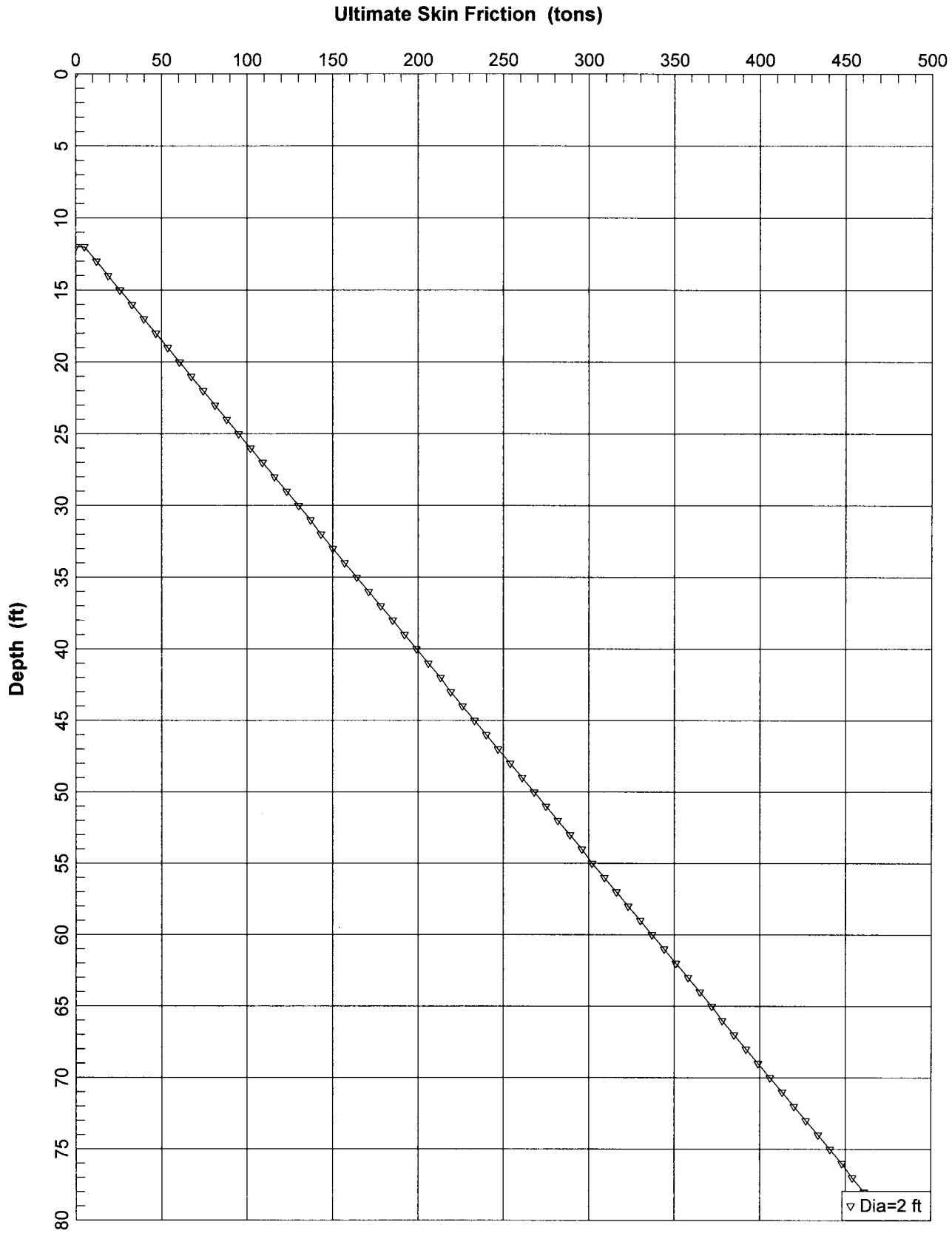
12 ———

Shale S_u = 4000 psf γ = 125 pcf

19 ▽ ———

Shale S_u = 4000 psf γ = 67.6 pcf





REDWOOD LANDFILL OVERCROSSING (WIDEN) - BENT 2

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

REDWOOD LANDFILL OVERCROSSING (WIDEN) - BENT 2

TOTAL LOAD = 200.0 TONS

NUMBER OF LAYERS = 4

WATER TABLE DEPTH = 19.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00

SOIL INFORMATION

LAYER NO 1----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.600E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.750E+03
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.750E+03
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.600E+01

LAYER NO 2----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00

BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.600E+01

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.120E+02

LAYER NO 3----CLAY SHALE

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.700E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.400E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.120E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.700E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.400E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.190E+02

LAYER NO 4----CLAY SHALE

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.700E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.400E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.190E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.700E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.400E+04

INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	2.000	FT.
DIAMETER OF BASE	=	2.000	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	10.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	4.524	SQ.IN.
ELASTIC MODULUS, Ec	=	0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
11.0	1.28	2.59	43.99	46.58	17.25	15.70	36.39
12.0	1.40	5.18	43.99	49.17	19.85	16.74	35.21
13.0	1.51	12.10	43.99	56.08	26.76	19.50	37.07
14.0	1.63	19.01	43.99	63.00	33.67	22.27	38.67
15.0	1.75	25.92	43.99	69.91	40.58	25.03	40.05
16.0	1.86	32.83	43.99	76.82	47.50	27.80	41.26
17.0	1.98	39.75	43.99	83.73	54.41	30.56	42.33
18.0	2.09	46.66	43.99	90.65	61.32	33.33	43.27
19.0	2.21	53.57	43.99	97.56	68.23	36.09	44.12
20.0	2.33	60.48	43.99	104.47	75.15	38.86	44.89
21.0	2.44	67.40	43.99	111.38	82.06	41.62	45.58
22.0	2.56	74.31	43.99	118.30	88.97	44.39	46.21
23.0	2.68	81.22	43.99	125.21	95.88	47.15	46.78
24.0	2.79	88.13	43.99	132.12	102.80	49.92	47.31
25.0	2.91	95.05	43.99	139.03	109.71	52.68	47.79
26.0	3.03	101.96	43.99	145.95	116.62	55.45	48.24
27.0	3.14	108.87	43.99	152.86	123.53	58.21	48.65
28.0	3.26	115.78	43.99	159.77	130.45	60.98	49.03
29.0	3.37	122.70	43.99	166.68	137.36	63.74	49.39
30.0	3.49	129.61	43.99	173.60	144.27	66.51	49.72
31.0	3.61	136.52	43.99	180.51	151.18	69.27	50.04
32.0	3.72	143.43	43.99	187.42	158.09	72.04	50.33
33.0	3.84	150.34	43.99	194.33	165.01	74.80	50.60

34.0	3.96	157.26	43.99	201.25	171.92	77.57	50.86
35.0	4.07	164.17	43.99	208.16	178.83	80.33	51.11
36.0	4.19	171.08	43.99	215.07	185.74	83.10	51.34
37.0	4.31	177.99	43.99	221.98	192.66	85.86	51.56
38.0	4.42	184.91	43.99	228.89	199.57	88.63	51.76
39.0	4.54	191.82	43.99	235.81	206.48	91.39	51.96
40.0	4.65	198.73	43.99	242.72	213.39	94.16	52.14
41.0	4.77	205.64	43.99	249.63	220.31	96.92	52.32
42.0	4.89	212.56	43.99	256.54	227.22	99.69	52.49
43.0	5.00	219.47	43.99	263.46	234.13	102.45	52.65
√44.0	5.12	226.38	43.99	270.37	241.04	105.22	52.80
45.0	5.24	233.29	43.99	277.28	247.96	107.98	52.95
√46.0	5.35	240.21	43.99	284.19	254.87	110.75	53.09
47.0	5.47	247.12	43.99	291.11	261.78	113.51	53.22
48.0	5.59	254.03	43.99	298.02	268.69	116.27	53.35
49.0	5.70	260.94	43.99	304.93	275.61	119.04	53.48
50.0	5.82	267.86	43.99	311.84	282.52	121.80	53.60
51.0	5.93	274.77	43.99	318.76	289.43	124.57	53.71
52.0	6.05	281.68	43.99	325.67	296.34	127.33	53.82
53.0	6.17	288.59	43.99	332.58	303.26	130.10	53.92
54.0	6.28	295.51	43.99	339.49	310.17	132.86	54.03
55.0	6.40	302.42	43.99	346.41	317.08	135.63	54.12
56.0	6.52	309.33	43.99	353.32	323.99	138.39	54.22
57.0	6.63	316.24	43.99	360.23	330.91	141.16	54.31
58.0	6.75	323.15	43.99	367.14	337.82	143.92	54.40
59.0	6.87	330.07	43.99	374.06	344.73	146.69	54.48
60.0	6.98	336.98	43.99	380.97	351.64	149.45	54.56
61.0	7.10	343.89	43.99	387.88	358.55	152.22	54.64
62.0	7.21	350.80	43.99	394.79	365.47	154.98	54.72
63.0	7.33	357.72	43.99	401.70	372.38	157.75	54.79
64.0	7.45	364.63	43.99	408.62	379.29	160.51	54.86
65.0	7.56	371.54	43.99	415.53	386.20	163.28	54.93
66.0	7.68	378.45	43.99	422.44	393.12	166.04	55.00
67.0	7.80	385.37	43.99	429.35	400.03	168.81	55.07
68.0	7.91	392.28	43.99	436.27	406.94	171.57	55.13
69.0	8.03	399.19	43.99	443.18	413.85	174.34	55.19
70.0	8.15	406.10	43.99	450.09	420.77	177.10	55.25
71.0	8.26	413.02	43.99	457.00	427.68	179.87	55.31
72.0	8.38	419.93	43.99	463.92	434.59	182.63	55.37
73.0	8.50	426.84	43.99	470.83	441.50	185.40	55.42
74.0	8.61	433.75	43.99	477.74	448.42	188.16	55.48
75.0	8.73	440.67	43.99	484.65	455.33	190.93	55.53
76.0	8.84	447.58	43.99	491.57	462.24	193.69	55.58
77.0	8.96	454.49	43.99	498.48	469.15	196.46	55.63
78.0	9.08	461.40	43.99	505.39	476.07	199.22	55.68
79.0	9.19	468.32	43.99	512.30	482.98	201.99	55.73

RESULT FROM TREND (AVERAGED) LINE

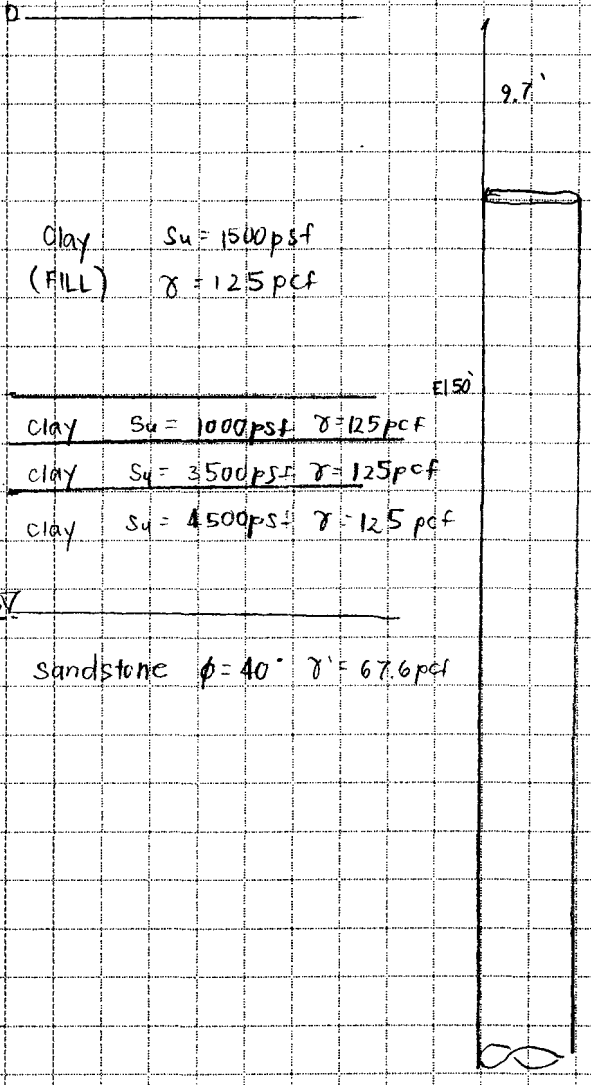
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3991E+01	0.1825E-02	0.1448E-01	0.1000E-03
0.4078E+02	0.1849E-01	0.1448E+00	0.1000E-02
0.9997E+02	0.4631E-01	0.3620E+00	0.2500E-02
0.1719E+03	0.8616E-01	0.7240E+00	0.5000E-02
0.2239E+03	0.1192E+00	0.1086E+01	0.7500E-02
0.2620E+03	0.1468E+00	0.1448E+01	0.1000E-01
0.3719E+03	0.2477E+00	0.3620E+01	0.2500E-01
0.4304E+03	0.3259E+00	0.7240E+01	0.5000E-01
0.4536E+03	0.3752E+00	0.1086E+02	0.7500E-01
0.4598E+03	0.4074E+00	0.1448E+02	0.1000E+00

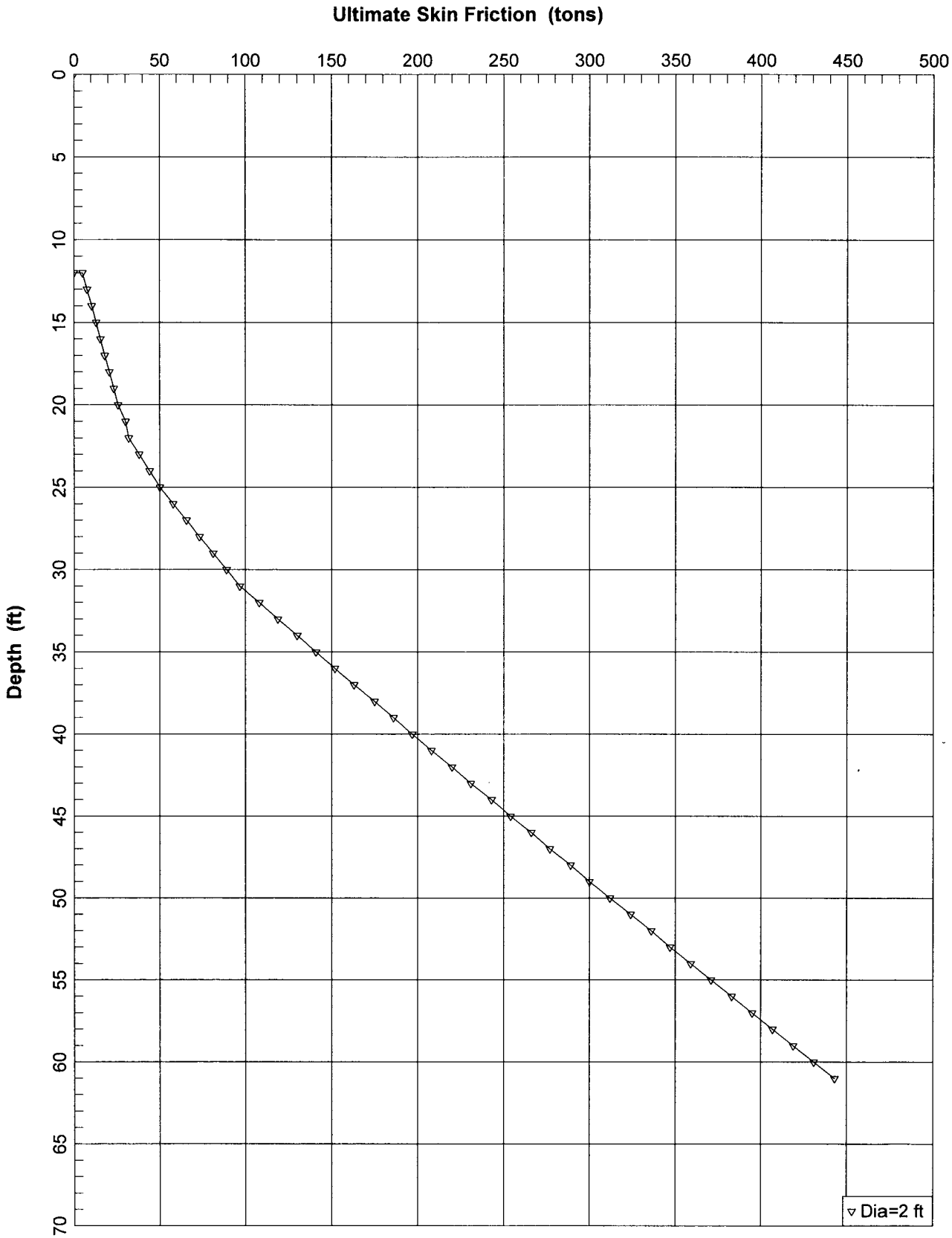
0.4578E+03	0.5660E+00	0.2515E+02	0.2500E+00
0.4337E+03	0.8013E+00	0.3503E+02	0.5000E+00
0.4385E+03	0.1057E+01	0.3986E+02	0.7500E+00
0.4406E+03	0.1309E+01	0.4194E+02	0.1000E+01
0.4422E+03	0.2711E+01	0.4359E+02	0.2400E+01

ROCK WITH COMPRESSIVE STRENGTH LESS THAN 1000 PSI (6894 kPA)

IF THE SETTLEMENT IS LESS THAN 0.4 IN. (10 mm), THE LOAD IS CARRIED ENTIRELY IN SIDE RESISTANCE. IF THE SETTLEMENT IS GREATER THAN 0.4 IN. (10 MM), THE LOAD IS CARRIED ENTIRELY IN END BEARING.

2' ϕ CIDH F.G. 69.7' Cut off elev = 60.0 X = -2.5





REDWOOD LANDFILL OVERCROSSING (WIDEN) - ABUTMENT 3

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

REDWOOD LANDFILL OVERCROSSING (WIDEN) - ABUTMENT 3

TOTAL LOAD = 200.0 TONS

NUMBER OF LAYERS = 5

WATER TABLE DEPTH = 31.2 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00

SOIL INFORMATION

LAYER NO 1----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.600E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.197E+02

LAYER NO 2----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.100E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00

BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.197E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.100E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.222E+02

LAYER NO 3----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.350E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.222E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.350E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.247E+02

LAYER NO 4----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.450E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.247E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.450E+04

INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.312E+02

LAYER NO 5----GRAVEL

AT THE TOP

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.000E+00
POISSION RATIO OF GRAVEL	= 0.300E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.750E+02
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.312E+02

AT THE BOTTOM

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.000E+00
POISSION RATIO OF GRAVEL	= 0.300E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.750E+02
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	= 2.000	FT.
DIAMETER OF BASE	= 2.000	FT.
END OF STEM TO BASE	= 0.000	FT.
ANGLE OF BELL	= 0.000	DEG.
IGNORED TOP PORTION	= 9.700	FT.
IGNORED BOTTOM PORTION	= 0.000	FT.
AREA OF ONE PERCENT STEEL	= 4.524	SQ.IN.
ELASTIC MODULUS, Ec	= 0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	= 0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
11.0	1.28	2.59	19.03	21.62	8.94	7.38	16.89

12.0	1.40	5.18	19.39	24.57	11.65	8.54	17.59
13.0	1.51	7.78	19.74	27.52	14.36	9.69	18.19
14.0	1.63	10.37	20.09	30.46	17.07	10.84	18.70
15.0	1.75	12.96	20.45	33.41	19.78	12.00	19.14
16.0	1.86	15.55	20.80	36.35	22.49	13.15	19.52
17.0	1.98	18.15	18.54	36.68	24.32	13.44	18.54
18.0	2.09	20.74	15.63	36.37	25.95	13.51	17.36
19.0	2.21	23.33	26.76	50.09	32.25	18.25	22.66
20.0	2.33	25.92	41.91	67.83	39.89	24.34	29.15
21.0	2.44	30.24	49.49	79.73	46.74	28.59	32.63
22.0	2.56	31.97	54.54	86.51	50.15	30.97	33.79
23.0	2.68	38.02	60.60	98.61	58.22	35.41	36.84
24.0	2.79	44.07	63.63	107.69	65.28	38.84	38.56
25.0	2.91	50.11	63.63	113.74	71.32	41.25	39.10
26.0	3.03	57.89	63.63	121.52	79.10	44.37	40.16
27.0	3.14	65.67	63.63	129.29	86.88	47.48	41.15
28.0	3.26	73.44	66.19	139.63	95.51	51.44	42.85
29.0	3.37	81.22	69.35	150.57	104.34	55.60	44.62
30.0	3.49	89.00	71.07	160.07	112.69	59.29	45.85
31.0	3.61	96.77	71.30	168.07	120.54	62.48	46.59
32.0	3.72	107.77	71.53	179.30	131.61	66.95	48.15
33.0	3.84	118.81	71.76	190.57	142.73	71.44	49.62
34.0	3.96	129.89	71.98	201.87	153.88	75.95	51.02
✓35.0	4.07	141.00	72.20	213.20	165.07	80.47	52.35
36.0	4.19	152.15	72.42	224.57	176.29	85.00	53.61
37.0	4.31	163.34	72.64	235.98	187.56	89.55	54.81
38.0	4.42	174.57	72.85	247.42	198.85	94.11	55.95
39.0	4.54	185.84	73.06	258.90	210.19	98.69	57.05
40.0	4.65	197.14	73.27	270.41	221.56	103.28	58.09
41.0	4.77	208.48	73.47	281.95	232.97	107.88	59.10
42.0	4.89	219.86	73.68	293.53	244.42	112.50	60.06
43.0	5.00	231.27	73.88	305.15	255.90	117.13	60.98
44.0	5.12	242.72	74.08	316.80	267.41	121.78	61.87
45.0	5.24	254.20	74.27	328.48	278.96	126.44	62.73
46.0	5.35	265.72	74.47	340.19	290.55	131.11	63.55
47.0	5.47	277.28	74.66	351.94	302.16	135.80	64.35
48.0	5.59	288.87	74.85	363.72	313.82	140.50	65.12
49.0	5.70	300.49	75.04	375.54	325.51	145.21	65.86
50.0	5.82	312.15	75.23	387.38	337.23	149.94	66.58
51.0	5.93	323.85	75.42	399.26	348.98	154.68	67.27
52.0	6.05	335.57	75.60	411.17	360.77	159.43	67.95
53.0	6.17	347.34	75.78	423.12	372.60	164.20	68.60
54.0	6.28	359.13	75.96	435.09	384.45	168.97	69.24
55.0	6.40	370.96	76.14	447.10	396.34	173.76	69.86
56.0	6.52	382.83	76.32	459.14	408.27	178.57	70.46
57.0	6.63	394.72	76.49	471.21	420.22	183.39	71.04
58.0	6.75	406.65	76.66	483.32	432.21	188.22	71.61
59.0	6.87	418.62	76.84	495.45	444.23	193.06	72.16
60.0	6.98	430.61	77.01	507.62	456.28	197.91	72.70
61.0	7.10	442.64	77.18	519.81	468.36	202.78	73.23

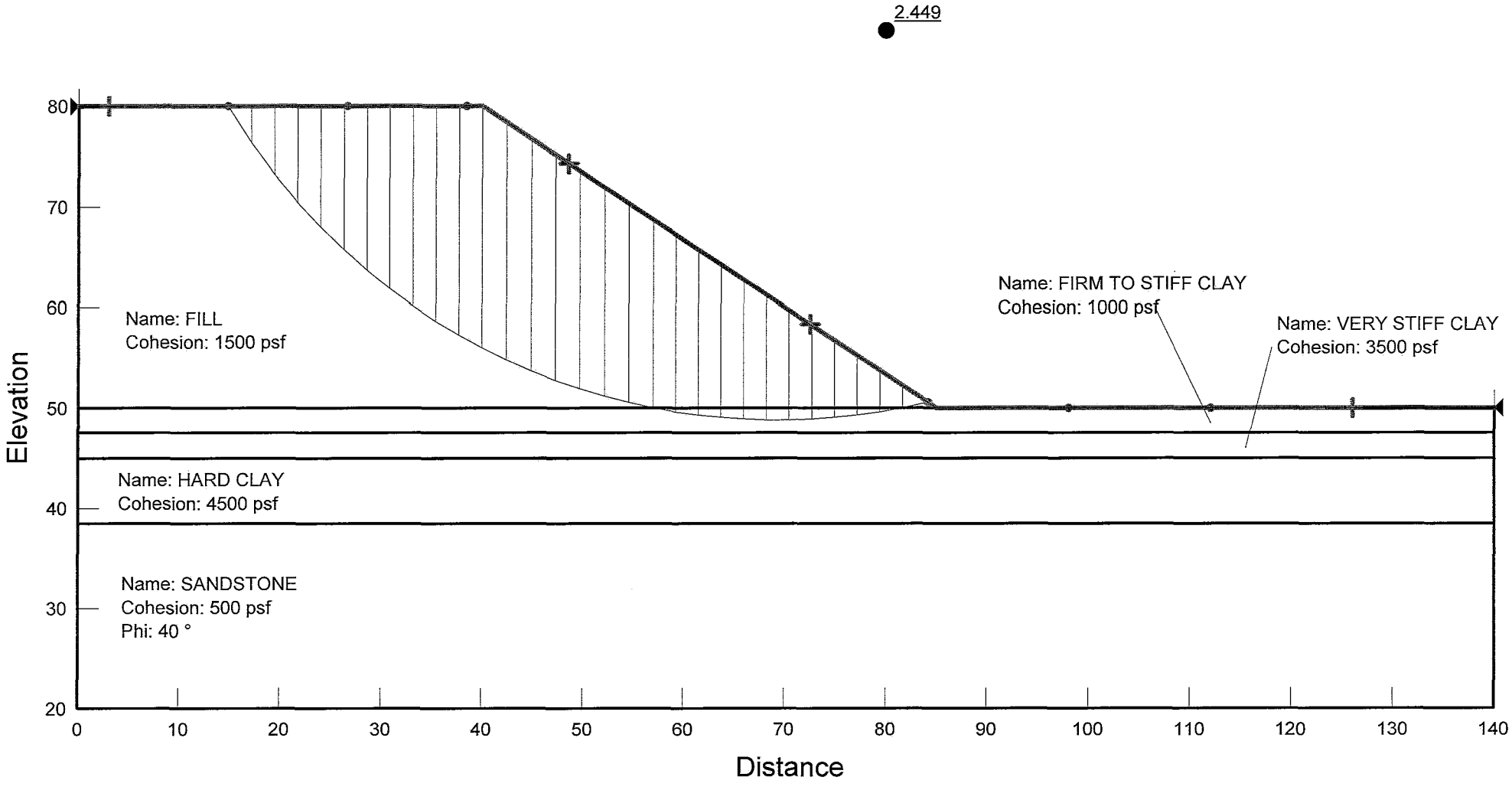
LOAD SETTLEMENT RELATIONSHIP

LOAD (TON)	SETTLEMENT (IN.)
0.453E+02	0.274E-01
0.906E+02	0.548E-01
0.136E+03	0.822E-01
0.181E+03	0.110E+00
0.227E+03	0.137E+00
0.272E+03	0.164E+00
0.317E+03	0.192E+00

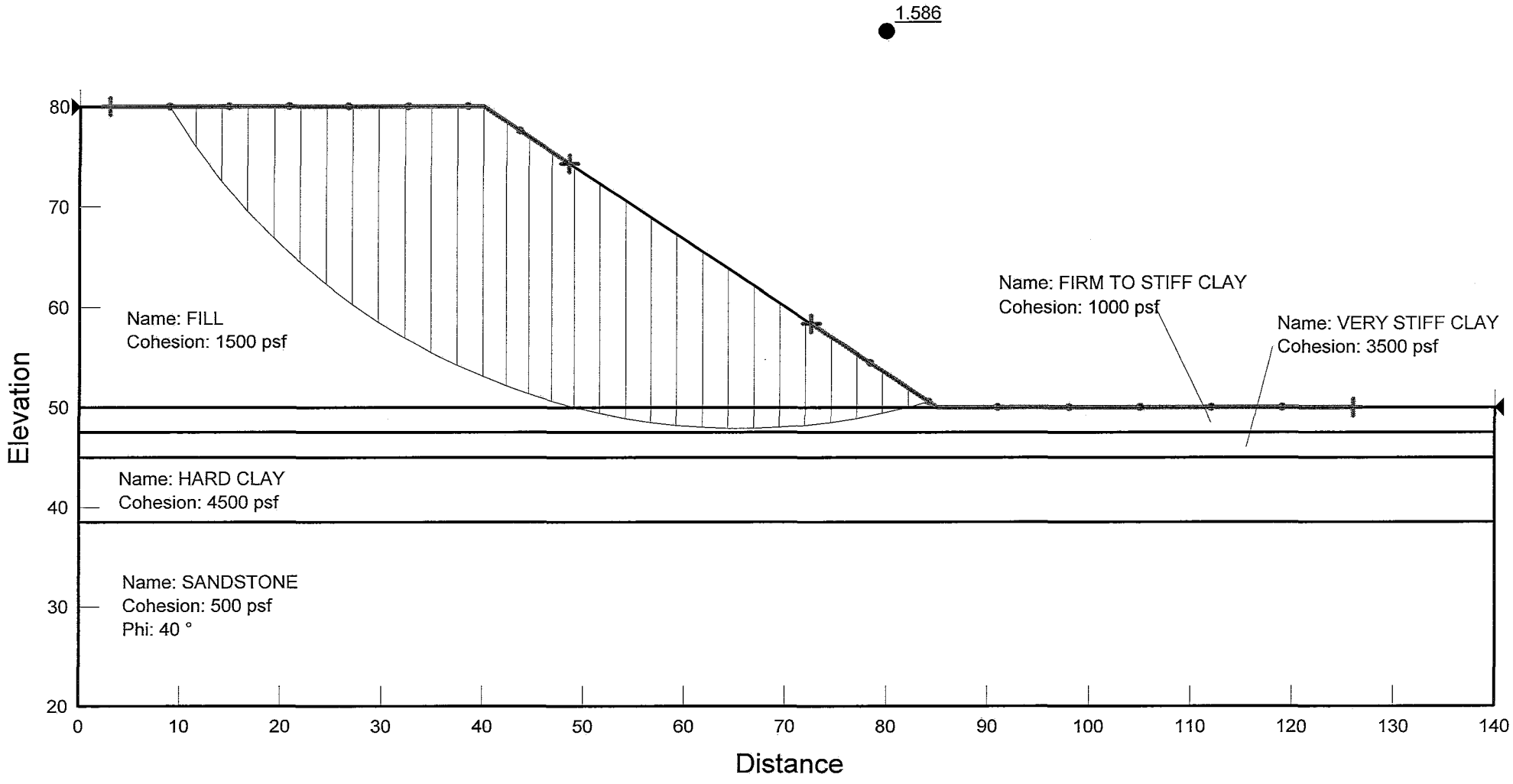
	Abutment 3.sfo
0.363E+03	0.219E+00
0.408E+03	0.247E+00
0.453E+03	0.274E+00
0.470E+03	0.536E+00
0.487E+03	0.798E+00
0.503E+03	0.106E+01
0.520E+03	0.132E+01
0.520E+03	0.159E+01

SLOPE STABILITY

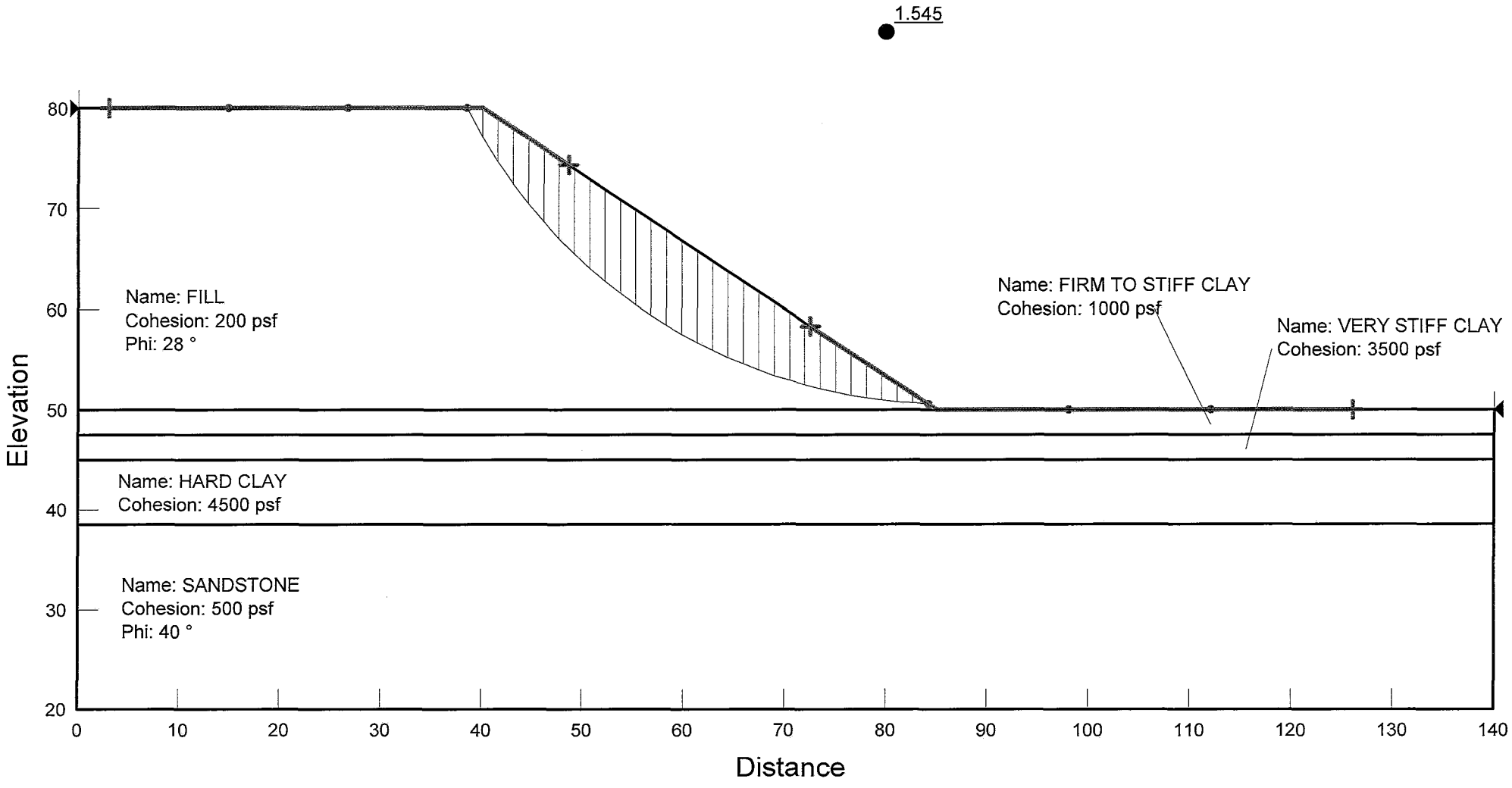
REDWOOD LANDFILL OVERCROSSING - ROUTE 101 (WIDEN)
MARIN COUNTY, CALIFORNIA
(BRIDGE NO. 27-0115)



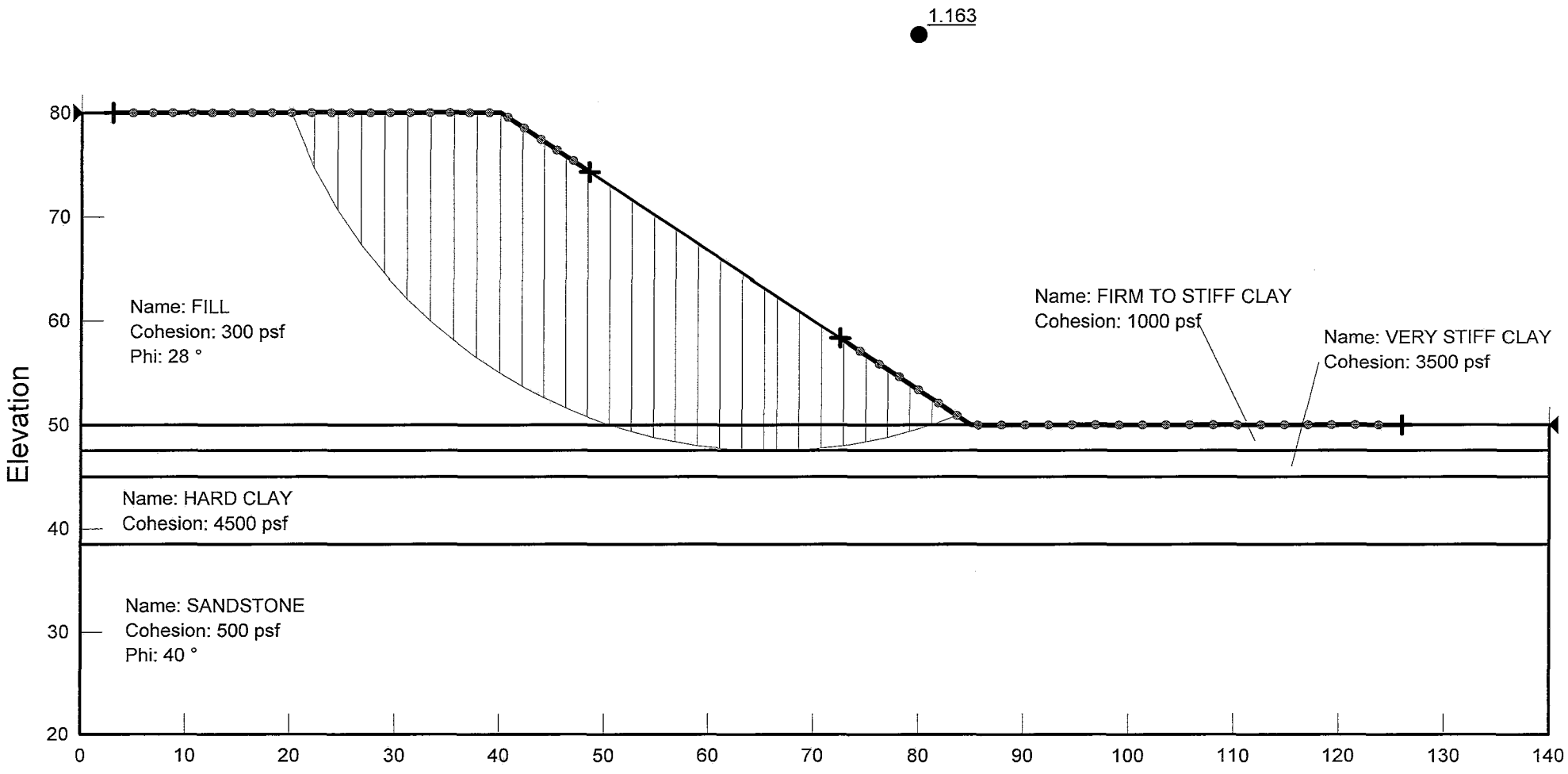
REDWOOD LANDFILL OVERCROSSING - ROUTE 101 (WIDEN)
MARIN COUNTY, CALIFORNIA
(BRIDGE NO. 27-0115)
SEISMIC CONDITION - 0.2g



REDWOOD LANDFILL OVERCROSSING - ROUTE 101 (WIDEN)
MARIN COUNTY, CALIFORNIA
(BRIDGE NO. 27-0115)



REDWOOD LANDFILL OVERCROSSING - ROUTE 101 (WIDEN)
MARIN COUNTY, CALIFORNIA
(BRIDGE NO. 27-0115)
SEISMIC CONDITION - 0.2g



SETTLEMENT OF APPROACH FILLS

PROCEDURE FOR SETTLEMENT CALCULATIONS FOR APPROACH FILL

Elastic settlement for the new fill placed for widening were calculated as follows:

- Compression settlements of the underlying native clay layers and the existing fill were computed using elastic compression theory
  - Compressible (clay) layer thicknesses for Boring D were used.
  - Computations were performed for 3 existing fill thicknesses: 0ft; 10ft and 20 ft
  - Elastic modulus for each sublayer was computed as follows:
    - Shear strength of the sublayer was assigned, based on the blow count. Shear strength foe existing fill was taken as 1500 psf.
    - Elastic Modulus was based on the E/Su curves presented in Duncan and Buchignani (1976), based on OCR and Plasticity Index of the clays. . An average value of E/Su = 350 was deemed appropriate.
  - Settlements were based on a strip loaded area under the fill, based on the height of the fill and the width of the top of fill.
  - Stresses were computed at the center of each strip, based on the a 2V:1H dispersion of the fill load
  - Elastic settlements for each sublayer was computed based on the formula:

  - Settlement $= \frac{\text{(Stress at Center of Sublayer)x(thickness of Sublayer)}}{\text{Elastic Modulus}}$

The results are summarized below:

- For 20ft of existing fill – Elastic Settlement = 0.42 inches
- For 10ft of existing fill – Elastic Settlement = 0.29 inches
- For 0ft of existing fill – Elastic Settlement = 0.13 inches

OC Embankment **Height of Fill =** **7** **Contact Width (B) =** **45** **20 Feet of Existing Fill**

Boring No. **Boring D** **Contact Pressure =** **875**

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	10			1.5	525000	50	788	0.180			#DIV/0!	350
10	20			1.5	525000	60	656	0.150	1.875	6	3.2	350
20	22.5	12	8	1.0	350000	66.25	594	0.051	2.65625	4	1.505882	350
22.5	25	44	29	3.5	1225000	68.75	573	0.014	2.96875	14	4.715789	350
25	28	76	49	5.0	1750000	71.5	551	0.011	3.3125	20	6.037736	350
28	31.5	108	70	5.0	1750000	74.75	527	0.013	3.71875	20	5.378151	350
								0.419				

0

OC Embankment **Height of Fill =** **7** **Contact Width (B) =** **45** **10 Feet of Existing Fill**

Boring No. **Boring D** **Contact Pressure =** **875**

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	10			1.5	525000	50	788	0.180	0.625	6	9.6	350
10	12.5	12	8	1.0	350000	56.25	700	0.060	1.40625	4	2.844444	350
12.5	15	44	29	3.5	1225000	58.75	670	0.016	1.71875	14	8.145455	350
15	18	76	49	5.0	1750000	61.5	640	0.013	2.0625	20	9.69697	350
18	21.5	108	70	5.0	1750000	64.75	608	0.015	2.46875	20	8.101266	350
								0.284				

OC Embankment **Height of Fill =** **7** **Contact Width (B) =** **45** **0 Feet of Existing Fill**

Boring No. **Boring D** **Contact Pressure =** **875**

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	2.5	12	8	1.0	350000	46.25	851	0.073	0.15625	4	25.6	350
2.5	5	44	29	3.5	1225000	48.75	808	0.020	0.46875	14	29.86667	350
5	8	76	49	5.0	1750000	51.5	765	0.016	0.8125	20	24.61538	350
8	11.5	108	70	5.0	1750000	54.75	719	0.017	1.21875	20	16.41026	350
								0.126				

LL = 38, PI = 20 **E = 350 Su**

APPENDIX D

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264701 Project Name: Redwood Landfill I/C OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for OC-6th review **Structure Information** (Use when necessary to document comments by individual structure) Structure Name:_____ Br No: 27-0115	Reviewer Name: Betty Lee/Mahmood Momenzadeh Functional Unit: GS Phone Number: 510-286-4825 e-mail: betty_lee@dot.ca.gov Date of Review: 11/16/2011

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
____	Parikh Inc.	____	____	____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
			Final Foundation Report for OC (Oct 2011)		
9	FR	Pg. 14-15	In the absence of sufficient data, the settlement period of 30 days cannot be ascertained.	We have provided calculations in the report (Appendix C) based on our interpretation of the subsoil conditions. There is a detailed discussion on this topic on pages 14 and 15 of the report and also calculations in the report. Any small amount of incremental settlement is expected to be immediate (elastic). The bridge and the embankment has already been in-place for several years and the proposed 7 feet of fill is only a sliver fill. Most of the soil underneath has already experienced loads from the embankment which is 20' plus high. From a practical standpoint and as a precaution a 30-day settlement period is discussed prior to starting final pavement and pile construction.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			A 30-day settlement period is NOT "Standard Caltrans State of Practice". In the absence of sufficient data, the consultant's assertion that "groundwater is unlikely to rise above the rock into the overlying soils" is also not justified.	Reference to 'Caltrans standard practice' (on page 15 fourth paragraph) will be deleted. Groundwater was encountered in the rock in Boring D (drilled by Miller Pacific on March 2002) within the sandstone approximately 8 feet below the top of the rock. Groundwater was NOT encountered in any other borings (in the vicinity) including the recent borings drilled by PARIKH for the bridge, the walls and the GDMR. In our professional opinion and judgment, the groundwater in Boring D was a perched condition within the rock and has no relevance. As a point of clarification, as discussed with Caltrans Geotechnical (Mahmood Momenzadeh) and Parikh on December 2nd, the 30-day waiting period suggested is ONLY for the bridge approach which is part of this response to comments. The remaining project (roadways portion) and the various fills that are identified have their own settlement monitoring program identified in the GDMR, plans and specs which should be adhered to.	
14	FR		Our comments for differential settlement are the same as for Item 9.	We have provided calculations and discussions in the report (pages 14-15) based on our interpretation of the subsurface conditions. Differential settlement is discussed accordingly. The bridge and the embankment has already been in-place for several years and the proposed 7 feet of fill is only a sliver fill. Most of the soil underneath has already experienced loads from the embankment.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264701 Project Name: Redwood Landfill I/C OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for OC-5th review **Structure Information** (Use when necessary to document comments by individual structure) Structure Name:_____ Br No: 27-0115	Reviewer Name: Betty Lee/Mahmood Momenzadeh Functional Unit: GS Phone Number: 510-286-4825 e-mail: betty_lee@dot.ca.gov Date of Review: 9/27/2011

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	Parikh Inc.	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
9	FR	Pg. 14-15	Our comments regarding the issue of total and differential settlements are the same as for the GDR. Our consensus was that Consultant would define the foundation soil settlement characteristics and use a suitable method to determine the total and differential settlements along the proposed approach widening and bridge support areas and present these in the foundation report.	-In our judgement, calculations for immediate (elastic) settlements would be appropriate for the present location. Based on the calculations, the total settlement ranges from 0.42 inches to 0.13 inches; so, the possible maximum differential settlement is 0.29 inches. The actual differential settlement should be significantly less since the settlement should occur rapidly and all settlement should be complete by the end of the 30-day period. -The lowest elevation of the top of rock in this location is at Elev. 39 ft (12 m) on Boring D (Miller Pacific). This is significantly higher than the groundwater encountered during drilling.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			The inference that "groundwater is unlikely to rise above the rock into the overlying soils" is not justified. The 30-day settlement period is also not justified.	-A 30-day settlement period is the standard Caltrans State of Practice	
10	FR		Excavation limits of the organic soils that are proposed to be removed need to be shown on the Plans.	Organic soils were encountered in the as-built log of test borings prior to the construction of the bridge. In our judgment, the organic soils were removed when the bridge was built since organic soils were not encountered in the boring log drilled by Parikh Consultants, Inc.	
14	FR		Our comments for differential settlement are the same as for Item 9.	See response #9.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264071 Project Name: REDOOD LANDFILL OC/101 (WIDEN) OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail: tracy bertram@dot.ca.gov	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. 1) ☐ Construction Support ☒ Other: FINAL FR **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Redwood Landfill OC (Widen) Br No: 27-0115	Reviewer Name: Rifaat Nashed Functional Unit: GS Phone Number: 510-622-1773 e-mail: rifaat_nashed@dot.ca.gov Date of Review: 09/29/11

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Response
1	FR FINAL	Report Reviewed Title	Final Foundation Report Redwood Landfill Overcossing / Route 101 (Widen)- (Bridge No. 27-0115) Marin County, California 04-Mrn-101 EA 264071 Dated August 29, 2011	N/A	N/A
2	FR FINAL	**SUBSURFACE CONDITIONS** Page 5	1- The soil thickness range should be defined in lieu of " varying thickness" 2- The depth range to the bedrock (Sandstone/ shale) should be defined.	Will address depth and elevation of soil and bedrock in the report Pocket penetrometer or torvane were not performed on this sample. Thus, the consistency (very stiff) is based on the blow count (MC=39, SPT=26)	1-Based on As-Built borings (Miller Pacific, 2002), sandy lean clay is soft to stiff, but the new boring A-09-001 indicates Very stiff clay without showing any Pocket Pentrometer, Torvane, or Van shear measurements- Please Justify. 2-Our comment dated 7/19/11 has been adequately addressed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

3	FR FINAL	**APPENDIX A** Page 3	For the LOTB, the bench mark for the borehole location as required by the Soil /Rock classification Manual is missing	Will include in the LOTB	Our comment dated 7/19/11 has been adequately addressed.
5					
6					
9					
10					

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: e EA: 264701 Project Name: Redwood Landfill I/C OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for OC-4nd review **Structure Information** (Use when necessary to document comments by individual structure) Structure Name:_____ Br No: 27-0115	Reviewer Name: Betty Lee/Mahmood Momenzadeh Functional Unit: GS Phone Number: 510-286-4825 e-mail: betty_lee@dot.ca.gov Date of Review: 7/1/2011

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm Parikh Inc.	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
			In the future, please state the **page number** where the revision is made.	*Response locations (page numbers) will be identified as requested once the revised FR Reports are finalized (following the PS&E submittal).*	
1	FR	LOTB,	Labeling of boreholes A,C,D still unclear. Where is Boring C?	The as-built Log of Test Boring is from the report by Miller Pacific, obtained from Caltrans files The plan portion of the LOTB shows the boring locations, including Boring C, but it is difficult to see with the dark contours. For convenience, we have plotted the locations of the relevant as-built borings, Borings A, C, and D on the plan portion of Log of Test Boring 4 of 5 for. (See Appendix A). The LOTB sheet 4 of 5 will be revised to make the boring locations clearer.	
3	FR	7	Groundwater is not static. How will silt content effect liquefaction?	Based on the as-built LOTB, groundwater was measured from the monitoring well 20 days after drilling at approximately 18.7 feet below grade (Elev. 31.5 feet). For design purpose, we have assumed groundwater 15 feet below grade to account for seasonal fluctuation. Material with silt is above	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

				groundwater and should not affect liquefaction. The material below the groundwater depth consists of sandstone material, which encountered refusal and blow counts greater than 100, the potential for liquefaction is low. See Page 5 for groundwater discussion and Page 7 for further discussion).	
9	FR		Settlement comments not adequately answered.	-As-built borings shows soft material but the blow counts do not support the consistency. Based on the correlated shear strength by blow count (Kulhany, 1990), the consistency should indicate firm to stiff clay. *The new fill to be placed will be a sliver fill on top of the existing approach fill. The maximum height of the new fill is 7 feet. The existing fill and the native compressive clays are all above water. Thus, per consensus at the 8/5/11 meeting with Caltrans, consolidation settlements are inapplicable and elastic settlements are appropriate for the present situation. Elastic settlements will be computed and the report will be updated as appropriate. The settlements will therefore be rapid as consolidation settlements are not involved.(See Pages 14 and 15)*	
10	FR	14, Appendix C	What about the presence of organic soils? LOTBs show organic soils.	The organic soils were indicated at shallow depth (upper 2 feet) in the as-built logs. It is common to have some organics in the top soils. Generally, the topsoils are stripped during earthwork preparation as a standard earthwork practice.	
11	FR		Seismic slope stability still not addressed.	Seismic stability analyses will be performed. *It will be reported in updated GDMR. Caltrans (Mahmood) advised that the analyses should be performed for 0.5PGA and not 0.2g.* According to CGS Special Publication 117A (2008), the use of 0.5PGA closely resembles the selection of ground motion with a threshold of 5 cm. We have also evaluated Caltrans Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading (February 2011), which cites Bray and Travasarou (2007) for slope displacement evaluation.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

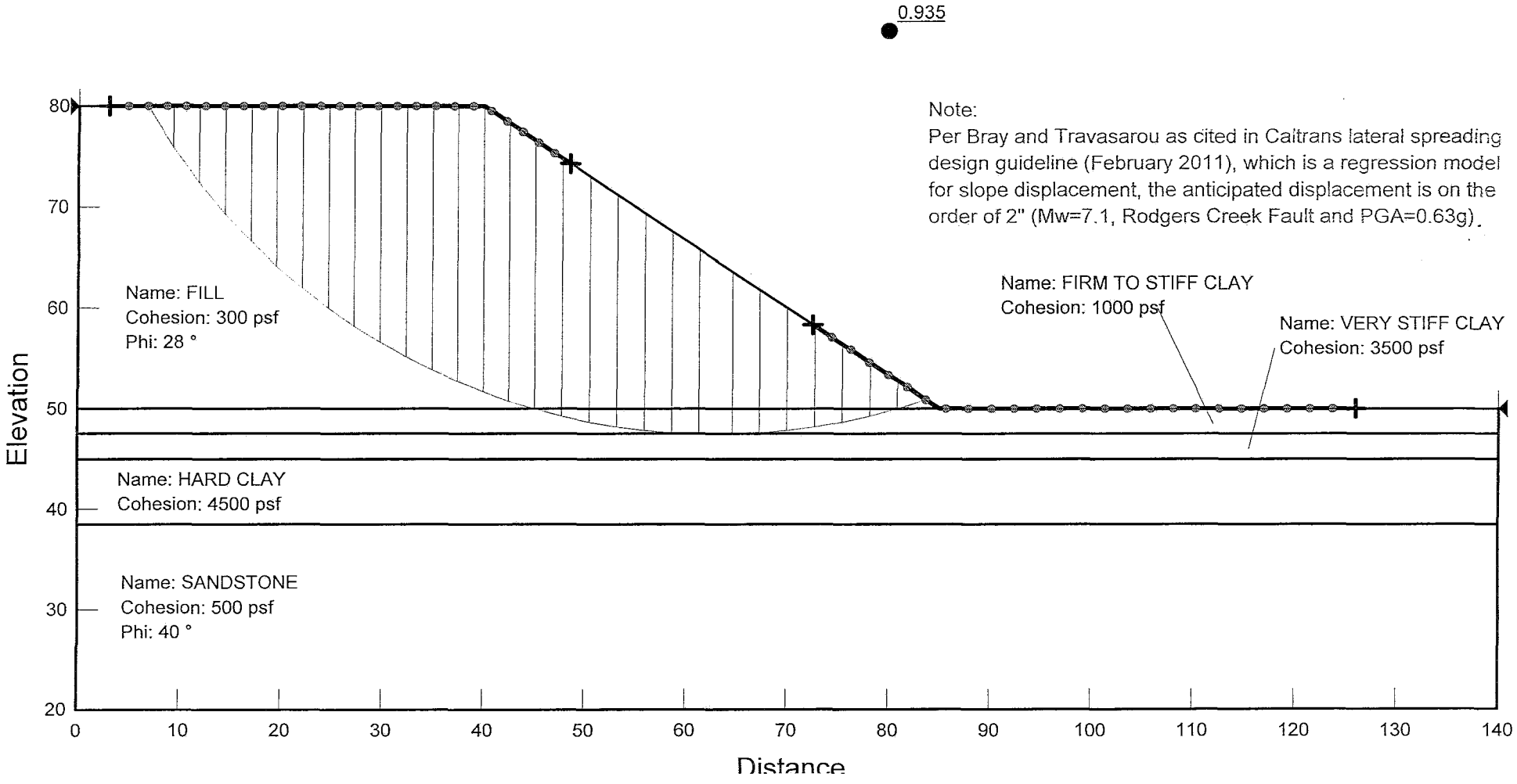
✓= Comment Resolved
(for Reviewer's use)

				We have performed the pseudostatic analysis with 0.5PGA and provided the information in the response. The analyses using 0.5PGA yields a factor of safety of 0.935 (e.g. less than 1.0) for the approach fill slope. Therefore, yield acceleration (ky) and slope displacement were evaluated. Based on Bray and Travasarou (2007), which is a regression model for slope displacement, the anticipated displacement is on the order 2 inches (Mw=7.1, Rogers Creek fault and PGA = 0.63g). The displacement is considered tolerable for the slopes. The analysis results are attached with this response for information. For report preparation, we have performed analyses in accordance with the latest Caltrans Guidelines for Structures Foundation Reports (December 2009) using 1/3 PGA or max. of 0.2g with FS requirement of 1.1. Based on the analyses, the factors of safety were greater than the required value of 1.1. We have reported the analysis results in the report. (see Pages 15 & 16 and attached analyses for 0.5PGA)	
13	FR		Where is this discussed?	Liquefaction potential at the site is relatively low. Therefore, post liquefaction settlement should be minimal and downdrag forces are not considered in the foundation design. (See Page 7).	
14	FR		Please address differential settlement.	-The bridge foundations consist of CIDH piles socketed in rock formation. The new embankment construction will abut the existing embankment and the new embankment is about 7 feet (vertical height). The site soils are generally shallow and stiff materials overlying rock. Differential settlement is relatively insignificant for the design. (See Page 15)	

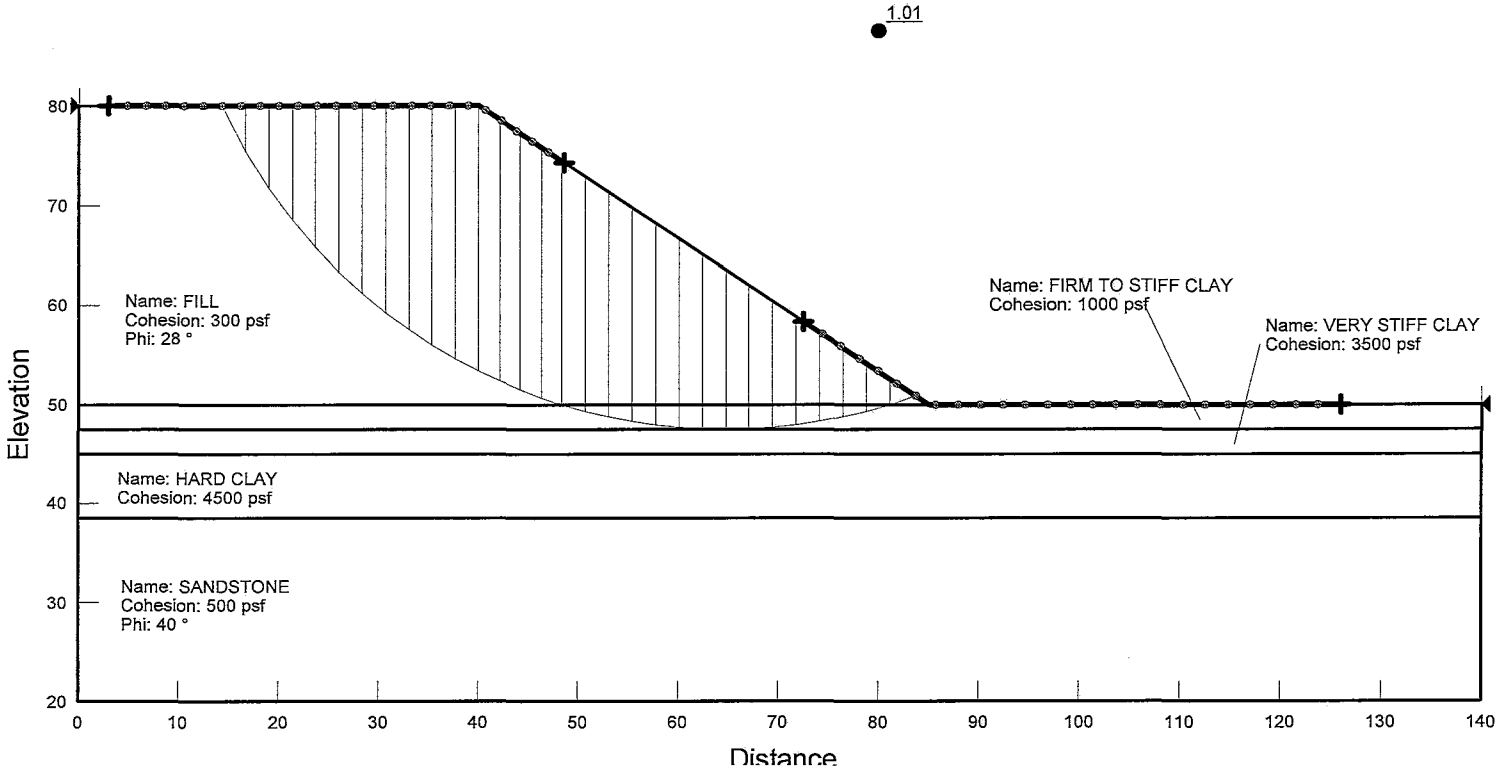
Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

REDWOOD LANDFILL OVERCROSSING - ROUTE 101 (WIDEN)
MARIN COUNTY, CALIFORNIA
(BRIDGE NO. 27-0115)
SEISMIC CONDITION - 0.315g



REDWOOD LANDFILL OVERCROSSING - ROUTE 101 (WIDEN)
MARIN COUNTY, CALIFORNIA
(BRIDGE NO. 27-0115)
SEISMIC CONDITION - ky = 0.275g



OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264701 Project Name: Redwood Landfill I/C OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for OC-3rd review **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Redwood Landfill OC (Widen) Br No: 27-0115	Reviewer Name: Betty Lee Functional Unit: GS Phone Number: 510-286-4825 e-mail: betty_lee@dot.ca.gov Date of Review: 5/3/2011

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
____	Parikh Inc.	____	____	____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	LOTB, pg 1	Labeling of boreholes A,C,D unclear. Also, what is the numbers to the right of the log?	The log is an as-built LOTB by Miller Pacific Engineering Group. The numbers on the right are dry density and moisture content, as specified on the legend on the left.	
2	FR	LOTB, pg 2	Locations of boreholes unclear. Also, this LOTB is in metric while the rest of the report is in English units.	This LOTB is in metric because it is an as-built log. We have included a conversion chart in the LOTB.	
3	FR	7	Liquefaction: groundwater is not addressed.	Will discuss groundwater in liquefaction section.	
4	FR	8,9	Chart for abutments says LRFD, while your text says WSD. Which did you use? Please be consistent.	MTD 3-1, p. 1: "Loads from the LRFD Service-I Limit State shall be used as design loads for WSD of the abutments." Table shows the LRFD Service-I foundation loads, however the design is based on WSD. Wording revised to show consistency.	
5	FR	8	For Chart #2, Foundation Loads, the loads per pile appears incorrect. For example, for Bent 2, Strength Limit Compression, 7370 kips per	Chart #1 and #2 revised such that total load "per support" and number of piles "per support" include both existing and proposed piles. Maximum "per	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			support: Max per pile=7370/8 piles per support is NOT 250. Same with Abutments.	pile" loads expected to be greater than the total load divided by number of piles due to the effects of moment and shear occurring on the top of the foundation footings.	
6	FR	9, 10	For Charts #3, 4, 5, Design Tip Elevations should also be provided for 1" settlement.	Per the results of the SHAFT analyses, for piles constructed to the specified tip elevation in the Pile Data tables, the 'top of pile deformations' are less than 1 inch for all cases. Therefore, design tip elevations for 1 inch settlements are not provided. A note to this effect will be added in the Pile Data Tables.	
7	FR		Will rock sockets be used? If so, identify the limits of the rock sockets for construction bid/payment purposes.	Rock sockets will not be used. We recommended drilling standard CIDH piles.	
8	FR	12, 14	Abutment 3?	Comment unclear. I assume this comment is a continuation of comment 7. Please explain.	
9	FR	Appendix C	Settlement calculations: What are the assumptions? And basis of the assumptions?	The assumptions are discussed on page 14. The settlements were based on 7 feet (vertical thickness) of new fill at the Abutment 3 location.	
10	FR	14, Appdx C	Slope stability analysis: Which borehole information was used? Borehole C shows a top layer of soft organic clay. Borehole D shows a 4 meter layer of soft to med stiff clay layer. This is not consistent with the modeling shown.	Slope stability analyses was using a combination of as-built Borings C & D. Soil description in Boring C shows 'soft clay'; but the blow count was indicative of a firm to stiff clay. Boring D shows "soft to medium stiff" with decent blow counts, therefore, the layer was modeled as "firm to stiff clay" in our analyses.	
11	FR		Seismic slope stability analysis should be addressed.	Will be addressed in the report.	
12	FR		Lpile model used does not match LOTBs. Abut 1: Boring C shows top layer to be soft clay. The Lpile model uses "stiff clay". Abut 2: Boring D shows top layer to be soft clay. The Lpile model uses "stiff clay".	See Response 10.	
13	FR		Please address drag forces on the piles.	Downdrag forces on the pile are not an issue because liquefaction potential is low and consolidation settlement is minimal. Will discuss in report.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264071 Project Name: REDOOD LANDFILL OC/101 (WIDEN) OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail: tracy_bertram@dot.ca.gov	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. 1) ☐ Construction Support ☒ Other: FINAL FR **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Redwood Landfill OC (Widen) Br No: 27-0115	Reviewer Name: Rifaat Nashed Functional Unit: GS Phone Number: 510-622-1773 e-mail: rifaat_nashed@dot.ca.gov Date of Review: 07/19/11

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR FINAL	Report Reviewed Title	Final Foundation Report Redwood Landfill Overcossing / Route 101 (Widen)- (Bridge No. 27-0115) Marin County, California 04-Mrn-101 EA 264071 Dated June 2, 2011		
2	FR FINAL	**SUBSURFACE CONDITIONS** Page 5	1- The soil thickness range should be defined in lieu of " varying thickness" 2- The depth range to the bedrock (Sandstone/ shale) should be defined.	Will address depth and elevation of soil and bedrock in the report.	
3	FR FINAL	**APPENDIX A** Page 3	For the LOTB, the bench mark for the borehole location as required by the Soil /Rock classification Manual is missing	Will include in the LOTB.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

FINAL
FOUNDATION REPORT FOR RETAINING WALLS
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
AT RTE 101
MARIN COUNTY, CALIFORNIA
04-MRN-101 R23.2/27.1 EA 264071
Project No. 040000073 Phase 1

For

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A,
San Jose, CA 95131
(408) 452-9000

March 14, 2012 Job No. 208140.RET

TABLE OF CONTENTS

Page

Title Page i
Table of Contents iv
List of Tables v
List of Plates vi

INTRODUCTION 1
PROPOSED CONSTRUCTION 1
PURPOSE AND SCOPE 2
SITE CONDITIONS 2
Project Topography and Drainage 2
Existing Facilities 3
FIELD EXPLORATION AND LABORATORY TESTING 4
Drilling, Sampling and Test Pit Excavation 4
Laboratory Testing 6
Geologic Interpretation and Mapping 7
SITE GEOLOGY 7
SUBSURFACE SOIL AND GEOLOGIC CONDITIONS 8
Information from Soil Borings and Test Pits 8
Information from Cut Slopes and Rock Outcrops 9
Geologic Interpretation 10
Bimrocks (Blocks-in-matrix) 11
Groundwater 12
EARTHQUAKE CONSIDERATIONS 13
Seismic Sources 13
Ground Rupture 14
Liquefaction 14
FINDINGS AND RECOMMENDATIONS 15
General 15
Retaining Walls 15
Erosion Control & Mitigation Measures 26
Subsurface Drainage Mitigation 27
Corrosion Investigation 27
CONSTRUCTION CONSIDERATIONS 28

Grading 28
Construction Advisories 28
Plan Review 30
Construction Observation 30
Differing Site Conditions 30
INVESTIGATION LIMITATIONS 31
REFERENCES 33
AERIAL PHOTOGRAPHS 34

APPENDICES

Appendix A

Log of Test Borings
As-built Log of Test Borings (Miller Pacific Engineering)
Logs of Test Pits

Appendix B

Laboratory Tests ..... Plates B-1A and B-1B
Plasticity Chart ..... Plates B-2A and B-2B
Particle Size Distribution Curves ..... Plates B-3A thru B-3E
Corrosion Tests ..... Plates B-4A thru B-4V
Consolidation Test ..... Plates B-6A thru B-6C
Consolidated Undrained Triaxial Test ..... Plates B-7A and B-7B
Unconfined Compression Tests ..... Plates B-8A thru B-8F
Direct Shear Tests Test ..... Plates B-9A and 9-B
Unconsolidated Undrained Compression Test ..... Plate 10

Appendix C

Slope Stability Analysis
Tieback Design (Wall Nos. 4 and 5)
Calculation of Unbonded Lengths for Tiebacks
Retaining Wall No. 2 – Settlement and Bearing Capacity

Appendix D

Index Map ..... Plate D
Geologic Maps ..... Plates D-1 thru D-7

Appendix E

Index – Photo Locations
Onsite Photographs ..... Photo Nos. 1 thru 5

Appendix F
Caltrans Comments and Responses

LIST OF TABLES **Page**

TABLE 1A: SOIL BORINGS 5
TABLE 1B: TEST PITS 5
TABLE 2: SEISMIC SOURCES 13
TABLE 3: SUMMARY OF PROPOSED RETAINING WALLS 16

LIST OF PLATES

Project Location Map ..... Plate 1
Site Plan ..... Plate 2
Site Plan Sheets ..... Plates 2A thru 2C
Area Geologic Map ..... Plate 3A and 3B
Regional Fault Map ..... Plate 4A
Design ARS Curve ..... Plate 4B
Liquefaction Susceptibility Map ..... Plate 5
Tieback Design Recommendations for Wall Nos. 4 & 5 ..... Plates 6A and 6B
Tieback Design Recommendations for Wall Nos. 4 & 5 ..... Plates 6A and 6B
Tieback Design Recommendations for Wall Nos. 4 & 5 ..... Plates 6A and 6B
Retaining Wall No. 4 – Retaining Wall Layout ..... Plates 7A-1 and 7A-2
Retaining Wall No. 5 – Retaining Wall Layout ..... Plates 7B-1 and 7B-2

FINAL
FOUNDATION REPORT FOR RETAINING WALLS
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT AT RTE 101
MARIN COUNTY, CALIFORNIA
04-MRN-101 R23.2/27.1 EA 264071
PROJECT NO. 040000073 PHASE 1

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the four retaining walls proposed as part of the "Improvements at the Redwood Landfill Interchange on Rte 101 from 1.0 mile north of North Novato Overhead to 0.6 mile south of Sonoma County Line" in the City of Novato and adjacent incorporated areas in Marin County, California (Marin-Sonoma Narrows Contract B-1). The work described in this report was performed in general accordance with the scope of work outlined in our proposal to BKF Engineers (Designer). The general location of the project site and its limits are shown on Plate 1 - Project Location Map.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the proposed retaining walls and to recommend design and construction criteria for the retaining walls.

The geotechnical recommendations presented in this report are intended for design input and are not intended for use as specifications. These recommendations should not be used for direct bidding purposes.

PROPOSED CONSTRUCTION

A Site Plan for the Marin-Sonoma Narrows Contract B-1 project presented on Plate 2 shows the locations of the proposed retaining walls. Retaining walls are proposed at the following locations (stationings for the retaining wall locations are presented in Table 3):

- Retaining Wall No. 2 (Type 1 Wall) – Approximately 258 feet long, on the western edge of the proposed new bike trail. Typical wall height ranges from 4 feet to 10.6 feet.
- Retaining Wall No. 4 (Combination of Soldier Pile-Lagging Wall and Tieback Wall) – Approximately 429 feet long, running along the southwestern edge of the proposed new frontage road, starting from Redwood Landfill Overcrossing. The wall height

ranges from 3 to 31 feet.

- Retaining Wall No. 5 (Combination of Soldier Pile-Lagging Wall and Tieback Wall) – Approximately 273 feet long, running along the northeastern edge of the northbound on-ramp. The wall height ranges from 3 to 16 feet.
- Retaining Wall No. 7 (Type 1 Wall) – Approximately 223 feet long, running along the southwestern edge of the proposed new frontage road north of Retaining Wall No. 4. The wall height is up to 12 feet.

More detailed Site Plans from the overall project showing the retaining wall locations, boring locations and other pertinent features are presented in Plates 2A through 2C. Only the Site Plans which include the retaining walls are included in this report.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide recommendations for foundation support of the proposed retaining walls. The basis for this investigation is the preliminary plans provided to us by BKF Engineers. Relevant information from the Geotechnical Design and Materials report as it pertains to the present project were extracted and are presented in this report.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

Project Topography and Drainage

At the Marin-Sonoma Narrows Contract B-1 project location, existing Rte 101 cuts across the toes of several steep slopes and gently sloping valleys and plains adjacent to Petaluma River marshes to the east. Elevations of Rte 101 range from approximately Elev. 10 feet at the southern end of the project, to approximately 110 feet at the northern end. On the western side of Rte 101, the terrain rises from the road level throughout the alignment within project limits.

Steepest slopes (approximately 2:1) are present in several locations with slope heights up to 40 feet higher than adjacent grade (e.g. at Sta. 344+50 ("N2R" Line)). On the eastern side, south of Landfill Access Road (approximately Sta. 329+00 ("N2R" Line)), the terrain is relatively flat (Elevation +2.0). To the north beyond Sanitary Landfill Road to approximately Sta. 341+00 ("N2R" Line), a ridge is present. The slopes of the ridge are around 2:1. Beyond Sta. 341+00, the terrain is significantly less steep, rising gently to the east. A small hill, approximately 40 feet higher than the adjacent grade of Rte 101 is present about 150 feet east of the travel way at approximate Sta. 338+00 ("N2R" Line).

Per the Designers, there are 10 existing seasonal creeks/stream locations within the project limits, which are conveyed into cross culverts that pass below Rte 101.

Two additional drainage features are noted within the project limits and are considered significant to the project:

(a) A drainage course running west to east on the slope west of Rte 101, intersecting the RLF line at Sta. 345+90.
(b) A drainage course running west to east on the slope west of Rte 101, intersecting the highway at Sta. 409+05 (RLF Line).

Existing Facilities

Rte 101 is a north-south interstate highway. Within the project limits, the freeway is a four-lane facility with two travel lanes in each direction and shoulders separated by a median. The Redwood Landfill Road Overcrossing (Bridge No. 27-0115) is within the project limits. The existing overcrossing is a two-span cast-in-place concrete box girder structure, approximately 253'– 6" long and 34'- 4" wide. The bridge carries one lane of traffic each in the southwest and northeast directions. Other existing facilities of potential significance to the project are:

- The Verizon Wireless Cellular Tower building (Sta. 337+00 - "RL2" Line, 40' Rt.)
- Several livestock tunnel structures
- Forty-three cross culverts Water Pipelines (NMWD)

- PG&E gas pipeline
- PG&E overhead electric line
- Overhead telephone lines (Verizon and AT&T)
- Fiber Optic Line (Verizon Wireless)
- Retaining wall on the eastern edge of Rte 101 (Sta. 336+ 08 to Sta. 339+52 ("N2R" Line))
- Existing cut slopes along the western side of Rte 101 at several locations

FIELD EXPLORATION AND LABORATORY TESTING

Drilling, Sampling and Test Pit Excavation

Based on the plans and discussions with the design team, and readily available geotechnical data in the vicinity of the project area, 13 borings and 4 test pits were relevant to the design and construction of the proposed retaining walls. Depths of these borings ranged from 6 to 60.5 feet. The test pits ranged in depth from approximately 7.5 feet to 11 feet. Fifteen of the borings were drilled in 2009. Subsequently, three additional borings were drilled and the four test pits were excavated between November, 2010 to January, 2011 to allow for the design and alignment changes.

Pertinent information of the borings for the proposed retaining walls is summarized in Table 1A. Pertinent information of the test pits pertaining to the retaining walls is summarized in Table 1B. The locations of all the borings and test pits are presented in the Site Plans (Plates 2A through 2C). Log of Test Borings (LOTB) sheets for the boring logs and as-built boring logs; and test pit logs are presented in Appendix A.

TABLE 1A: SOIL BORINGS

Boring No.	Station (ft.) "N2R" Line	Offset (ft.)	Drilling Method	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
A-11-158A	306+78	58 Lt.	Hollow Stem Auger	10.5	34.5	*
A-11-158	307+92	72 Lt.	Hollow Stem Auger	8.5	33	*
A-11-158B	309+52	72 Lt.	Hollow Stem Auger	9.5	29	*
A-09-001	335+85	125 Rt.	Hollow Stem Auger	50	59	*
R-09-112	336+55	225 Rt.	Rotary Wash	40.5	84	*
R-09-113	338+60	180 Rt.	Rotary Wash	40.5	92	*
A-09-114	341+00	80 Rt.	Hollow Stem Auger	25	45	*
A-09-129	334+95	295 Lt.	Hollow Stem Auger	21.5	85	*
R-09-130	336+45	435 Lt.	Rotary Wash	60.5	120	*
R-09-131	338+25	385 Lt.	Rotary Wash	47.5	101	*
A-09-132	340+10	325 Lt.	Hollow Stem Auger	35	74	*
A-09-135	349+45	215 Lt.	Hollow Stem Auger	35	93	*
A-09-136	352+15	210 Lt.	Solid Stem Auger	10	90	*
* Groundwater was not encountered in the boring during drilling						

TABLE 1B: TEST PITS

Test Pit No.	Station (ft.) "N2R" Line	Offset (ft.)	Excavation Method	Test Pit Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
TP-168	348+36	184 Lt.	Backhoe	8.5	75	*
TP-169	349+80	175 Lt.		11	82	*
TP-170	352+20	164 Lt.		7.5	82	*
TP-171	339+10	300 Lt.		7.5	75	*
* Groundwater was not encountered in the test pit excavation						

Most of the borings were drilled with truck-mounted drill rig using 8-inch-diameter hollow stem auger. At one location that presented access difficulties, the boring was drilled using a portable drill rig using a 4-inch-diameter solid stem auger. Four borings were drilled using a track-mounted rotary wash drill rig, using an approximately 5-inch diameter hole. Test pits were excavated using a backhoe with a 30-inch bucket.

Soil samples were generally obtained by driving either a 2.5-inch I.D. (Modified California, MC) sampler or a 1.4-inch I.D. (Standard Penetration Test, SPT) sampler at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The blow counts are presented on the LOTB sheets in Appendix A. When correlating standard penetration data, the blow counts for the Modified California Sampler may be converted to equivalent Standard Penetration Test blow counts by multiplying a factor of 0.65 (DMG Special Publication 117 (Guidelines for Analyzing and Mitigating Liquefaction). The samples were sealed and transported to our laboratory for further evaluation and testing. A few rock core samples were obtained using HQ diamond core barrels. The core barrel had a 2.4-inch ID and was advanced by hydraulic pressure.

The field investigation was conducted under the supervision of our field engineer/geologist who logged the soils encountered in the test borings during drilling and prepared the samples for subsequent laboratory testing and evaluation.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

Laboratory Testing

Laboratory tests performed for the study include the following: Laboratory determination of Moisture-Density (California Test Method 226), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), Unconsolidated Undrained (UU) and Consolidated Undrained (CU) Triaxial Tests, Direct Shear Test, R-value Test (California Test Method 301), Corrosion Test (California Test Method 643), and Consolidation Test . The laboratory test results are included in Appendix

B. Laboratory test results for moisture content, unit weight and unconfined compression tests are presented on the LOTB sheets in Appendix A at the appropriate sample depths.

Geologic Interpretation and Mapping

Published geologic maps and other geologic information pertinent to the project were reviewed. In addition, apparent surface contacts between deep-seated landslides, debris flow deposits, alluvial fans, and "bedrock slopes" (area of thin soil over in-place bedrock) were mapped, based upon their distinctive geomorphic expressions in the photogrammetrically produced topographic contours and stereoscopically viewed aerial photographs. In general, such interpretations involved recognition of the intersections of different fan-shaped surfaces formed by accumulation of slopewash and debris flow deposits, as well as the lobate toes of the landslides. Site visits were conducted and photographs were taken at various locations of interest to the project. Selected site photographs and a key map of the photograph locations are presented in Appendix E. On-the-ground observations enabled us to map the approximate extents of scarps and depositional lobes of localized slumps. This helped confirm the available information or modify it as appropriate. Project-specific geologic maps were thereby generated for use in the development of appropriate engineering recommendations for various elements of the project. The resulting geomorphic maps (presented as Plates D-1 through D-7 in Appendix D) show the inferred geologic contacts in the vicinities of the planned walls and cut slopes, presented on the project's topographic base map overlaid on recent orthophotos.

SITE GEOLOGY

General geologic features pertaining to the site were evaluated by reference to the “Preliminary Geologic Map of the Napa 30’ x 60’ (100k) Quadrangle, California”, compiled by Wagner, D. L. and Gutierrez, C. I. (California Geological Survey, 2010). A portion of the map that covers the project vicinity is shown on Plate 3A; a companion key to the map is presented on Plate 3B.

Based on the available geologic maps, the geologic units at the project location consist predominantly of Alluvium (Qa and Qhf), Colluvium (Qc), Franciscan Complex blocks-in-matrix schist and semi-schist (KJfsch), and Great Valley Sequence (KJgv). Presence of

Undifferentiated Tertiary Volcanic Rock (Tv) unnamed tuffaceous sediments (Ts), and Franciscan Mélange (KJfm) is also noted in the vicinity of the project on the western side of Rte 101. Landslide Deposits, both deep-seated rotational slumps (Qlsv) and shallow debris flow deposits (arrows), occupy much of the lower slopes west of Rte 101. Bay Mud (Qhbm) is mapped in several places east of Rte 101, beneath a small portion of the freeway alignment, where it is buried by artificial fill (afbm). Published maps also note areas of Debris Flow Landslides and Block Slump Landslides. Detailed descriptions of the rock units are included in Appendix D.

SUBSURFACE SOIL AND GEOLOGIC CONDITIONS

Subsurface information for the overall the Marin-Sonoma Narrows Contract B-1 project site consisted of (a) information from soil borings and test pits; (b) information from cuts and rock outcrops within the project limits and vicinity; (c) information from geologic maps and interpretations of the geologic maps in conjunction with geomorphology.

Information from Soil Borings and Test Pits

Relevant subsurface information is presented in appropriate sections discussing specific retaining walls. General subsurface information for the project location as revealed by the relevant soil borings and test pits is summarized below:

- In general, rock was encountered at relatively shallow depths - rock was encountered at the surface in several borings. The deepest depth to rock was 20 feet in Boring A-09-135, drilled in the vicinity of Wall No. 7. The rock was identified as weathered sandstone or claystone. There is evidence of mylonite below the sandstone (in boring A-09-132) west of the freeway along the proposed Northwest Frontage Road. The sandstones and claystones are generally blocks within the Franciscan Complex (e.g. blocks-in-matrix (bimrocks)). The debris flow deposits and landslide deposits are also classed as bimrocks. Further discussion on bimrocks is presented in a later section.
- The soils overlying the rock are alluvium, colluvium, or landslide deposits consisting predominantly of very stiff lean clays and sandy clays and medium dense to very

dense silty and clayey sands with gravel. Significant portions of the colluvium have been identified as debris flow deposits.

- Presence of soft clay (e.g. Bay Mud) or firm clay was not revealed by any of the borings.
- Groundwater was not encountered in any of the borings in the vicinity of the retaining walls. Groundwater was encountered at two locations within the limits of the overall project.

Information from Cut Slopes and Rock Outcrops

Soil/rock exposed by the cut slopes and the outcrops of relevant to the retaining walls are discussed below:

- At the location of the proposed Retaining wall No. 4, colluvium and debris flow deposits overlie Franciscan Complex rock in the southern end of the cut slope along the west/northwest edge of the existing on-ramp to the Redwood Landfill Bridge from the western side. The thickness of the colluvium increases to the north, where the cut face exposes debris flow deposits over the full 8-foot height (see Photo No. 3 in Appendix E). A shear zone, approximately 25 feet wide was noted in the cut face and fragments of serpentinite was observed within the zone.
- The entire face of the existing cut slope above the existing retaining wall (Sta. 336+08 to Sta. 339+52 ("N2R" Line)) on the northeastern side of Rte 101, (where the northbound on-ramp is planned) exposes competent rock (Franciscan Chert (fch)).
- A knob of rock, identified as Franciscan Chert (fch) is noted on the eastern side of Rte 101, near the Verizon Wireless facility. The knob falls within the alignment for proposed Retaining Wall No. 5. The rock appears to be hard, though it may be possible to excavate the rock by conventional equipment (including hoe ram) due to its bedded and fractured nature; however, extra drilling and excavation efforts should be expected. Controlled Blasting may be required at depth at this location. For drilling purposes, coring may also be required.

Geologic Interpretation

The project site is underlain by the Franciscan Complex blocks–in-matrix rock (Franciscan Mélange (fm)), which consist of various rock types, having different origins, brought together during subduction beneath the westerly advancing North American Continental Plate. For the most part, within the project area, Franciscan Complex and mélange rocks were the result of tectonic agglomeration of massive sandstone and alternating thin beds of sandstone and shale with minor chert. It appears that the predominant rock type on the northeastern side of Rte 101 is chert and on the southwestern side it is greywacke sandstone.

The geologic maps prepared by our engineering geologist presented in Appendix D indicate the following in the areas of the proposed retaining walls:

- As shown on Plate D-4, the Retaining Wall No. 2 alignment (Sta. 306+39 to Sta. 308+97 – "BK" Line) for the major part crosses the nose of a small ridge composed of Franciscan Mélange, flanked on both sides by alluvial deposits. A small slump of the soil exposed in the upper portion of the existing cut slope has slumped on to the level shoulder of Rte 101.
- As shown on Plate D-5, the Retaining Wall no. 4 alignment (Sta. 336+39 to Sta. 339+12 – "RL2" Line) crosses over an area of debris flow deposits. The debris flow deposits extended to the Highway prior to construction of the interchange. The geologic map is confirmed by the borings and the existing cut exposure discussed in the previous section, where the debris flow is underlain by greywacke sandstone within Franciscan Mélange.
- As shown on Plate D-5, the Retaining Wall No. 5 alignment is underlain by chert within Franciscan Mélange. The rock type is confirmed by the outcrop and the existing cut slope exposure at the alignment location and vicinity discussed in the section 'Information from Cut Slopes and Rock Outcrops'.
- A cut (which includes Retaining Wall No. 7) is proposed on the west side of West Frontage Road, north of Retaining Wall No. 4. The cut alignment (Sta. 413+50 to Sta.

418+50 – "RLF" Line) as shown on Plate D-5 crosses a zone of landslide deposits, confirmed by test pits TP-168, 169, and 170.

Bimrocks (Blocks-in-matrix)

A common characteristic of all these three material types is that they are chaotic mixtures of strong blocks within a weaker matrix. They may, therefore, be designated as "bimrocks," a geologically neutral word coined by Medley (1994) as a short form for "block in matrix rocks" per Raymond (1984). Their mechanical properties are significantly different from those of conventional 'soil' or 'rock' units. A detailed discussion on bimrocks is presented in the Geotechnical Design and Materials Report (GDMR) for this project. Key items as they pertain to retaining wall design and construction are discussed below.

From associated literature, it appears that block volumetric proportions (BVP) are probably the most significant parameter for design for this project. Two terms that are very significant for our purposes emerge from literature: "block-rich" and "block-poor". The fundamental meanings of the terms are somewhat self explanatory. Available literature indicates that for BVP below 25 percent, the strength will be dominated by that of the matrix and BVP above 75 percent will be dominated by block strength. For intermediate values of BVP, the values may be interpolated. It may be noted that the overall strength of a bimrock is typically independent of the strength of the blocks themselves.

For convenience, bimrocks at the site were classified as either "block-rich" or "block-poor." The classification was based on: (a) information from cut exposures or natural outcrops, wherever available; (b) information from boring logs and test pits; (c) geologic and geomorphic interpretation of subsurface conditions at specific locations. In general, the Franciscan Complex was classified as "block-rich" and the debris flow and landslide deposits and shear zone material were classed as "block-poor." Based on the above information, our geologist established expected zones of block-rich and block-poor materials at several pertinent locations as discussed in appropriate subsequent sections. Design parameters were established for each zone.

An internal friction angle of 26 degrees was assigned to the block-poor material. The value appears reasonable based on the literature for the clay/shale matrix; it is also at the lower end of the range cited by Medley in a paper submitted for publication (in press). Finally, the steepest natural slopes within the project site are approximately 2H: 1V (e.g. 26 degrees).

An internal friction angle of 36-degrees was used for block-rich material. The 36-degree friction angle is well within the range cited by Medley for block-rich units. The friction angle is also in the lower bound of the relationship:

$$\tan(\varphi_{\text{weakest block}}) / \tan(\varphi_{\text{matrix}}) = 1.5 \text{ to } 2.0$$

A particular characteristic of bimrock materials is the extreme heterogeneity in terms of block volumetric proportions, block sizes and block hardness. All of these characteristics will have significant impacts during construction. Extreme heterogeneity in terms of block volumetric proportions may result in unexpected construction difficulties. Therefore, the prospective Contractor should be made aware of that variability. Large, hard blocks of intact rock may be encountered, which may not be excavatable by conventional excavators; jackhammers or blasting may be required to break up large hard rock blocks. Hard rocks may impose hard drilling for tiebacks and/or soldier piles. All these issues are covered in greater detail in the section 'Construction Advisories'.

Groundwater

Groundwater was not encountered in any of the borings and test pits relevant to the retaining walls. Groundwater may be encountered in excavations, particularly those made in the flatter, lower elevation areas. Localized trapped water and seepages may occur, particularly in the rainy season. The presence of water is intermittent and not sustained to establish a groundwater table. However, encountering groundwater in excavations cannot be ruled out.

It is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface and subsurface flow, ground surface run-off, and other factors that were not existent at the time of investigation.

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project site is located in a seismically active part of Northern California. Seismic activity may result in geological and seismic hazards including seismically induced fault displacement and rupture, ground shaking, liquefaction, lateral spreading, landslides, and structural hazards. Many faults exist in the San Francisco Bay Area and are capable of producing earthquakes. These faults may cause strong ground shaking at the site.

Caltrans has revised the 1996 Hazard Map and has produced a new map and an associated report (2009 Caltrans Deterministic PGA Map and ARS Online Report). The new map (2007 Caltrans Deterministic PGA Map) shows all the known faults and contours of peak ground accelerations (PGA) based on New Generation Attenuation (NGA) ground motion prediction equations. The report also includes an associated database (2007 Data Base) providing relevant information for all the faults in the map; and procedures for the development of Acceleration Response Spectra (ARS) curves based on a user friendly on-line web tool. The Regional Fault Map, Plate 4A, presents the locations of the fault systems relative to the project site, based on the 2007 Caltrans Deterministic PGA Map.

The major faults in the vicinity, their distances from the project site, fault types and the maximum earthquake magnitudes (Mmax) associated with each fault are summarized in the table below. These maximum earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 2: SEISMIC SOURCES

Fault	Fault Type	Estimated Closest Distance to the Project Area (miles)	Maximum Earthquake Magnitude (Mmax)
Rodgers Creek Fault	RLSS	5.6	7.1
San Andreas Fault zone (North Coast section)	RLSS	14.5	7.9
RLSS – Right Lateral Strike Slip Fault			

A design ARS curve was developed, based on the 2009 Online report for the site, which is presented in Plate 4B. The Peak Ground Acceleration per the design ARS curve is 0. 634g.

The Burdell Mountain Fault Zone is not identified in the 2007 Caltrans Deterministic PGA Map, a portion of which is presented in Plate 4. However, two traces of the Burdell Mountain Fault are shown on the geologic map by Wagner et al (2010), a portion of which is presented in Plate 3A. Where they cross the central portion of the project area, the faults are concealed (represented by a dotted line) beneath landslide deposits and have no identifiable geomorphic expression at the ground surface (Ford, 2007). It is discussed extensively in the Geotechnical Design and Materials Report (GDMR) for the MSN B1 project in Sections 4.4 (Regional Geology and Seismicity) and 7.4.2 (Fault Rupture). In section 7.4.2, it is noted that the Burdell Mountain Fault Zone crosses a portion of the Southwest Frontage Road between Sta. 247+20 and Sta. 268+50 ("FR2" Line). The limits of the Burdell Mountain Fault Zone are shown on Sheet D-2 of Appendix D in the GDMR. Based on this, the fault zone is not in the vicinity of any of the four retaining walls. Per the Preliminary Geotechnical Report (PGR) by Caltrans August 2005, the fault zone "should be considered potentially active, unless later proven otherwise."

Ground Rupture

The Burdell Mountain Fault Zone is mapped as crossing a portion of Southwest Frontage Road (Sta.247+20 to Sta. 258+80 ("FR1" Line)). The potential for ground rupture due to movement of this fault is undetermined. The project does not include any proposed retaining wall within the fault zone.

Liquefaction

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils

have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004).

USGS Liquefaction Susceptibility maps published in 2006 indicate 'Moderate' liquefaction susceptibility for essentially the entire project (See Plate 5). A zone of 'Very High' liquefaction susceptibility is noted on the USGS map between Sta. 241+50 and 246+00 ("N2R" Line). However, groundwater was not encountered in any of the borings relevant to the retaining walls. Additionally, there is no indication of loose or medium dense sands at the retaining wall locations. The potential for liquefaction at the retaining wall locations is therefore considered low.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the proposed retaining walls provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed retaining walls according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Retaining Walls

Due to right-of-way and other geometric constraints, the project will require construction of four retaining walls. Information of approximate wall locations, length and maximum wall heights

provided by the designer are summarized in Table 3 below. The subsurface soil conditions and design considerations of each of the retaining walls are discussed after the table.

TABLE 3: SUMMARY OF PROPOSED RETAINING WALLS

Wall No.	Approximate Wall Location	Cut/ Fill	Max. Wall Height (ft)	Approx. Length (ft)	Proposed Wall Type	Relevant Borings and Test Pits
1	Not Used					
2	Sta. 306+39 to 309+07 (BK Line')	Cut	14.2	266	Type 1	A-10-158, 158A, 158B
3	Not Used					
4	Sta. 342+77 to 346+74 ('RLF Line')	Cut	31	429	See Note 1 below	A-09-130, 131, 132, TP-171
5	Sta. 336+39 to 339+12 ('RL2 Line')	Cut	16	273	See Note 2 below	A-09-112, 113, 114
6	Not Used					
7	Sta. 358+96 to 361+20 ('RLF Line')	Cut	9	223	Type 1	A-09-135, 136 TP-168, 169, 170

Notes:
1. Tieback wall between Sta. 343+24 and Sta. 346+10; Soldier-Pile Lagging Wall for the rest of the wall.
2. Tieback wall between Sta. 336+92 and Sta. 338+54; Soldier-Pile Lagging Wall for the rest of the wall.

Retaining Wall No. 2

The proposed cut wall will be located along the western edge of the proposed new bike path. Wall heights range from 4 to 14.2 feet with a 2H:1V slope behind it. The entire wall alignment will be located across the nose of a small ridge of Franciscan Complex (KJf) flanked on both sides by colluvial deposits (see Plate D-4 in Appendix D). There are several slumps noted in the existing cut slope adjacent to the highway. The slumps appear to be surficial. Near the bottom of the slope, the ground is essentially level and appears to be covered with debris from these surficial slides. Subsurface conditions exposed in the existing cut slope indicate weathered Franciscan Complex rock in the lower portions of the cut and residual sandy soils are exposed in the upper portion of the cut slope. Boring A-10-158A drilled approximately 35 feet east of the wall near the southern end of the wall alignment indicates rock at a depth of 9 feet. Borings A-10-158 and 158B were drilled approximately 15 feet east of the retaining wall alignment near the

center and northern end of the wall, respectively, indicate rock at the ground surface. The soil overlying the rock on the southern end (based on Boring A-10-158A), consist of stiff lean clay at the surface, underlain by medium dense clayey sand at 5-ft depth. However, the southern end of the wall is 35 feet to the west of the boring, on steeper terrain, where the rock depth is expected to be shallower. It is therefore expected that majority of the wall will be founded on rock, with a small portion in the southern end may be on medium dense sand or a thin layer of clay overlying the sand. An allowable bearing capacity of 3.5 ksf is recommended for the stiff clay overlying the sand.

A Caltrans Standard Type 1 wall on spread footing is considered feasible, since per Caltrans Standard Plans, the required toe pressure for a 14-ft high wall is 3.3 ksf, which is less than the recommended allowable bearing capacity.

An immediate (elastic) settlement on the order of 0.2 inch was computed for the southern end of the wall. This is based on a toe pressure of 3.3 ksf. and an 8-ft wide footing (per Standard Plans for a 14-ft high wall) underlain by 6 feet of stiff clay overlying rock. Calculations are presented in Appendix C. Settlement from the middle of the alignment to the northern end should be negligible, the wall being founded on rock in this segment. The maximum differential settlement is therefore conservatively estimated to be on the order of 0.2 inch.

Retaining Wall No. 4

The proposed cut wall will extend along the southwestern edge of the Northwest Frontage Road. It starts from the northwestern edge of the Redwood Landfill overcrossing, and extends towards the northwest. There is an existing cut slope that was excavated several years ago for the existing overcrossing ramp. The new alignment will expand the cut into the hillside. The new excavation will result in a vertical cut for the wall itself, with a 2H:1V cut slope above the top of the wall. The maximum height of the vertical cut will be 31 feet. Per our geomorphic map interpretation (see Plate D-5 in Appendix D), the surficial soils in the area consist of debris flow deposits. Local slumps are also noted in the overlying debris flow deposits along the upper portions of the existing cut slope, northeast of the proposed wall alignment (See Photo No. 3 in Appendix E).

Rock (Franciscan Complex) is indicated near the surface (within 3 feet) in Borings R-09-130, R-09-131, A-09-132, drilled on the southwest side of Rte 101, and along the southwestern edge of the proposed Northwest Frontage Road in the area of proposed Retaining Wall No. 4. Rock was identified at 10 feet below ground surface in Boring A-09-129 within 80 feet of the southern end of the wall. The rock is identified as sandstone/siltstone in Borings 129, 130 and 131 and as claystone in Boring 132. Crushed sediments and mylonized sediments are noted in Boring 131 at depths ranging from 20 to 30 feet below ground surface. Test pit TP-171 was excavated approximately 20 feet south of the wall alignment, near the north end of the wall. It indicated debris flow material to a depth of 4.5 feet, underlain by sandstone of the Franciscan Complex. (See Plate D-5 in Appendix D).

A 25-ft wide shear zone was observed within the sandstone near Sta. 345+75 ("RLF" Line). The shear zone, as exposed, is essentially vertical. It is anticipated that the width of the shear zone may increase toward the southwest (i.e. where the wall will be built). At the cut face for the proposed wall, the shear zone could be up to 100 feet wide. Therefore, it is assumed that along the wall alignment, shear zone will be present north of Sta. 345+50 ("RLF" Line).

Based on the topography, the exposed material in the existing cut slope and the borings and test pits located along the wall alignment and the field observations (Borings 129, 130, 131 and 132 and TP-171), our Engineering Geologist has estimated the depth to rock along the wall on the order of 4 feet. Based on this information, e.g. the vertical cut in this section south of Sta. 345+50 is expected to be in rock (e.g. block-rich bimrock). North of Sta. 345+50, the wall will support shear zone material. Shear zone material is assumed as block-poor bimrock. These approximate stationings could vary in the field and adjustments in the wall design may be required. Therefore for contingency purposes the "shear zone" wall design has been extended 25 feet on either side of the estimated station.

Based on the above conditions, a Soldier Pile-Lagging wall is recommended for Wall No. 4. The wall should be designed for the following parameters:

South of Sta. 345+50 (wall supporting block-rich bimrock):

Effective Angle of Internal Friction (phi)	= 36 degrees
Wall Friction Angle (delta)	= 0 (per BDS)
Active Earth Pressure, Ka	= 0.41 (assuming 2:1 backslope)
Soil Unit Weight	= 135 pcf
Cohesion	= 100 psf
Passive Earth Pressure Coefficient (Kp)	= 9.0
Maximum Pile Arching Capability	= 2.0 (for permanent walls, per B.D.S.)

North of Sta. 345+50 (wall supporting shear zone material, e.g. block-poor bimrock):

Effective Angle of Internal Friction (phi)	= 26 degrees
Wall Friction Angle (delta)	= 0 (per BDS)
Active Earth Pressure, Ka	= 0.59 (assuming 2:1 backslope)
Soil Unit Weight	= 130 pcf
Cohesion	= 100 psf
Passive Earth Pressure Coefficient (Kp)	= 3.5
Maximum Pile Arching Capability	= 2.0 (for permanent walls, per B.D.S.)

Depending on the structural demands and to control top of the wall deflections, a tieback wall is proposed for a segment of the wall near the center of the wall alignment between Sta. 343+24 and 346+10 ("RLF" Line), where wall heights are greater than 16 to 18 feet. Design recommendations for the tieback wall (single row of tiebacks) are presented in Plate 6A for block-rich bimrock and in Plate 6B for block-poor bimrock. Associated backup calculations are presented in Appendix C.

The design recommendations for tieback walls are based on Caltrans Bridge Design Specifications (BDS), Section 5 – Retaining Walls. The trapezoidal design lateral pressure diagram presented on Plates 6A and 6B are based on the following:

- Unit Weight of Block-Rich Bimrock: 135 pcf; Phi angle = 36 degrees; Delta = 0
- Unit Weight of Block-Poor Bimrock: 130 pcf; Phi angle = 26 degrees; Delta = 0

Other design input information is as follows:

- Unbonded Length = 15 feet (minimum) – based on AASHTO LRFD Design Manual as revised by Caltrans. Applicable unbonded lengths were calculated, based on the recommendations of the FHWA Manual, which considers the failure wedge behind the wall based on the friction angle of the material. Unbonded lengths for Wall No. 4 are presented on the Tieback Data Table in Plate 7A-1. Calculations for required unbonded lengths are presented in Appendix C.
- Ultimate Bond Strength in Block-Rich Bimrock = 80 psi (allowable = 40 psi)
  Ultimate Bond Strength in Block-Poor Bimrock = 40 psi (allowable = 20 psi)
  (Based on Recommendations for Prestressed Rock and Soil Anchors" by Post Tensioning Institute. (Tables 6.1 and 6.2)
- Coefficient of Passive Resistance (Kp) = 9.0 -- Block-Rich Bimrock
  Coefficient of Passive Resistance (Kp) = 3.5 -- Block-Poor Bimrock
- Maximum Pile Arching Capability = 2.0
  (effective width of passive pressure = 2 times effective width of soldier pile)
- Allowable Skin Friction for Soldier Piles = 2.0 ksf – Block-Rich Bimrock
  Allowable Skin Friction for Soldier Piles = 1.0 ksf – Block-Poor Bimrock

Pertinent information for Retaining Wall No. 4 were provided by the Structural Designer, which are presented in Plates 7A-1 and 7A-2. The plates include the following information:

- Pile Data Table, which includes the pile cut-off elevations and pile tip elevations for the soldier pile wall, including the tieback segment.
- Tieback Data Table, which includes tieback forces for different tieback types, their offsets from the top of wall and the corresponding unbonded lengths. Five different tieback types are listed.

A cast-in-place concrete facing should be installed on the outer (roadside) face of the lagging. Adequate drainage should be provided behind the wall to reduce build-up of hydrostatic pore pressures.

The 2H:1V backslope above the top of the wall will be within debris flow material, which will potentially be subject to periodic creep movements, resulting in some of the material moving down the slope. Therefore, we recommend the top of the cut slope be rounded off and a V-ditch be installed on top of the slope to reduce water flow from upslope. In addition, we recommend erosion protection measures be implemented on the cut slope. Typical erosion protection measures are discussed in the section titled 'Erosion Control and Mitigation Measures'. Currently the existing 2H:1V slope at the location has been performing reasonably well. However, until the slopes have established ground cover erosion protection measures, they are expected to slump and would require higher maintenance.

A drainage channel is present upslope of the location of Retaining Wall No. 4, which intersects the wall alignment approximately at Sta. 345+90 (RLF Line). This drainage could cause seepage to emerge from the debris flow exposed in the cut slopes, resulting in further slumping. Appropriate surface and subsurface drainage mitigation measures such as described in the section titled 'Subsurface Drainage Mitigation Measures' should be implemented.

Particular care should be exercised during excavation into the potentially unstable Shear Zone. Large mass of this material could become unstable requiring additional caution and monitoring. Construction staging may also need to be reviewed to reduce such risks. The issue is discussed further in the section titled 'Construction Advisories'.

<u>Retaining Wall No. 5</u>

The proposed cut wall will run along the northeastern edge of the northbound on-ramp. The excavation will result in vertical cuts up to 19 feet backed by 2H:1V slopes up to 16 feet high. Borings drilled north of Redwood Landfill Road along the proposed new northbound on-ramp (Borings A-09-001, R-09-112, R-09-113 and A-09-114) encountered rock (Franciscan Complex) at depths ranging from 3 to 18 feet below ground surface. The rock was identified as sandstone. The soils overlying the rock are generally medium dense to dense silty sand with gravel.

An existing cut slope is present in the general vicinity of the proposed wall, above the existing retaining wall along the northeastern edge of Rte 101. The exposed face of the cut slope indicates

the presence of intact rock (e.g. block-rich bimrock) for the most part (see Photo No. 4 in Appendix E). A large rock outcrop is present within the retaining wall alignment. The outcrop, identified as Franciscan chert (fch), appears to be a hard block, though it appears to be excavatable. Difficult excavation should be expected requiring specialized equipment. The wall alignment is assumed to be in Chert rock. Borings along the alignment (Borings 113 and 114) seem to indicate this.

A Soldier Pile-Lagging wall is recommended. The wall should be designed for the following parameters:

Effective Angle of Internal Friction (phi)	= 36 degrees
Wall Friction Angle (delta)	= 0 (per BDS)
Active Earth Pressure, Ka	= 0.41 (2:1 backslope in rock)
Soil Unit Weight	= 135 pcf
Cohesion	= 100 psf
Passive Earth Pressure Coeff. (Kp)	= 9.0 (for soldier pile in rock)
Passive Arching Capability	= 2.0 (for permanent walls, per B.D.S.)

Depending on the structural demands and to control top of the wall deflections, a tieback wall is proposed for a segment of the wall. This zone is near the center of the wall alignment between Sta. 336+92 and Sta. 338+54, where wall heights are 16 feet or the wall is in the vicinity of the Verizon Wireless Cellular Tower. Design recommendations for the tieback wall (single row of tiebacks) are presented in Plate 6A. Associated backup calculations are presented in Appendix C.

The design recommendations for tieback walls are based on Caltrans Bridge Design Specifications (BDS), Section 5 – Retaining Walls. The trapezoidal design lateral pressure diagram presented on Plate 6A is based on the following:

Unit Weight of Block-Rich Bimrock: 135 pcf; Phi angle = 36 degrees; Delta = 0

Other design input information is as follows:

- Unbonded Length = 15 feet (minimum) – based on AASHTO LRFD Design Manual as revised by Caltrans. Applicable unbonded lengths were calculated, based on the recommendations of the FHWA Manual, which considers the failure wedge behind the wall based on the friction angle of the material. Unbonded lengths for Wall No. 5 are presented on the Tieback Data Table in Plate 7B-1. Calculations for required unbonded lengths are presented in Appendix C.
- Ultimate Bond Strength in Block-Rich Bimrock = 80 psi (allowable = 40 psi) – Based on Recommendations for Prestressed Rock and Soil Anchors" by Post Tensioning Institute. (Table 6.1)
- Coefficient of Passive Resistance (Kp) = 9.0
- Maximum Pile Arching Capability = 2.0

  (effective width of passive pressure = 2 times effective width of soldier pile)
- Allowable Skin Friction for Soldier Piles = 2.0 ksf

Due to the presence of the Verizon Wireless Cellular Tower, it is required that seismic loading be incorporated in the design of the tieback wall. The following is recommended for seismic input for the design, based on the AASHTO LRFD Bridge Design Specifications with California Amendments:

Total Seismic Force P (in lb/ft) = $16H^2$ (where H = height of wall in feet)
(The total seismic force is distributed uniformly over the height of the wall.)

The total seismic force is based on the Mononobe-Okabe equation as modified by Seed and Whitman and a horizontal acceleration of 0.317g (0.5PGA) as recommended in the AASHTO specifications. A level ground behind the wall (i.e. no backslope) is assumed.

Pertinent information for Retaining Wall No. 5 were provided by the Structural Designer, which are presented in Plates 7B-1 and 7B-2. The plates include the following information:

- Pile Data Table, which includes the pile cut-off elevations and pile tip elevations for the soldier pile wall, including the tieback segment.
- Tieback Data Table, which includes only one tieback type in Plate 7B-1. The tieback type is offset 5 feet from the top of the wall. Required tieback force and unbonded length are also noted on the table.

The proposed cut will be very close to the existing Verizon Wireless Cellular Tower, which will impose additional (surcharge) loads on the wall. The surcharge load (as uniform pressure on the surface) should be multiplied by a factor of 0.3 and added to the active earth pressures as a uniform load over the height of the wall.

A cast-in-place concrete facing should be installed on the outer (roadside) face of the lagging. Adequate drainage should be provided behind the wall to reduce build-up of hydrostatic pressures.

Required excavation of the highly block-rich bimrock could pose problems for conventional equipment. The problem could be exacerbated if the blocks are larger than the equipment can handle. Special measures such as use of hoe-ram, jackhammer and in the extreme case, controlled blasting may be required. Drilling for soldier piles through the hard chert blocks could potentially pose additional difficulties. Core barrel drilling may be required. Hard drilling for tiebacks through the block-rich bimrocks should be expected.

Retaining Wall No. 7

The proposed cut wall runs along the western edge of the Northwest Frontage Road. The maximum height of the wall will be 12 feet with approximately a 3H:V slope behind the wall. The wall will cut across the toe lobe of a landslide deposit (see Plate D-4 in Appendix D). Three test pits (TP-168, 169 and 170) were excavated in the vicinity of the retaining wall alignment. The test pit depths ranged from 8 to 11 feet. The test pits encountered landslide deposits that are classified as clayey sands with minor gravel to silty sand and gravel. Near the bottom of the pits, large rock blocks (up to 30 inches) in soil matrix were encountered. A thin layer of gray brown

clay with slickensides (slide plane gouge) was encountered in TP-168 and TP-169, both to the south of the southern limit of the wall. The dip of the slide plane was into the slope. Slide plane gouge was not encountered in TP-170, which is within the north-south limits of the wall alignment, 50 feet to the west of the alignment. Nearest borings in the area (Borings A-09-135 and A-09-136) indicate medium dense to very dense silty and clayey sands, underlain by sandstone rock. The rock depths occur at 8-ft depth below ground surface in Boring A-10-136 and at 20-ft depth in Boring A-10-135. It is likely that the rock noted in the boring is actually a large boulder within the landslide deposit.

As indicated above, per geologic mapping, the wall will cut through the toe of a mapped landslide deposit. Per our geomorphic interpretation, the toe of the landslide deposits extends to the western edge of Route 101. From our cross-sectional interpretations, at the wall location the slide plane is probably 50 feet deep beneath the wall. This is about 15 feet beneath the highway.

Analyses were performed to investigate if the potential for slope instability in the landslide mass was exacerbated by the introduction of the cut for the retaining wall. Based on the terrain contours and other pertinent field observations, our engineering Geologist developed an initial (preslide) section and a zone for possible location for the slide plane. Analyses were first performed for this initial condition to recreate the slide plane and the shear strength characteristics of the slide plane material. Subsequently, the recreated failure plane and the strength characteristics were used to analyze (a) the existing profile at the wall location; and (b) the profile after the introduction of the proposed cut and wall. The factor of safety was found to be essentially unchanged due to the introduction of the wall, indicating that the proposed cut has no measurable impact on the stability of the slope. All analyses were performed using the SLOPE/W computer program. A more detailed discussion of the procedure of the analyses and the results of the analyses are presented in Appendix C. Based on these discussions, there is no intent to mitigate any potential “deep seated” movements. Investigations to locate the slide inferred from the geomorphic interpretation were therefore deemed unnecessary and was not pursued.

The proposed wall is to support the required cut for the roadway. A Caltrans Standard Type 1 wall is proposed. Based on the information from the relevant soil borings (A-09-135 and 136), the soils at the foundation level are dense to very dense silty and clayey sand. An allowable bearing capacity of 1.3B (ksf) is recommended, where the width of the footing is B (in feet). Thus, for the footing width of 7.25 feet for a standard 12-ft high Type 1 wall, the allowable bearing capacity is 9.4 ksf. A Caltrans Standard Type 1 on spread footing is therefore considered reasonable at this location, since, per Caltrans Standard Plans, the required toe pressure for a 12-ft high wall of 2.8 ksf is less than the recommended allowable bearing capacity.

Since the wall will be underlain by dense silty and clayey sands, total settlements, and consequently, differential settlements should be negligible.

Appropriate erosion protection should be provided for the backslope behind the wall. Suitable erosion protection measures are recommended in the section titled 'Erosion Control and Mitigation Measures'.

Erosion Control & Mitigation Measures

The proposed project will have cut slopes within alluvium and colluvium soils. Also there are proposed cuts that will expose debris flow deposits and landslide deposits. These materials are subject to erosion and slumping until they have been stabilized by established ground cover.

As part of the erosion mitigation it is recommended to construct lined surface drainage ditches at the top of all cut slopes five feet or greater in height to intercept the surface run off before it reaches the top of the cut slopes. It is also recommended to use slope rounding wherever possible to reduce the sharp cut edge at the top of the slope.

For surface treatment, it is recommended that the slopes be covered with erosion control material such as jute netting that is impregnated with grass seed. Other netting materials may also be used if preferred and approved by Caltrans. In addition, other types of plantings can be used that are able to establish quickly and have deeper root systems.

Subsurface Drainage Mitigation

In areas where there is potential for seepage to 'blow-out' from the slope cuts, it is recommended to install subsurface interceptor drains. These should be installed at the top of the cut slope just downslope of the lined surface drainage ditch. The intent of these drains is to collect and divert the subsurface seepage before it reaches the slope face. These interceptor drains are typically 18 inches wide and 7' to 8' deep. The typical drain backfill consists of Standard Class 1 permeable material wrapped in appropriate filter fabric with an 8" diameter perforated PVC pipe at the bottom. The top 18-24" of the surface of the drain is sealed with native soil.

In addition, subsurface drainage mitigation is recommended at the following location:

- Upslope of Retaining Wall No. 4 intersecting the wall at the approximate location 345+90 ("RLF" Line). Based on soil gradation, a Class C filter fabric is recommended for the location.

Corrosion Investigation

Three corrosion tests were performed on samples collected from borings relevant to the retaining walls. The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. A summary of the corrosion test results is presented in the table below (Corrosion tests on samples from relevant borings are highlighted).

SUMMARY OF CORROSION TEST RESULTS

Sample No.	Station (ft.) "N2R" Line	Offset (ft.)	Depth (ft)	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
A-09-114	341+00	80 Rt.	4	7500	4.10	4.1	8.0
A-09-129	334+95	295 Lt.	4.5	5360	5.18	1.9	13.4
A-09-135	349+45	215 Lt.	9.5	2680	4.23	6.4	57.1

Based on the data, the site subsoil is non-corrosive per Caltrans corrosion design guidelines, and standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructures. The minimum cement factor and cover thickness should be per Caltrans Bridge Design Specifications (Section 8.22).

CONSTRUCTION CONSIDERATIONS

Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19).

Engineered Fill. Engineered fill should be non-expansive and consist of relatively granular material having a P.I. of less than 15. In addition, we recommend that the material within 3 feet of the proposed pavement subgrade have minimum R-values of 15. The fill shall also be free of organic and inorganic debris, rubles and any other deleterious material. The on-site soils may be used as engineered fill, provided they meet the above criteria.

Construction Advisories

The project site is located along the existing Rte 101 and the Marin County roads. Therefore, traffic control is required to maintain traffic flow along Rte 101 and the other local streets. Several underground utilities exist at the site. The contractor should verify the utility lines, be aware of the existing conditions and plan the construction activities accordingly.

A significant portion of the construction will involve excavation of 'bimrocks' (see section titled "Bimrocks' for additional discussions). The Contractor should be prepared to deal with the very high degree of heterogeneity, both spatial and lithological, in the bimrock formations. He should in particular be prepared for very large and/or very hard blocks, which may not be easily excavatable using conventional equipment. (Jackhammers or even controlled blasting may be required). Hardness of the rocks may also result in very hard drilling for the soldier piles, and core barrel drilling may be required, particularly at Retaining Wall No. 5 location. Very hard drilling may also be encountered for tiebacks.

Contractor should also be prepared for the high probability of encountering potentially unstable formations during excavation such as block-poor bimrocks with weak matrix material, shear zones and serpentines (such as present in the Wall No. 4 location). Large mass of material could become unstable during excavation. The situation may require close monitoring and appropriate

additional precautions by the Contractor. Trapped water sources in the rock formations may suddenly be exposed during excavation and adequate, timely measures will be required. Serpentines are also often associated with naturally occurring asbestos (NOA), which is considered hazardous. Appropriate mitigation measures should be implemented if it is encountered.

The materials to be excavated may also consist of stiff to hard clay, medium dense to dense sand and weathered rock material. Localized subgrade pumping may be encountered during earthwork construction depending on the weather, moisture condition of the subsurface soils, and surface drainage conditions. Equipment mobility may also be difficult if the subgrade is wet. Under such circumstances, the subgrade soils may require reworking, moisture conditioning, aeration, or over-excavation and replacing with dry granular fill to facilitate earthwork construction. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. are located along the alignment. It might require special equipment and additional efforts to remove these buried objects.

Soft ground conditions near the ground surface are anticipated at the lower elevations in the areas of alluvial fans, where groundwater seepage and surface flows accumulate. This may lead to additional settlements and difficulties in equipment mobility if appropriate mitigation measures are not taken. Soft and/or saturated ground was encountered at several locations during the test pit excavations in January, 2011. We recommend that in areas designated for embankments for future roadway alignment, the soft and/or saturated material, if encountered, should be excavated to a minimum depth of 2 feet and removed and replaced with compacted fill to adjacent grade prior to construction of the embankment or the roadway. If the soft material persists after 2 feet of excavation, a layer of subgrade enhancement geotextile should be placed at the bottom of the excavation prior to placement of the compacted fill. This is primarily to facilitate mobility of equipment and to reduce future settlements from the saturated soils. Approximate footprints of potential areas of soft ground requiring overexcavation are presented in Appendix F of the Geotechnical Design and Materials Report (GDMR) for this project.

Prospective contractors for the project must be directed to evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other areas, or on the basis of field investigation on the site performed by them, taking into account their proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and State regulatory agencies.

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations is encountered this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

Differing Site Conditions

The soil conditions described in this report are based on available boring and test pit data and exposed cuts and rock outcrops. It should be noted that these borings and test pits depict subsurface conditions only at the locations explored. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface soil conditions could change between the explored locations. Due to the predominant presence of bimrocks at the project site, a high degree of variability in the subsurface than is generally encountered should be expected and planned for.

Early communication should be made between the Resident Engineer, the Contractor and the Geotechnical Engineer as soon as conditions that differ from those established in this report are

recognized by any of the parties. Additional recommendations could thereby be provided if such conditions arise.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed "Marin-Sonoma Narrows Contract B-1, Redwood Landfill Project" as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the Designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the

works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,

PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E., C54619
Senior Engineer

Gary Parikh, P.E., G.E., 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

James Baker, C.E.G., 1021 exp 10/2011
Engineering Geologist

REFERENCES

1. American Association of State Highway and Transportation Officials (AASHTO) "LRFD Bridge Design Specifications with California Amendments"

2. Blake, Jr., M.C.; Graymer, R.W.; and Jones, D.L.; 2000; Geologic Map and Map Database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California"; U. S. Geological Survey Miscellaneous Field Studies Map MF-2337 (1:75,000 scale)

3. California Department of Transportation, May 2006, Standard Plans.

4. California Department of Transportation, May 2006, Standard Specifications, Sections 1 through 95.

5. California Department of Transportation, Highway Design Manual, September 2006.

6. California Department of Transportation, Caltrans Deterministic PGA Map and ARS Online Report (2009)

7. Rice, S.J.; 1975; Geology for Planning, Novato Area, Marin County, California; California Division of Mines and Geology; Open-File Report 75-1 (Plate 1 - West: Geology Map, western part of the Novato Area; 1:12,000 scale)

8. United States Geological Survey (USGS), 2008, "The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2), by 2007 Working Group of Earthquake Probabilities, USGS Open File Report 2007-1437

9. Wagner, D..; Rice, S.R.; Bezore, S.; Randolph-Loar, C.E.; Allen, J.; and Witter, R.C.; 2002; Geologic Map of to Petaluma River 7.5' Quadrangle, Marin and Sonoma Counties, California: A Digital Database (1:24,000 scale)

AERIAL PHOTOGRAPHS

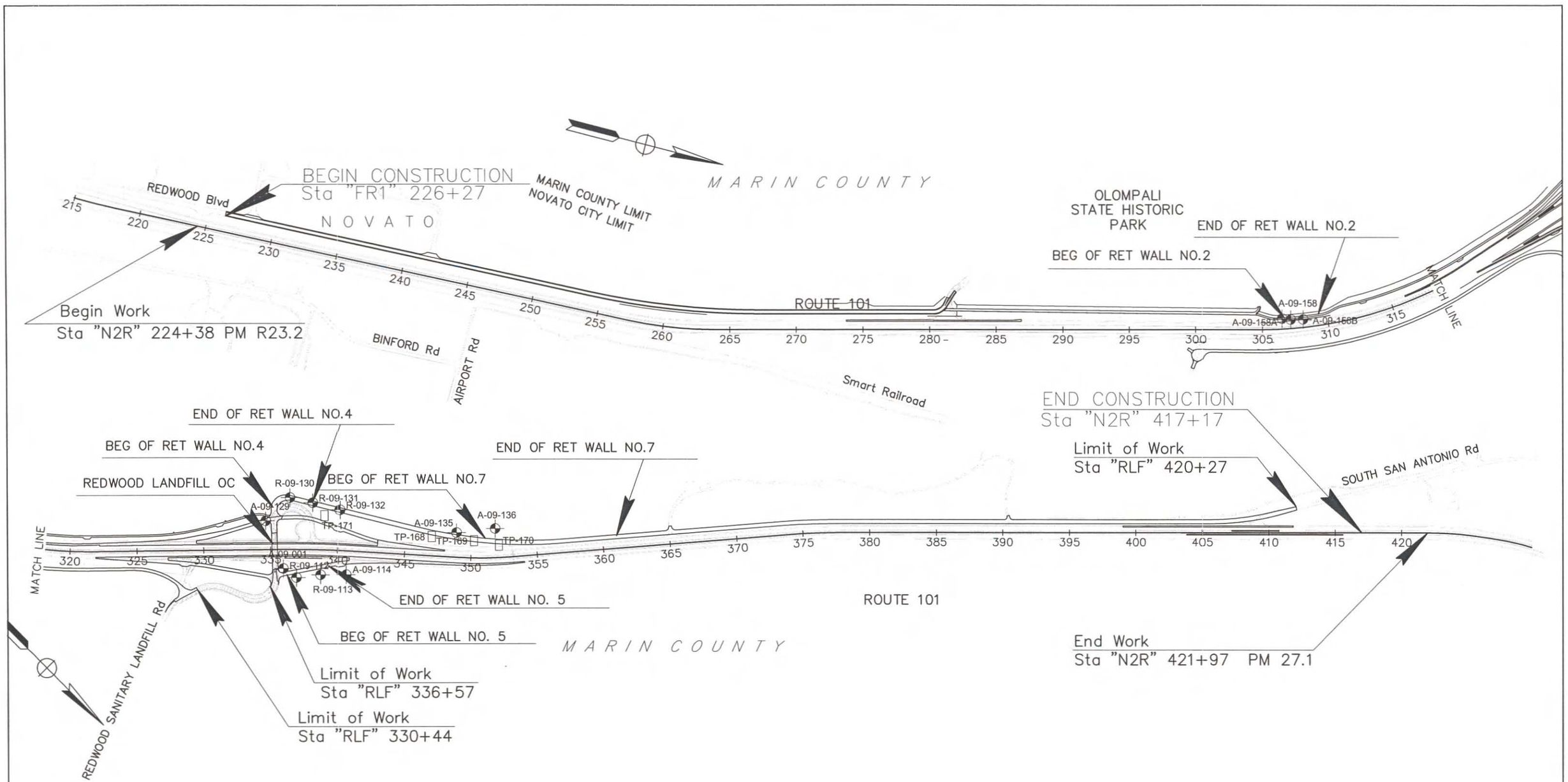
US Geological Survey Library; 7-3-1965; MRN 66-131, 132, and 133.
US Geological Survey Library; 5-3-1981; SCS – CHH – 1B – 155, 156, and 157.
US Geological Survey Library; 9-25-1973; SFB – 2 – 52 thru 55 (color).

PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: *208140.RET* | PLATE NO.: 1



LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

TP-171 — Test Pit Location

NOT TO SCALE

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.RET

PLATE NO: 2

SEE PLATE 2E

SEE PLATE 2G

Beg. Retaining Wall No. 2

End Retaining Wall No. 2

"BK" LINE

"N2R" LINE

"FR2" LINE

A-09-155

A-11-158A

A-11-158

A-11-158B

A-09-116

A-09-102

A-09-103

SITE PLAN

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2A

S:\ACAD\208140.GDR\RETAINING WALL.RET\Site Plan (Retaining Wall).dwg, 2AA, 8/17/2011 3:50:15 PM, \\PARIKH-FILE\HP5200

SEE PLATE 2G

SEE PLATE 2I

R-09-130

End Retaining Wall No. 4

R-09-131

Beg. Retaining Wall No. 4

B-B

TP-160

"BK" LINE

A-09-129

TP-B

TP-171

A-09-132

"RLF" LINE

A-09 133

TP-A

A-09-125

"RL4" LINE

A-09-122

TP-J

TP-C

TP-D

TP-172

A-09-134

"RL3" LINE

B-C

A-09-126

A-09-127

A-09-123

B-A

"N2R" LINE

A-09-124

A-09-128

9639-70P

TP-I

TP-H

Beg. Retaining Wall No. 5

B-D

A-09-114

A-09-115

A-09-081c

"RL1" LINE

A-09 110

"RL2" LINE

A-09-111

R-09-113

R-09-112

End Retaining Wall No. 5

Verizon Area
"RL2" LINE 337+00

LEGEND

A-09-149
Approx. Boring Location (Parikh 2010)

B-B
Approx. Boring Location (Miller Pacific Engineering Group 2002)

A-09-147
Approx. R-Value Boring Location (Parikh 2010)

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

Test Pit Location (Parikh 2010)

Test Pit Location (Miller Pacific Engineering Group-2002)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2B

S:\ACAD\208140.GDR\RETAINING WALL-RET\Site Plan (Retaining Wall).dwg, 2BB, 8/17/2011 13:54:24 PM, \\PARIKH-FILE\HP5200

SEE PLATE 2H

SEE PLATE 2J

A-09-135

A-09-136

TP-168

TP-169

Beg. Retaining Wall No. 7

End Retaining Wall No. 7

TP-170

A-09-137

A-09-138

"RLF" LINE

CPT-11-S-2

A-09-139

CPT-11-S-2

55861

"N2R" LINE

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

Test Pit Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

CPT-11-S2
Approx. CPT Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

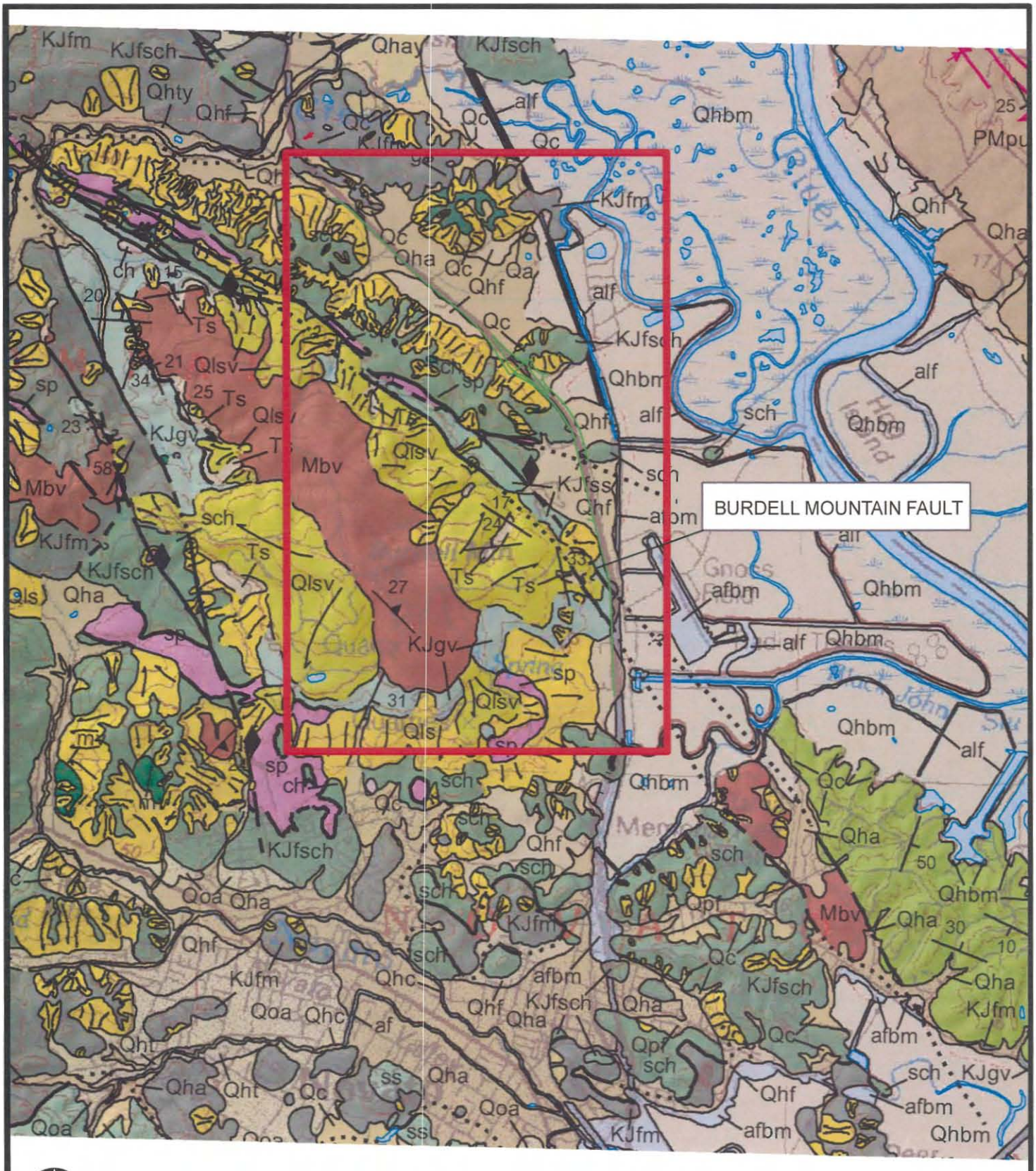
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2C

S:\ACAD\208140.GDR\RETAINING WALL.RET\Site Plan (Retaining Wall).dwg, 2CC, 8/17/2011 3:52:14 PM, \\PARIKH-FILE\HP5200



SOURCE: Wagner, et al; 2010

See Plate 3B for Explanation

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | **PLATE NO.:** 3A

EXPLANATION

CENOZOIC — QUATERNARY — Holocene

af	Artificial fill	afbm	Artificial fill placed over bay mud	adf	Artificial dam fill	alf	Artificial levee fill	ac	Artificial stream channel
Qhay	Latest Holocene alluvial deposits	Qhty	Latest Holocene stream terrace deposits	Qhly	Latest Holocene alluvial fan levee deposits	Qhfy	Latest Holocene alluvial fan deposits	Qhc	Latest Holocene stream channel deposits
Qhbm	Holocene estuarine deposits (bay mud)	Qht	Holocene stream terrace deposits	Qhl	Holocene alluvial fan levee deposits	Qhb	Holocene basin deposits	Qhed	Holocene estuarine deposits
Qha	Holocene alluvium	Qbmt	Bay mud and marine terrace deposits	Qhbs	Holocene beach sand	Qhf	Holocene alluvial fan deposits	Qhds	Holocene dune sand

CENOZOIC — QUATERNARY — Pleistocene

Qa	Alluvium (undivided)	Qm	Bay mud	Qds	Dune sand	Qf	Alluvial fan deposits	Qfc	Fan of Carriger Creek	Qtv	Travertine
Qpa	Pleistocene alluvium (undivided)	Qt	Stream terrace deposits	Qc	Colluvium	Qpf	Pleistocene alluvial fan deposits	Qls	Landslide deposit	Qg	Fluvial gravel
Qoc	Olema Creek Formation	Qml	Millerton Formation	Qtm	Marine terrace deposits	Qof	Alluvial fan deposits (old)	Qlsv	Landslide deposit (volcanic)		
Qoa	Alluvial deposits (old)	Qot	Stream terrace deposits (old)	Qop	Fan or terracel deposits (old)	Qofv	Alluvial fan deposits (old, volcanic)	Qols	Landslide deposit (old)	Qobs	Beach sand (old)

CENOZOIC — QUATERNARY — Pliocene

QPu	Gravel, sand, reworked tuff and clay	QPge	Glen Ellen Formation
Pth	Tehama Formation	Tgd	Sandstone, gravel and diatomite
Tsu	Unnamed sediments	Tss	Sandstone and volcanic gravel
Ph	Huichica Formation	Tdi	Diatomite
Tub	Unnamed basalt		
PMps	Purisima Formation		
Mwg	Wilson Grove Formation		
Mco	Sand and gravel of Cotati		
Mor	Orinda Formation		
Msc	Santa Cruz Mudstone		
Msm	Santa Margarita Sandstone		
Mbr	Briones sandstone (undivided)		
Tms	Marine sandstone and mudstone		
Mr	Rodeo Shale		
Mh	Hambre Sandstone		
Mti	Tice Shale		
Ml	Laird Sandstone		
Ms	Sobrante Sandstone	Msr	San Ramon Sandstone
Ts	Unnamed tuffaceous sediment	Mpb	Putnam Peak Basalt

Petaluma Formation: PMp | PMpu | Mpm | Mpl | Mpbr
- PMp - Undivided Petaluma Fm.
- PMpu - Upper Petaluma Fm.
- Mpm - Middle Petaluma Fm.
- Mpl - Lower Petaluma Fm.
- Mpbr - Silicic breccia

Tolay Volcanics: Mtvm | Mtvt | Mtvr
- Mtvm - Mafic volcanics
- Mtvt - Tuff
- Mtvr - Rhyolite to dacite flows and tuff

San Pablo Group: Msp | Mnr | Mc
- Msp - Undivided
- Mnr - Neroly Formation
- Mc - Cierbo Sandstone

Monterey Group: Mmy | Mmyd | Mmys
- Mmy - Undivided
- Mmyd - Diatomite
- Mmys - Sandstone and Tuffaceous sandstone

Mbv — Burdell Mountain volcanics

CENOZOIC — TERTIARY — Miocene

Ees	Escobar Sandstone of Weaver	Emk	Markley Sandstone	Emkj	Markley Sandstone Jameson Shale Member	Emr	Muir Sandstone of Weaver (1949)	Epr	Point Reyes Conglomerate of Galloway (1977)
Ed	Domengine Sandstone	Eeu	Unnamed mudstone, sandstone and siltstone	Esh	Shale	Ec	Capay Shale		
Rlj	Las Juntas Shale of Weaver	Ru	Unnamed sandstone, shale $us - Basal sandstone member	Rvh	Vine Hill Sandstone of Weaver (1949)	Rmz	Martinez Formation		
		TKfs	Coastal Belt Franciscan						

Nortonville Shale: Env | Envu | Envm | Envl
- Env - Gray-weathering, brown shale
- Envu - Upper member
- Envm - Middle member
- Envl - Lower member

CENOZOIC — MESOZOIC — CRETACEOUS

Kgd	Tonalite of Tomales Point	Kgv	Cretaceous Great Valley Sequence (undivided)	Ku	Upper Great Valley Sequence Kus - Massive sandstone				
Kgg	Porphyritic granodiorite of Point Reyes	Kush	Unnamed sandstone and shale	Kfo	Forbes Formation	Kg	Guinda Formation		
Kgr	Granodiorite and granite of Inverness Ridge	Kf	Funks Formation	Ks	Sites Formation	Ky	Yolo Formation		
		Kv	Venado Sandstone	Kn	Novato Conglomerate	Kl	Lower Great Valley Sequence		
		KJgv	Great Valley Sequence (undivided)	KJss	Ridge-forming sandstone	KJgvm	Melange in the lower Great Valley Sequence	KJssp	Detrital serpentine

Coast Range Ophiolite: Jk | Jgb | sp
- Jk - Volcanic rocks
- Jgb - Gabbro
- sp - Ultramafic rocks

Jk — Knoxville Formation

MESOZOIC — JURASSIC — Franciscan Complex

KJfss | KJfsch | KJfgs | KJfm

- KJfss - Sandstone and shale
- KJfsch - Schist and semischist
- KJgs - Greenstone
- KJfm - Melange

Blocks within the Franciscan Melange: ss | ch | gs | mg | mv | sch | sp | sc

- ss - Sandstone and shale
- ch - Chert and metachert
- gs - Greenstone and metagreenstone
- mg - Metagraywacke and graywacke
- mv - Metavolcanic rocks
- sch - Schist and semischist
- sp - Serpentinized ultramafic rocks
- sc - Silica carbonate rocks
- ◆ - Blueschist blocks

PzMz — Metamorphic rocks of uncertain age

Sonoma Volcanics

Tsv — Tsv - Sonoma Volcanics undivided

Tsvm — Tsvm - Mafic flows and breccia
- Psvasl - Andesite lava flows of Stags Leap
- Psvbsl - Andesite flow breccia of Stags Leap
- Psvatsl - Andesite ash flow tuff and tuff breccia of Stags Leap
- Pgisl - Stags Leap Stock
- Psvtt - Andesitic tuff and tuffaceous agglomerate of Tulucay Creek
- Psvbt - Basalt of Tulucay Creek
- Psvmb - Mafic flows of Bennett Mountain
- Tsva - Andesite lava flows
- Tsvg - Fluvial gravel, sand and silt
- Psvb - Basalt flows
- Psvbp - Basalt of Bouverie Preserve
- PMsvb - Basalt
- Msvbb - Basalt of Bismarck Knob
- Tsvdt - Andesitic to dacitic ash flow tuff
- Tsvh - Hyaloclastite
- Tsvib - Basalt plugs and dikes
- Tsvms - Mafic lava flows and intrusions of Sugarloaf Ridge
- Msvam - Andesite of Mission Highlands
- Msvas - Andesite of Shocken Hill

Tsvt — Tsvt- Sonoma Volcanics, tuff and sediments
- Ppt - Putah Tuff
- Psvrt - Rhyolite ash flow tuff
- Ptn - Tuff of Napa
- Psvtr - Tuff of Rockville
- Plt - Lawlor Tuff
- Psvpf - Ash flow tuff and welded ash flow tuff
- Msvtl - Tuff of Lovall Valley
- Msvtp - Tuff of Mt. Pisgah
- Tsvwt - Welded ash flow tuff
- Tsvmt - Ash flow tuff of Milliken Dam
- Tsvat - White pumiceous tuff of Atlas Peak
- Tsvtd - Air fall tuff
- Psvty - White pumiceous tuff
- Tsvtb - Tuff breccia
- Mpt - Pinole Tuff
- Mrt - Roblar tuff
- Mt - Tuff interbedded with the Wilson Grove Fm.
- Tt - Tuff
- Tsvft - Tuff and flows

Tsvr — Tsvr- Sonoma Volcanics, rhyolite flows, tuff and intrusive rocks
- Psvdg - Dacite of Mt. George
- Psvdgp - Pumice breccia
- Psvdgi - Gray porphyritic intrusions
- Psvbn - Breccia of Napa
- Tsvri - Intrusive rhyolite plugs and breccia
- Psvrb - Rhyolite of Bennett Mountain
- Psvrs - Soda rhyolite of Sugarloaf Ridge
- Msvra - Rhyolite of Adobe Canyon
- Msvfh - Dacitic lava flows of Huichica Creek
- Msvrb - Rhyolite of Bismarck Knob
- Msvr - Rhyodacite to dacite flows

MAP SYMBOLS

- Contact between map units - Solid where accurately located, dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain.
- Fault - Solid where accurately located, dashed where approximately located; short dash where inferred; dotted where concealed, queried where uncertain. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.
- Thrust Fault- Solid where accurately located; dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain. Barb located on upthrown block.
- Detatchment fault - Solid where accurately located, dashed where approximately located; dotted where concealed; hachures on upper plate.
- Zone of intense shearing along the Tolay Fault Zone.
- Anticline - Solid where accurately located, dashed where approximately located; dotted where concealed.
- Overturned Anticline - Solid where accurately located, dashed where approximately located.
- Syncline - Solid where accurately located, dashed where approximately located; dotted where concealed.
- Overturned Syncline - Solid where accurately located, dashed where approximately located; dotted where concealed.

Strike and dip of sedimentary beds:
- Inclined bedding
- Inclined bedding - Top direction of beds known from local features.
- Vertical bedding
- Horizontal bedding
- Overturned bedding
- Inclined bedding - Showing approximate strike and direction of dip.
- Strike and dip of foliation
- Strike and dip of volcanic flow unit
- Landslide - arrow indicates principal direction of movement, queried where existence is questionable (some geologic features are drawn within questionable landslides); hachured where headscarp is mappable.

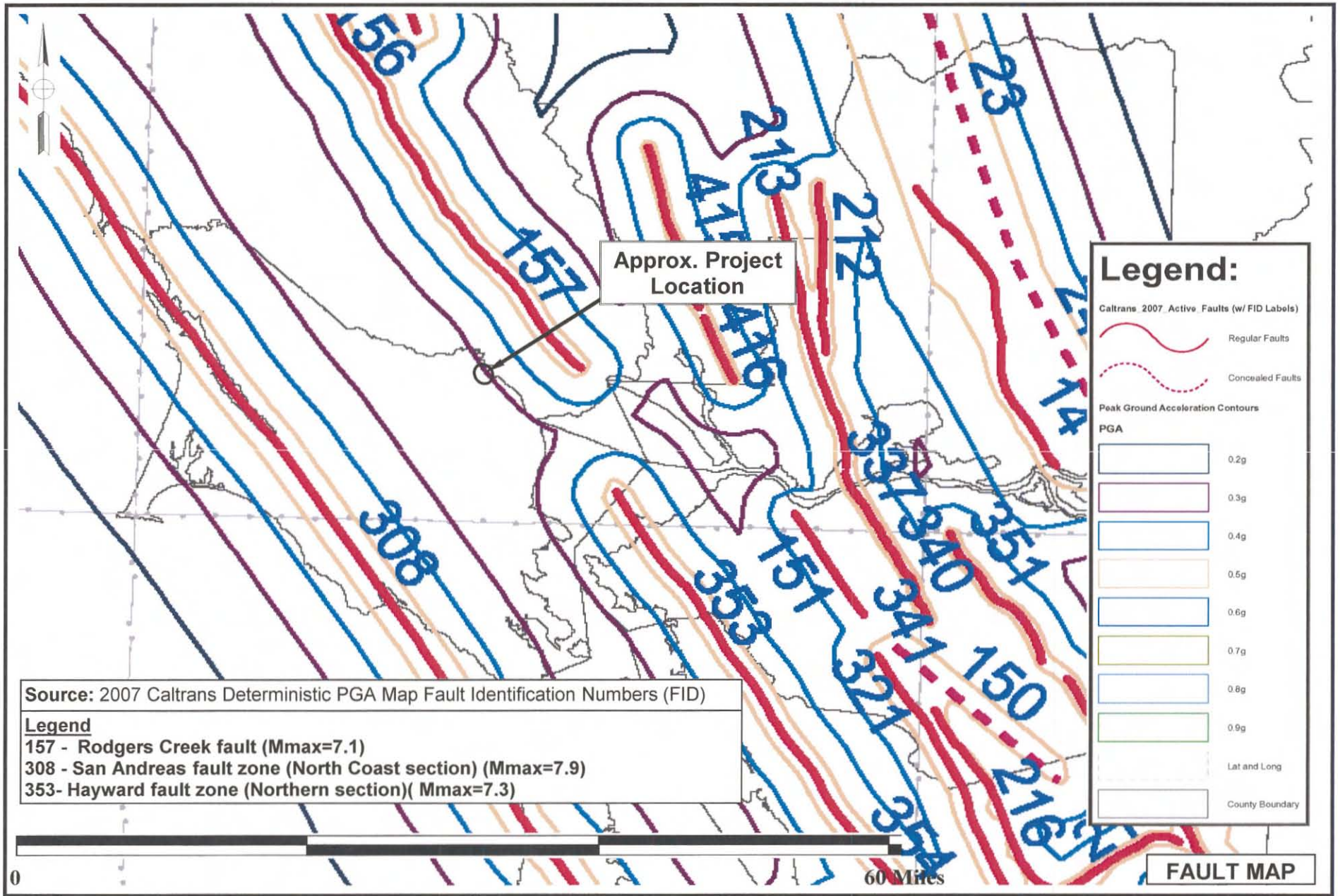
SOURCE: Wagner, et al; 2010

EXPLANATION FOR AREA GEOLOGIC MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: 3B



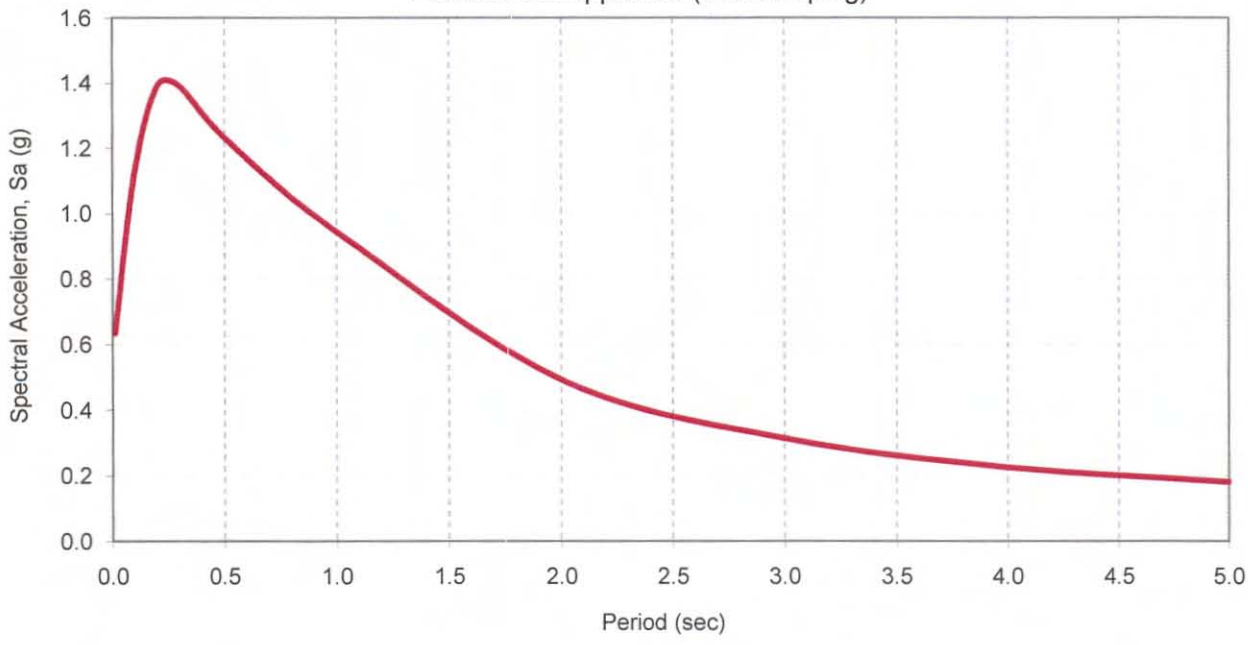
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: 4A

RECOMMENDED ARS CURVE

Probabilistic Approach (5% Damping)



Site Information

Latitude:	38.1631
Longitude	-122.5752
V_{S30} (m/s) =	400
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	5.9

Governing Curve:

Caltrans ARS Online Probablistic Curve

Recommended Response Spectrum

Period (sec)	Caltrans Online Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.634	1.000	1.000	0.634
0.1	1.135	1.000	1.000	1.135
0.2	1.391	1.000	1.000	1.391
0.3	1.39	1.000	1.000	1.390
0.5	1.233	1.000	1.000	1.233
1.0	0.787	1.200	1.000	0.944
2.0	0.411	1.200	1.000	0.493
3.0	0.262	1.200	1.000	0.314
4.0	0.188	1.200	1.000	0.226
5.0	0.151	1.200	1.000	0.181

Source:

1. Caltrans ARS Online tool (V.1.0.4, http://dap3.dot.ca.gov/shake_stable/)
2. USGS Deaggregation 2008 beta (http://eqint.cr.usgs.gov/deaggint/2008/index.php)
3. Caltrans Geotechnical Services Design Manual (Version 1.0)

Note:

Refer to "Probablistic Response Spectum Spreadsheet" (attached) for development of the recommended ARS curve.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL ENGINEERING
MATERIALS TESTING

MARIN SONOMA NARROWS CONTRACT B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

Project No.: 208140.GDR | **Plate No.: 4B**

Legend

Liquefaction Susceptibility (2006)

- Very High
- High
- Moderate
- Low
- Very Low
- Water
- not mapped

SOURCE: Witter, et al; 2006

Approximate Project Limits

0 250 500 1,000 1,500 2,000 2,500 3,000 Feet

Liquefaction Susceptibility Map

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: 5

PARIKH
Practicing in the Geosciences

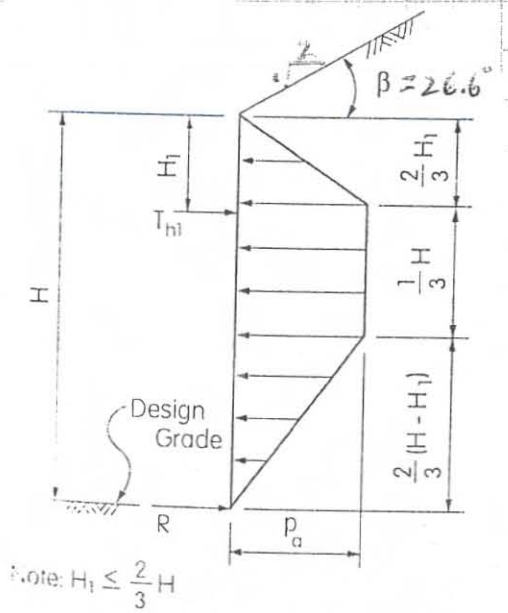
JOB 208140.10
SHEET NO ____ OF ____
CALCULATED BY P. Sircar DATE 2/10
CHECKED BY [illegible] DATE 2/10
SCALE ____

MSW - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4 & 5

(Tieback in Block-Rich Bimrock)

Lateral Earth Pressures



a) Wall with a single level of anchors

$P_a = 54\,H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

$\phi = 36°$

$\delta = 0$ (per BDS)

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum) - See Plates 7A & 7B

Ultimate Bond Strength = 80 psi (Allowable = 40 psi (FS=2))

Coefficient of Passive Pressure (K_p) = 9.0

Unit Weight = 135 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 × eff. width of soldier pile)

Allowable Unit Skin Friction (for Soldier Piles) = 2.0 Ksf

PARIKH
Practicing in the Geosciences

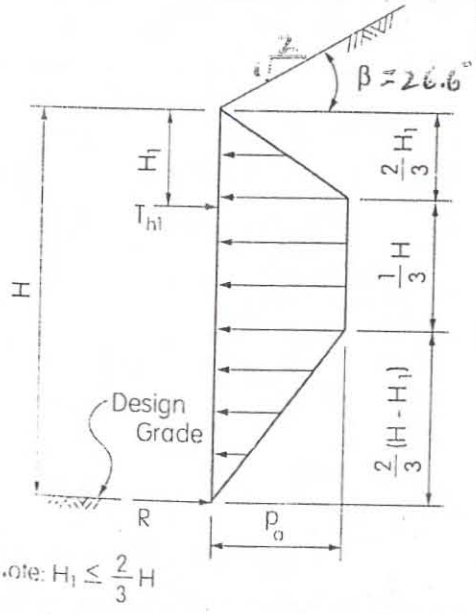
JOB 208140.10
SHEET NO ____ OF ____
CALCULATED BY P. Sircar DATE 2/11
CHECKED BY YDW DATE ____
SCALE ____

MSW - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4

(Tieback in Debris Flow (Block-Poor Bimrock)

Lateral Earth Pressures



Note: $H_1 \leq \frac{2}{3} H$

a) Wall with a single level of anchors

$P_a = 80\ H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

$\phi = 26°$

$\delta = 0$ (per BDS)

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum) - See Plate 7A

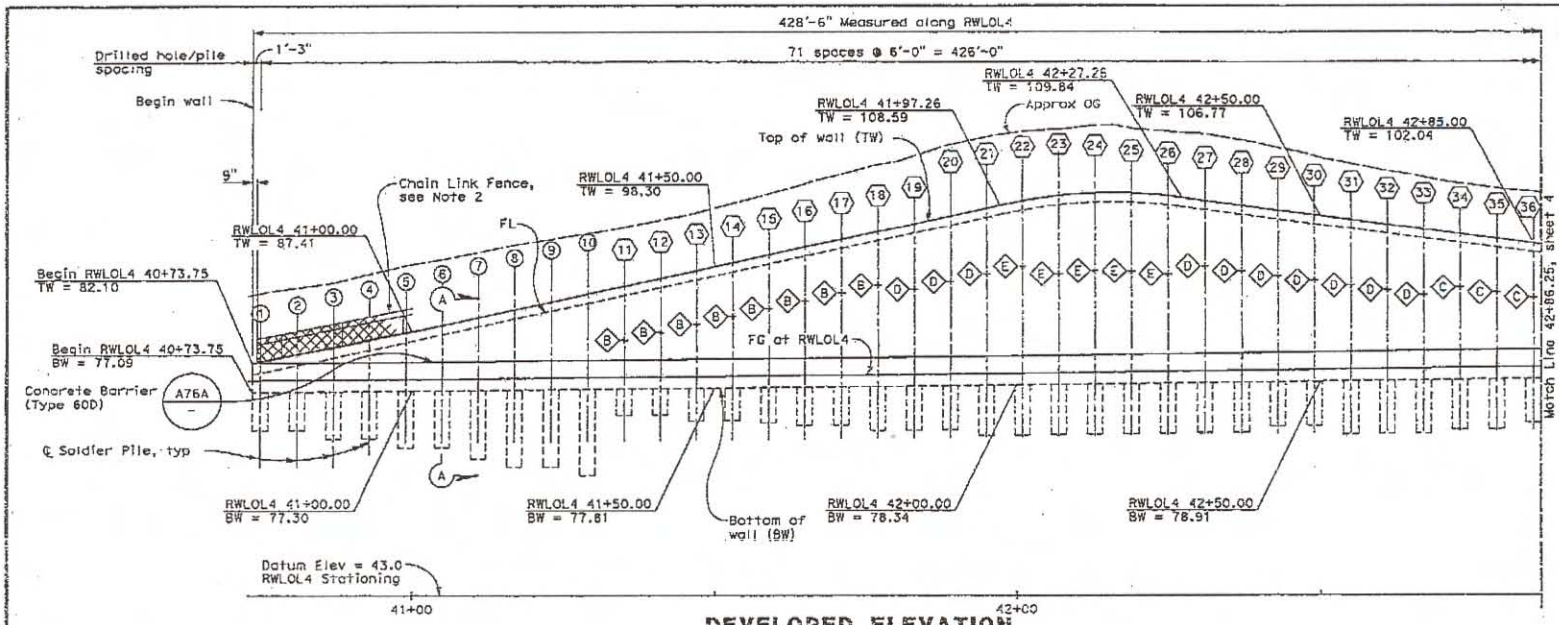
Ultimate Bond Strength = 40 psi (Allowable 2.0 psi (FS=2))

Coefficient of Passive Pressure (K_p) = 3.5

Unit Weight = 130 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 × eff. width of soldier pile)

Allowable Unit Skin Friction (for Soldier Piles) = 1.0 Ksf



DEVELOPED ELEVATION

1" = 10'

PILE DATA TABLE

Pile No.	STATION ALONG 'RWLOL4' LINE	PILE SECTION	TOP OF WALL (TW) ELEVATION	PILE CUT-OFF ELEVATION	PILE TIP ELEVATION
BEG WALL	40+73.75		81.69		
①	40+75.00	W21x44	81.96	80.00	70.60
②	40+81.00	W21x44	83.27	81.30	70.65
③	40+87.00	W21x44	84.58	82.60	69.20
④	40+93.00	W21x44	85.88	83.90	69.25
⑤	40+99.00	W21x44	87.19	85.20	67.79
⑥	41+05.00	W21x44	88.50	86.50	65.85
⑦	41+11.00	W21x68	89.81	87.80	65.91
⑧	41+17.00	W21x68	91.11	89.10	64.47
⑨	41+23.00	W21x68	92.42	90.40	64.53
⑩	41+29.00	W21x101	93.73	91.70	63.10
⑪	41+35.00	(2) W18x35	95.03	93.00	72.66
⑫	41+41.00	(2) W18x35	96.34	94.30	72.72
⑬	41+47.00	(2) W18x35	97.65	95.60	72.28
⑭	41+53.00	(2) W18x35	98.95	96.90	72.34
⑮	41+59.00	(2) W18x35	100.25	98.20	71.91
⑯	41+65.00	(2) W18x35	101.56	99.60	71.47
⑰	41+71.00	(2) W18x35	102.86	100.90	71.53
⑱	41+77.00	(2) W18x60	104.16	102.20	70.60
⑲	41+83.00	(2) W18x60	105.47	103.50	70.66
⑳	41+89.00	(2) W18x60	106.77	104.80	70.72
㉑	41+95.00	(2) W18x60	108.07	106.10	69.79
㉒	42+01.00	(2) W18x60	109.32	107.30	69.85
㉓	42+07.00	(2) W18x60	110.16	108.20	69.92
㉔	42+13.00	(2) W18x60	110.57	108.60	69.99
㉕	42+19.00	(2) W18x60	110.55	108.50	70.06
㉖	42+25.00	(2) W18x60	110.11	108.10	70.13
㉗	42+31.00	(2) W18x60	109.34	107.30	70.19
㉘	42+37.00	(2) W18x60	108.53	106.50	70.26
㉙	42+43.00	(2) W18x60	107.72	105.70	71.33
㉚	42+49.00	(2) W18x60	106.91	104.90	71.40
㉛	42+55.00	(2) W18x60	106.09	104.10	69.97
㉜	42+61.00	(2) W18x60	105.28	103.30	70.04
㉝	42+67.00	(2) W18x60	104.47	102.50	70.11
㉞	42+73.00	(2) W18x60	103.66	101.70	70.69
㉟	42+79.00	(2) W18x60	102.85	100.80	70.76
㊱	42+85.00	(2) W18x60	102.04	100.00	71.83
MAT LINE	42+86.25		101.90		

TIEBACK DATA TABLE

TIEBACK TYPE	TIEBACK FORCE (kips)	TIEBACK OFFSET FROM TOP OF WALL 'a' (ft)	UNBONDED LENGTH (ft)
Ⓐ	140	7'-0"	15'-0"
Ⓑ	140	9'-0"	15'-0"
Ⓒ	210	9'-0"	15'-0"
Ⓓ	210	11'-0"	15'-6"
Ⓔ	210	13'-0"	15'-6"

LEGEND:

① Denotes soldier pile no., see 'PILE DATA TABLE'

⑮ Denotes tieback pile no., see 'PILE DATA TABLE'

Ⓑ Denotes tieback type. See 'TIEBACK DATA TABLE'

\+ Denotes tieback location, see 'SECTION A'-A' on 'RETAINING WALL DETAILS No. 1' sheet

NOTES:

1. For 'SECTION A-A' see 'RETAINING WALL DETAILS No. 1' sheet
2. Install chain link fence full length of wall
3. Pile cut-off elevation shown is approximate. Verify with grading shown on Road Plans

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/23/11)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER ANTHONY P. NOTARO No. C51738 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

DESIGN	BY G. JEYARAMAN	CHECKED G. KENNING	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	ANTHONY P. NOTARO PROJECT ENGINEER	BRIDGE NO. 27E0030
DETAILS	BY G. JEYARAMAN	CHECKED J. VISAYA			POST MILES 25.5
QUANTITIES	BY P. GONGIDI	CHECKED K. CRUZ			

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 9-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

RETAINING WALL No. 4

RETAINING WALL LAYOUT No. 1

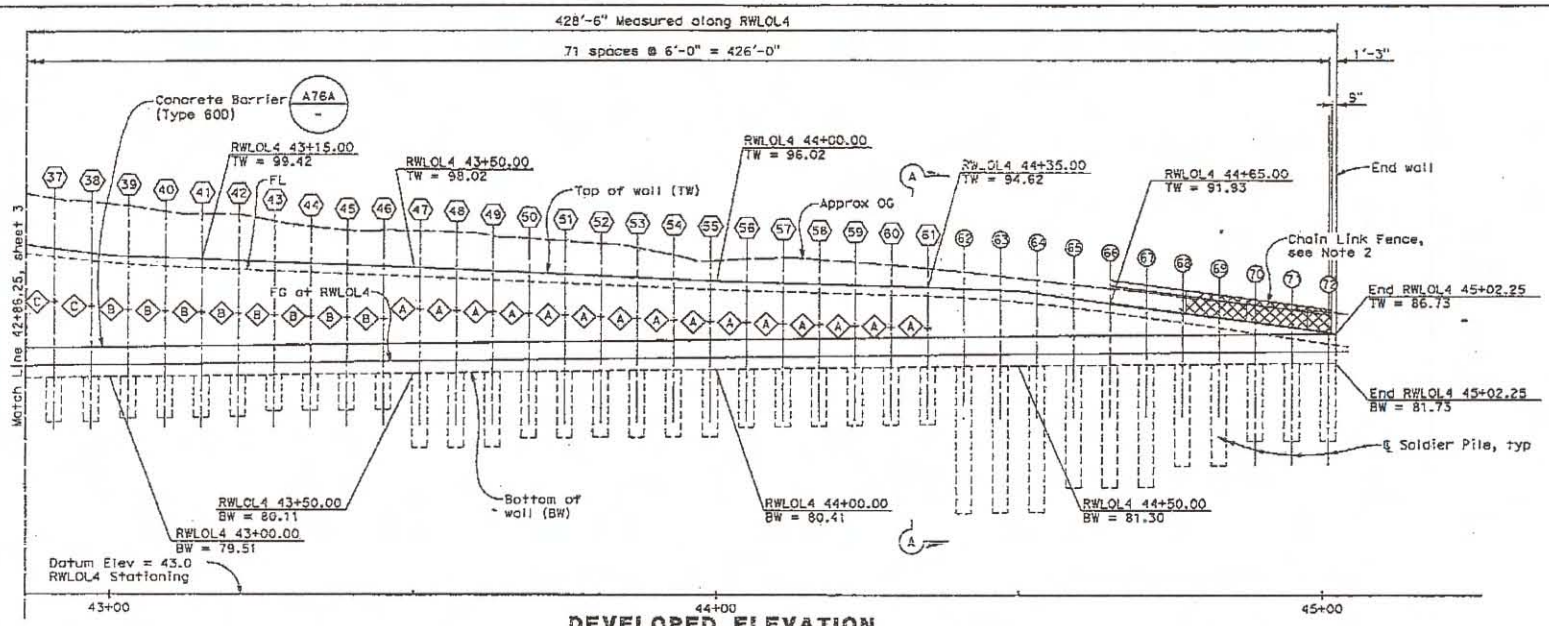
SHEET 3 OF 11

DATE PLOTTED => 8/23/11

TIME PLOTTED => 11:06

USERNAME => gkenn

Plate 7-A-1



DEVELOPED ELEVATION

1" = 10'

PILE DATA TABLE

Pile No.	STATION ALONG 'RWLOL4' LINE	PILE SECTION	TOP OF WALL (TW) ELEVATION	PILE CUT-OFF ELEVATION	PILE TIP ELEVATION
MAT LINE	42+86.25	-	101.90		
37	42+91.00	(2) W18x60	101.29	99.30	71.90
38	42+97.00	(2) W18x60	100.66	98.70	71.97
39	43+03.00	(2) W18x35	100.12	98.10	72.55
40	43+09.00	(2) W18x35	99.71	97.70	72.62
41	43+15.00	(2) W18x35	99.42	97.40	72.69
42	43+21.00	(2) W18x35	99.18	97.20	72.76
43	43+27.00	(2) W18x35	98.94	96.90	73.83
44	43+33.00	(2) W18x35	98.70	96.70	73.91
45	43+39.00	(2) W18x35	98.46	96.50	73.98
46	43+45.00	(2) W18x35	98.22	96.20	74.05
47	43+51.00	(2) W18x35	97.98	96.00	67.62
48	43+57.00	(2) W18x35	97.74	95.70	67.65
49	43+63.00	(2) W18x35	97.50	95.50	67.69
50	43+69.00	(2) W18x35	97.26	95.30	68.22
51	43+75.00	(2) W18x35	97.02	95.00	69.26
52	43+81.00	(2) W18x35	96.78	94.80	69.30
53	43+87.00	(2) W18x35	96.54	94.50	69.33
54	43+93.00	(2) W18x35	96.30	94.30	69.37
55	43+99.00	(2) W18x35	96.06	94.10	69.40
56	44+05.00	(2) W18x35	95.82	93.80	69.5
57	44+11.00	(2) W18x35	95.58	93.60	69.61
58	44+17.00	(2) W18x35	95.34	93.30	69.71
59	44+23.00	(2) W18x35	95.10	93.10	69.82
60	44+29.00	(2) W18x35	94.86	92.90	69.93
61	44+35.00	(2) W18x35	94.62	92.60	70.03
62	44+41.00	W21x101	94.31	92.30	56.64
63	44+47.00	W21x101	93.88	91.90	56.75
64	44+53.00	W21x101	93.32	91.30	56.82
65	44+59.00	W21x68	92.64	90.60	56.87
66	44+65.00	W21x68	91.82	89.80	60.92
67	44+71.00	W21x68	90.94	88.90	60.97
68	44+77.00	W21x44	90.07	88.10	64.52
69	44+83.00	W21x44	89.19	87.20	64.57
70	44+89.00	W21x44	88.32	86.30	68.62
71	44+95.00	W21x44	87.44	85.40	68.67
72	45+01.00	W21x44	86.56	84.60	68.72
END WALL	45+02.25		86.38	-	-

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER ANTHONY P. NOTARO No. C51739 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

NOTE:

For notes and legend, see 'RETAINING WALL LAYOUT No. 1' sheet

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/23/11)

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 6-01-03)

	BY	CHECKED
DESIGN	G. JEYARAMAN	G. KENNING
DETAILS	G. JEYARAMAN	CHECKED J. VISAYA
QUANTITIES	P. GONGIDI	CHECKED K. CRUZ

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ANTHONY P. NOTARO
PROJECT ENGINEER

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331

BRIDGE NO. 27E0030
POST MILES 25.5

RETAINING WALL No. 4
RETAINING WALL LAYOUT No. 2

DISREGARD PRINTS BEARING EARLIER REVISION DATES

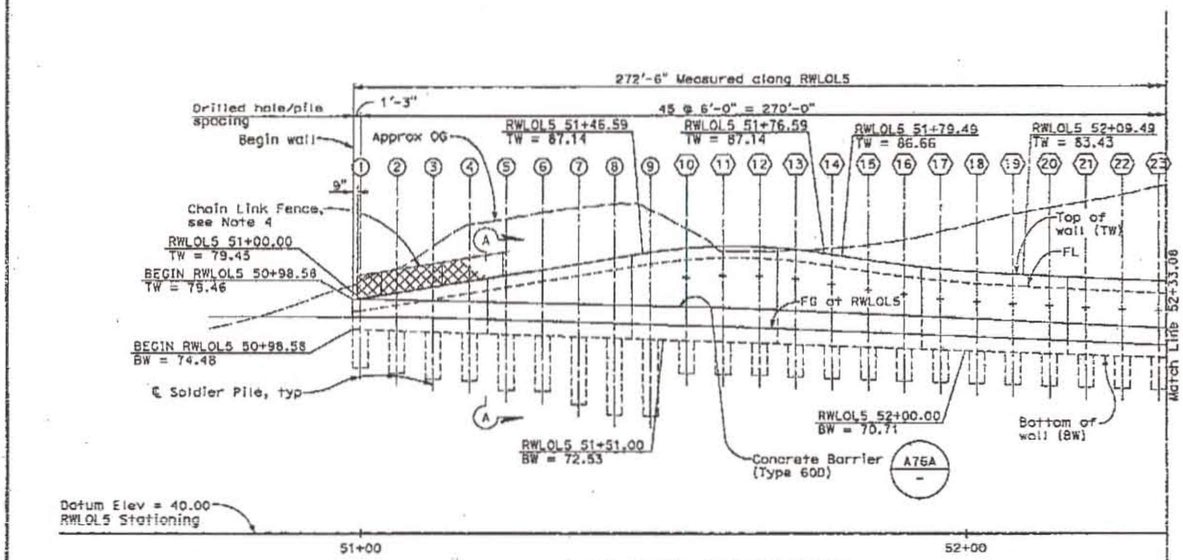
REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 4 OF 11

DATE PLOTTED => 8/24/11

USERNAME => USER

Plate 7-A-2



MIRRORED ELEVATION

1" = 10'

LEGEND:

(1) Denotes soldier pile no., see 'PILE DATA TABLE'

⟨15⟩ Denotes tieback pile no., see 'PILE DATA TABLE'

\+ Denotes tieback location. See 'TYPICAL SECTION' on 'RETAINING WALL DETAILS No. 1' sheet

NOTES:

1. For 'SECTION A-A' see 'RETAINING WALL DETAILS No. 1' sheet
2. For locations of wall expansion and weakened plane joints, see 'GENERAL PLAN' sheet
3. For architectural details not shown, see 'AESTHETIC TREATMENT DETAILS No. 1' & 'AESTHETIC TREATMENT DETAILS No. 2' sheets
4. Install chain link fence full length of wall
5. Pile cut-off elevation shown is approximate. Verify with grading shown on Road Plans

PILE DATA TABLE

Pile No.	STATION ALONG 'RWLOL5' LINE	PILE SECTION	TOP OF WALL (TW) ELEVATION	PILE CUT-OFF ELEVATION	PILE TIP ELEVATION
BEG WALL	50+98.58		79.22		
(1)	50+99.83	W21x44	79.43	76.90	67.93
(2)	51+05.83	W21x44	80.42	77.90	67.71
(3)	51+11.83	W21x44	81.41	78.90	65.99
(4)	51+17.83	W21x44	82.40	79.90	65.76
(5)	51+23.83	W21x44	83.39	80.90	64.04
(6)	51+29.83	W21x44	84.38	81.90	63.82
(7)	51+35.83	W21x68	85.37	82.90	61.59
(8)	51+41.83	W21x68	86.36	83.90	59.87
(9)	51+47.83	W21x68	87.34	84.80	59.65
⟨10⟩	51+53.83	(2)W18x35	88.05	85.50	66.92
⟨11⟩	51+59.83	(2)W18x35	88.36	85.90	66.70
⟨12⟩	51+65.83	(2)W18x35	88.28	85.80	66.48
⟨13⟩	51+71.83	(2)W18x35	87.80	85.30	66.26
⟨14⟩	51+77.83	(2)W18x35	86.94	84.40	66.03
⟨15⟩	51+83.83	(2)W18x35	85.98	83.50	65.81
⟨16⟩	51+89.83	(2)W18x35	85.16	82.70	65.59
⟨17⟩	51+95.83	(2)W18x35	84.48	82.00	65.36
⟨18⟩	52+01.83	(2)W18x35	83.93	81.40	65.14
⟨19⟩	52+07.83	(2)W18x35	83.52	81.00	64.92
⟨20⟩	52+13.83	(2)W18x35	83.22	80.70	64.69
⟨21⟩	52+19.83	(2)W18x35	82.92	80.40	64.47
⟨22⟩	52+25.83	(2)W18x35	82.62	80.10	64.25
⟨23⟩	52+31.83	(2)W18x35	82.32	79.80	64.02
MAT LINE	52+33.08		82.26		

TIEBACK DATA TABLE

TIEBACK FORCE (kips)	TIEBACK OFFSET FROM TOP OF WALL 'a' (ft)	UNBONDED LENGTH (ft)
70	5'-0"	18'-0"

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER ANTHONY P. NOTARO No. C51739 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/23/11)

DESIGN	BY G. JEYARAMAN	CHECKED G. KENNING
DETAILS	BY G. JEYARAMAN	CHECKED J. VISAYA
QUANTITIES	BY P. GONGIDI	CHECKED K. CRUZ

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 6-01-03)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ANTHONY P. NOTARO
PROJECT ENGINEER

BRIDGE NO. 27E0031
POST MILES 25.5

RETAINING WALL No. 5

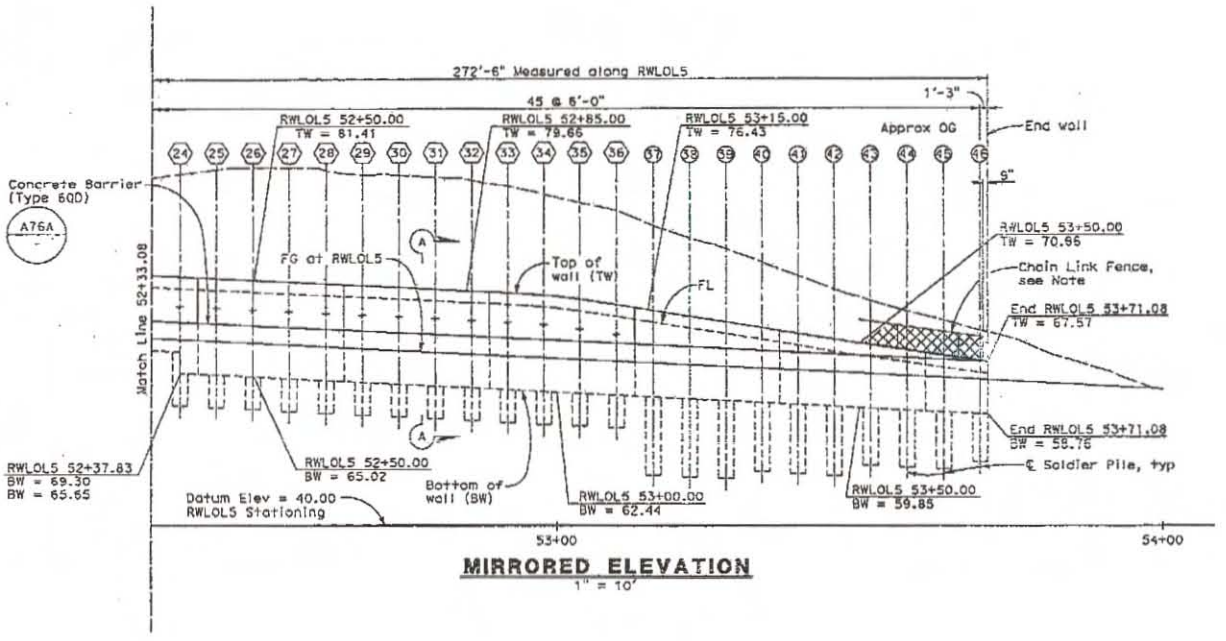
RETAINING WALL LAYOUT No. 1

UNIT: 0718
PROJECT NUMBER & PHASE: 04000007331

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/18/10 3/21/11 5/20/11 8/19/11

SHEET 3 OF 13



MIRRORED ELEVATION
1" = 10'

NOTE:
For notes and legend, see 'RETAINING WALL LAYOUT No. 1' sheet

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER ANTHONY P. NOTARO No. C61739 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

PILE DATA TABLE

Pile No.	STATION ALONG 'RWLOL5' LINE	PILE SECTION	TOP OF WALL (TW) ELEVATION	PILE CUT-OFF ELEVATION	PILE TIP ELEVATION
MAT LINE	52+33.08		82.26		
24	52+37.83	(2)W18x35	82.02	79.50	60.15
25	52+43.83	(2)W18x35	81.72	79.20	59.84
26	52+49.83	(2)W18x35	81.42	78.90	59.53
27	52+55.83	(2)W18x35	81.12	78.60	59.22
28	52+61.83	(2)W18x35	80.82	78.30	58.91
29	52+67.83	(2)W18x35	80.52	78.10	58.60
30	52+73.83	(2)W18x35	80.22	77.70	58.29
31	52+79.83	(2)W18x35	79.92	77.40	57.98
32	52+85.83	(2)W18x35	79.62	77.10	57.67
33	52+91.83	(2)W18x35	79.23	76.70	57.36
34	52+97.83	(2)W18x35	78.70	76.20	57.05
35	53+03.83	(2)W18x35	78.04	75.50	56.74
36	53+09.83	(2)W18x35	77.24	74.70	56.43
37	53+15.83	W21x68	76.30	73.80	48.62
38	53+21.83	W21x68	75.31	72.80	48.31
39	53+27.83	W21x68	74.32	71.80	48.00
40	53+33.83	W21x68	73.33	70.80	49.19
41	53+39.83	W21x68	72.34	69.80	48.88
42	53+45.83	W21x68	71.35	68.80	48.57
43	53+51.83	W21x68	70.36	67.90	50.26
44	53+57.83	W21x68	69.37	66.90	49.95
45	53+63.83	W21x68	68.38	65.90	49.63
46	53+69.83	W21x44	67.39	64.90	50.82
END WALL	53+71.08		67.18		

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/23/11)

DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN DETAIL SHEET REVISIONS (REV. 6-01-09)

DESIGN BY G. JEYARAMAN CHECKED G. KENNING
DETAILS BY G. JEYARAMAN CHECKED J. VISAYA
QUANTITIES BY P. GONGIDI CHECKED K. CRUZ

ORIGINAL SCALE IN INCHES FOR REVISED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ANTHONY P. NOTARO
PROJECT ENGINEER

BRIDGE NO. 27E0031
POST MILES 25.5

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331

DESIGNATED PRIMES REGARDING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

RETAINING WALL No. 5
RETAINING WALL LAYOUT No. 2

SHEET 4 OF 13

Plate 7-B-2

APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL — DATE 10/03/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

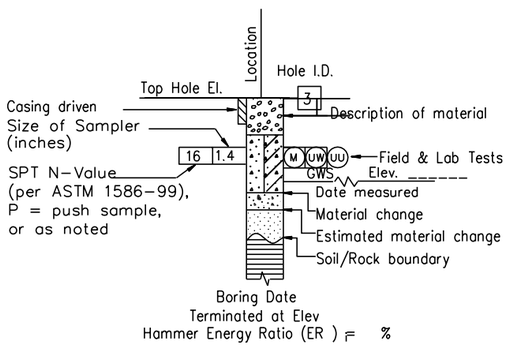
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring (hollow or solid stem bucket)
Size	R RW RC P	Rotary drilled boring (conventional) Rotary drilled with self-casing wire-line Rotary core with continuously-sampled, self-casing wire-line Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778)
□	O	Other (note on LOTB)

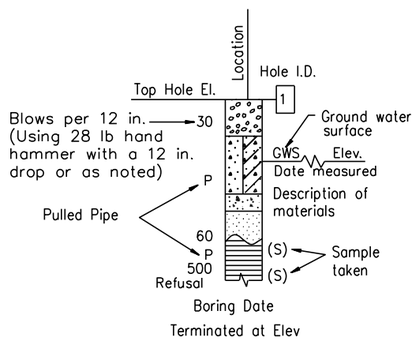
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

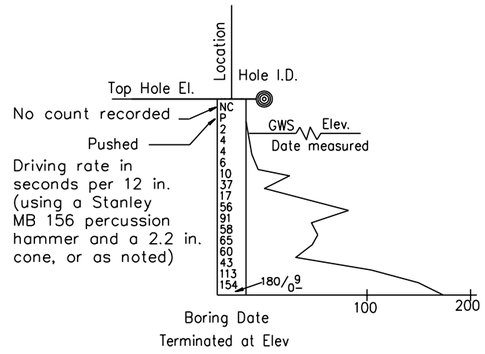
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 – 0.25	0.25 – 0.5	0.12 – 0.25	0.12 – 0.25
Medium Stiff	0.25 – 0.5	0.5 – 1	0.25 – 0.5	0.25 – 0.5
Stiff	0.5 – 1	1 – 2	0.5 – 1	0.5 – 1
Very Stiff	1 – 2	2 – 4	1 – 2	1 – 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



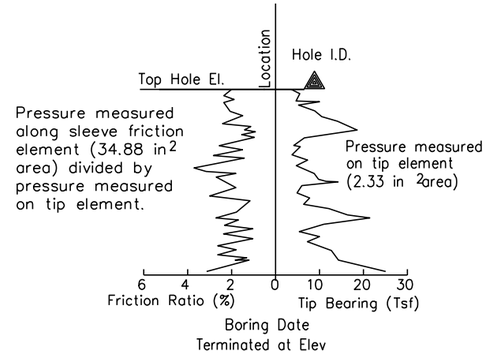
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	BRIDGE NO. -	LEGEND SHEET NO. 1
SIGN OFF DATE	CHECKED BY	P. SIRCAR	DATE: JUNE 2009 – JANUARY 2011			POST MILES -	LOG OF TEST BORINGS 1 OF 7

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-264074

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF
10/03/11					

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content–% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R–Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression–Soil (ASTM D 2166) Unconfined Compression–Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL — DATE 10/03/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT — SIGN OFF DATE

DRAWN BY: O. GOUTHIER — CHECKED BY: P. SIRCAR

FIELD INVESTIGATION BY: S. DUDDU — DATE: JUNE 2009 – JANUARY 2011

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR — PROJECT ENGINEER

BRIDGE NO. –

POST MILES –

LEGEND SHEET NO. 2

LOG OF TEST BORINGS 2 OF 7

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-264074

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
10/03/11					

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

Gary Parikh 10/03/11
GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA

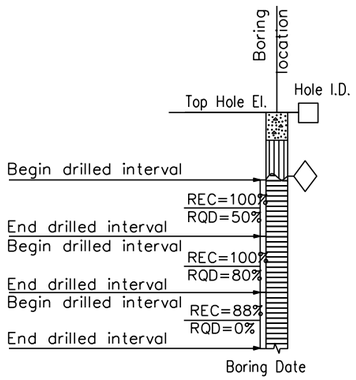
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PERCENT CORE RECOVERY (REC) + ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4"}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 – 30,000
Strong	7,000 – 14,500
Medium Strong	3,500 – 7,000
Weak	700 – 3,500
Very Weak	150 – 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3–5/8" to 1 ft
Thinly bedded	1–1/4" to 3–5/8"
Very thinly bedded	3/8" to 1–1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features: Chemical Weathering–Discoloration and/or oxidation: Body of Rock	Chemical Weathering–Discoloration and/or oxidation: Fracture Surfaces	Mechanical Weathering–Grain boundary conditions (disaggregation) primarily for granitics and some coarse–grained sediments	Texture and Solutioning: Texture	Texture and Solutioning: Solutioning	General Characteristics
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe–Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe–Mg minerals are altered to clay to some extent; or chemical alteration produces in–situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe–Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

DESIGN OVERSIGHT
SIGN OFF DATE
DRAWN BY: O. GOUTHIER
CHECKED BY: P. SIRCAR
S. DUDDU
FIELD INVESTIGATION BY:
DATE: JUNE 2009 – JANUARY 2011

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

LEGEND SHEET NO. 3
LOG OF TEST BORINGS 3 OF 7

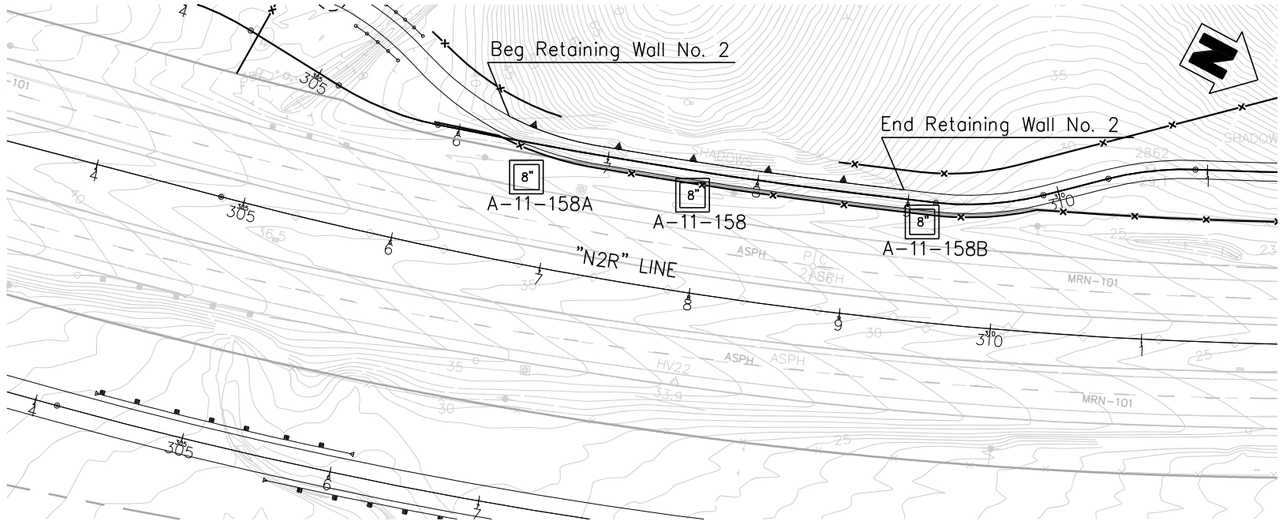
GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04–264074

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
10/03/11					



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL — DATE 10/03/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

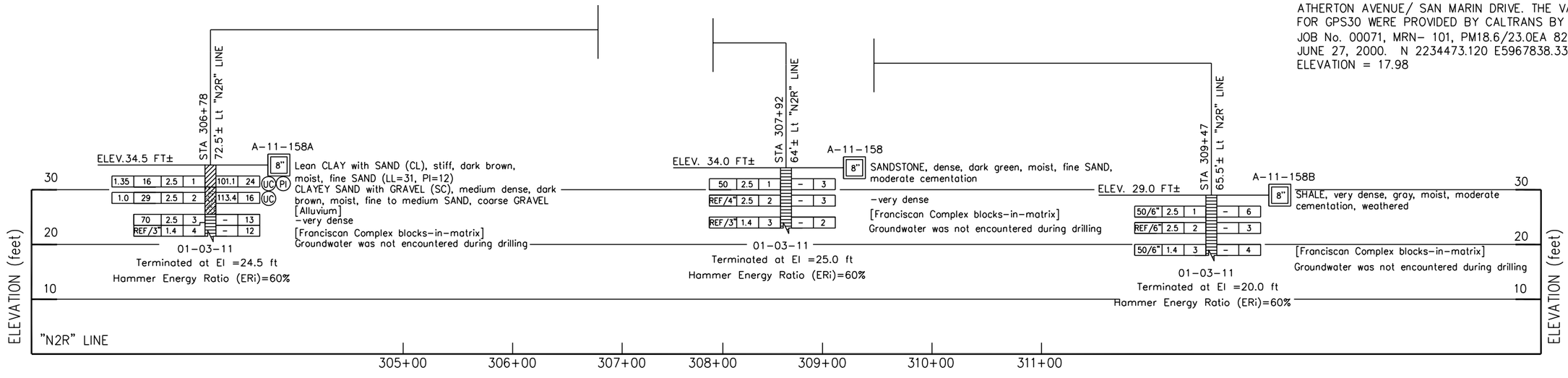
TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

BENCHMARK: %%U BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000. N 2234473.120 E5967838.330 ELEVATION = 17.98



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	RETAINING WALL NO. 2
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – JANUARY 2011		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS 4 OF 7

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
10/03/11					

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL — 10/03/11 DATE

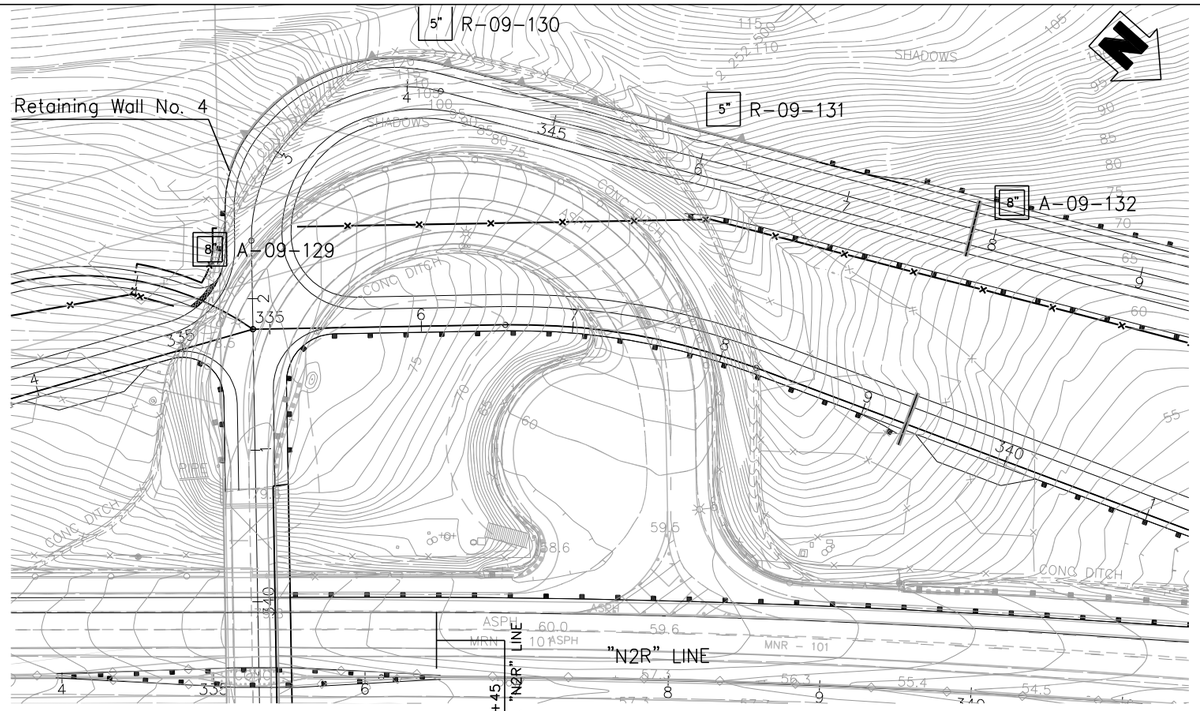
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901



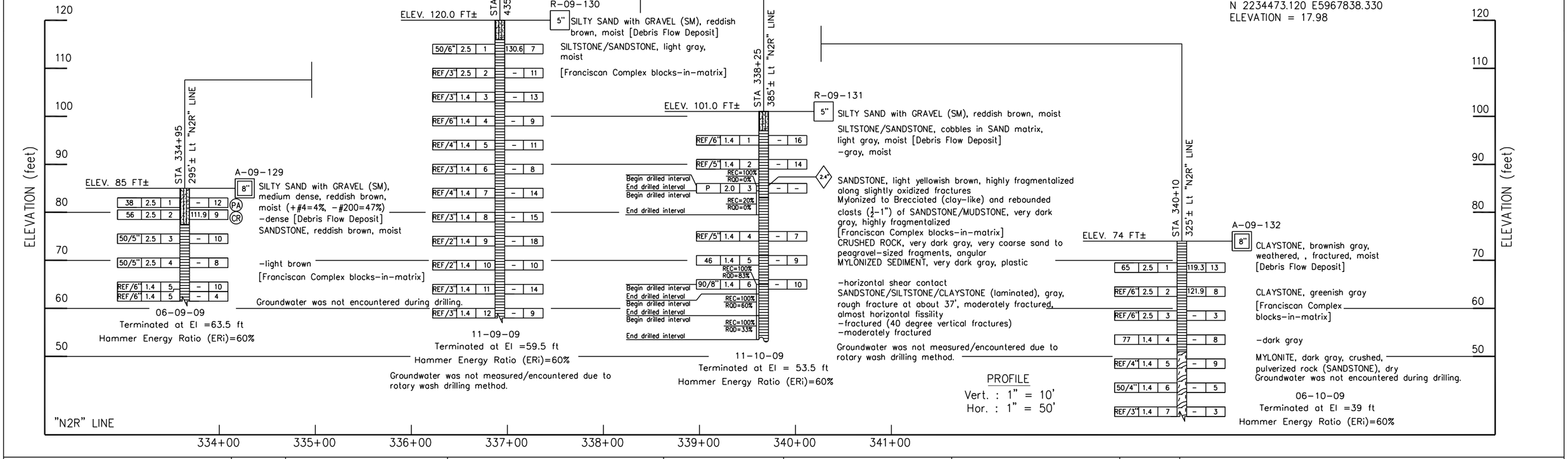
PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. 27E0030	RETAINING WALL NO. 4
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 - NOVEMBER 2009		PROJECT ENGINEER	POST MILES 25.5	LOG OF TEST BORINGS 5 OF 7

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-264074

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF
10/03/11					

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL — 10/03/11 DATE

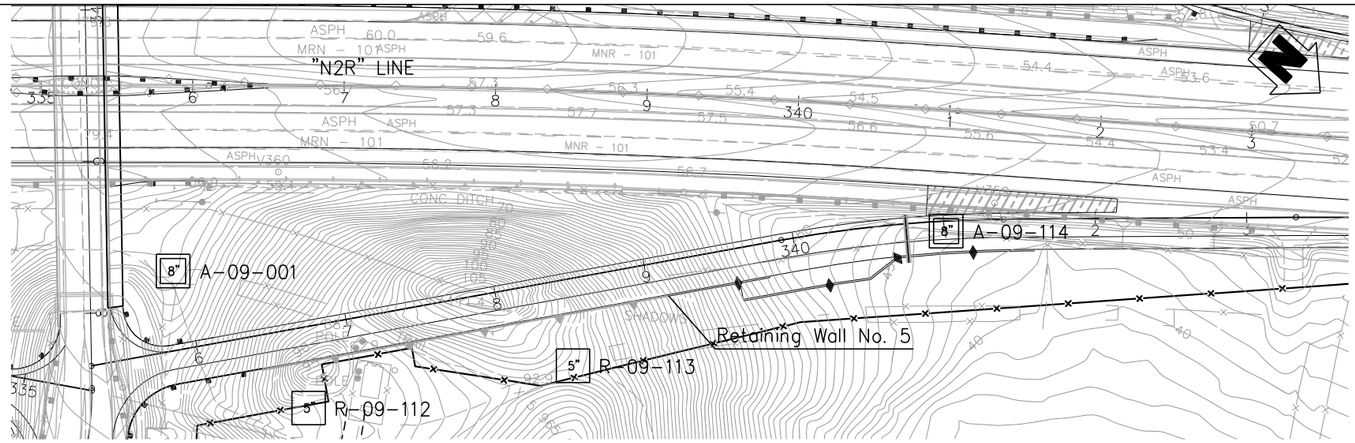
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901



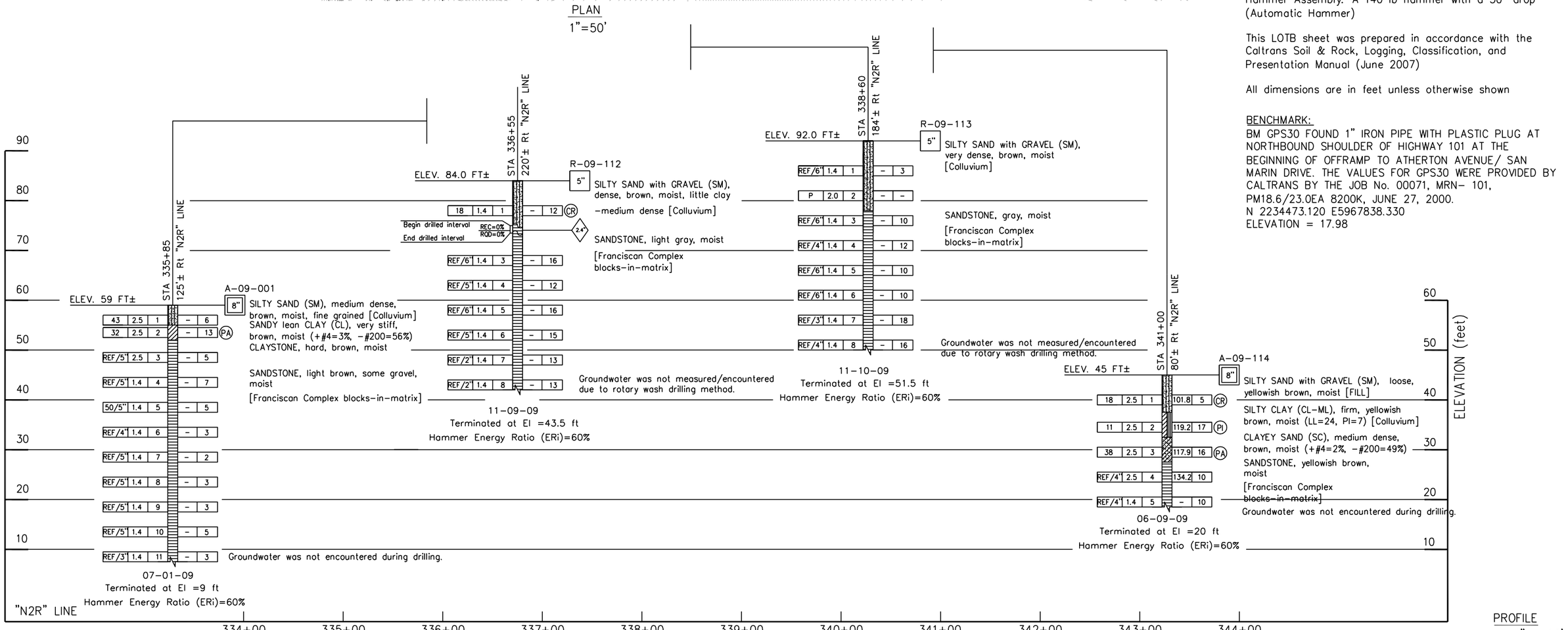
PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. 27E0031	RETAINING WALL NO. 5
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 - NOVEMBER 2009		PROJECT ENGINEER	POST MILES 25.5	LOG OF TEST BORINGS 6 OF 7

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-264074

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
10/03/11					

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL — 10/03/11 DATE

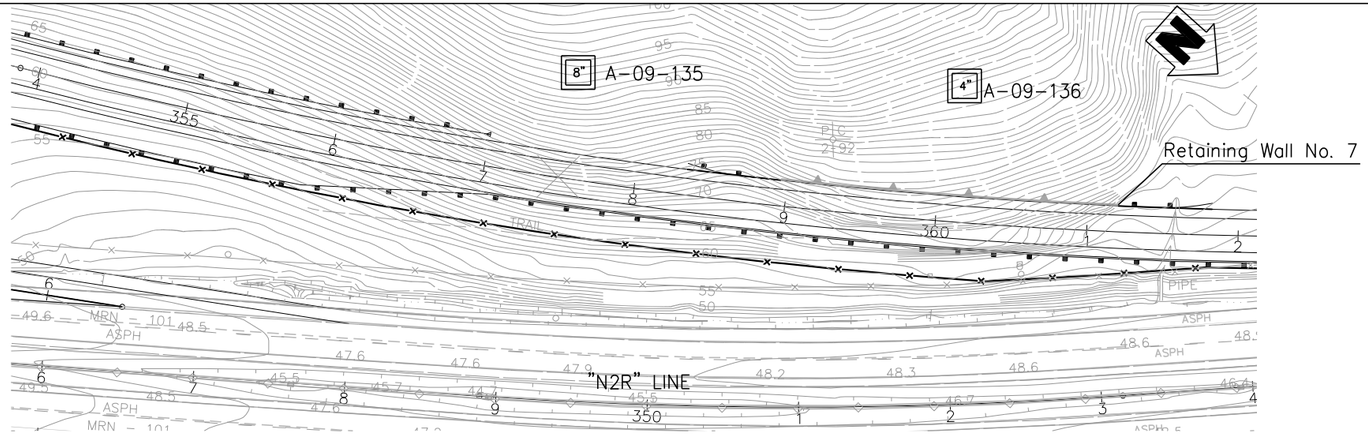
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901



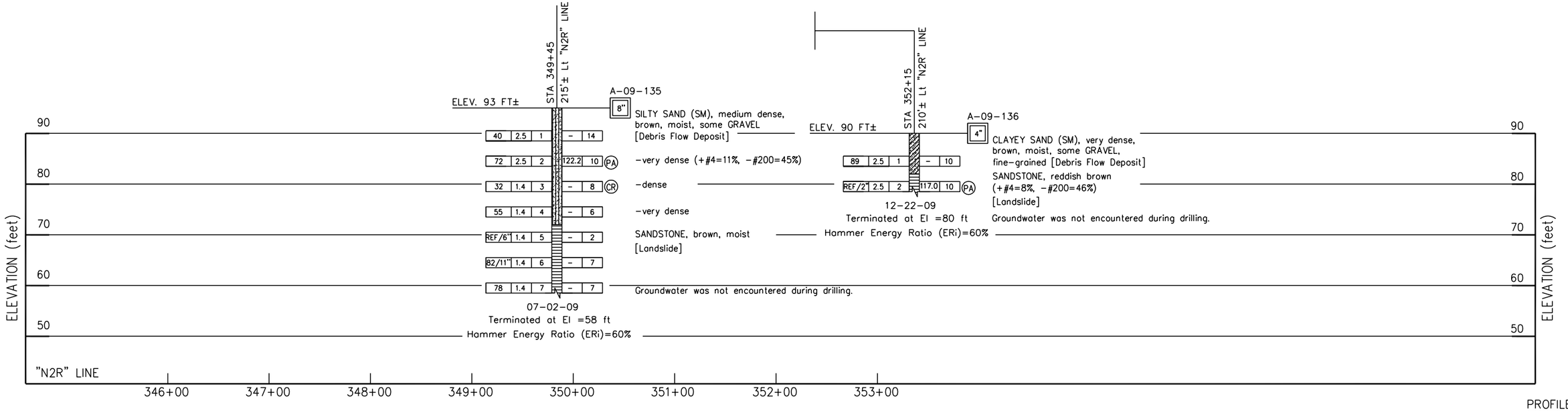
PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	BRIDGE NO.	RETAINING WALL NO. 7
SIGN OFF DATE	CHECKED BY	P. SIRCAR	DATE: JUNE 2009 – DECEMBER 2009			POST MILES	LOG OF TEST BORINGS 7 OF 7

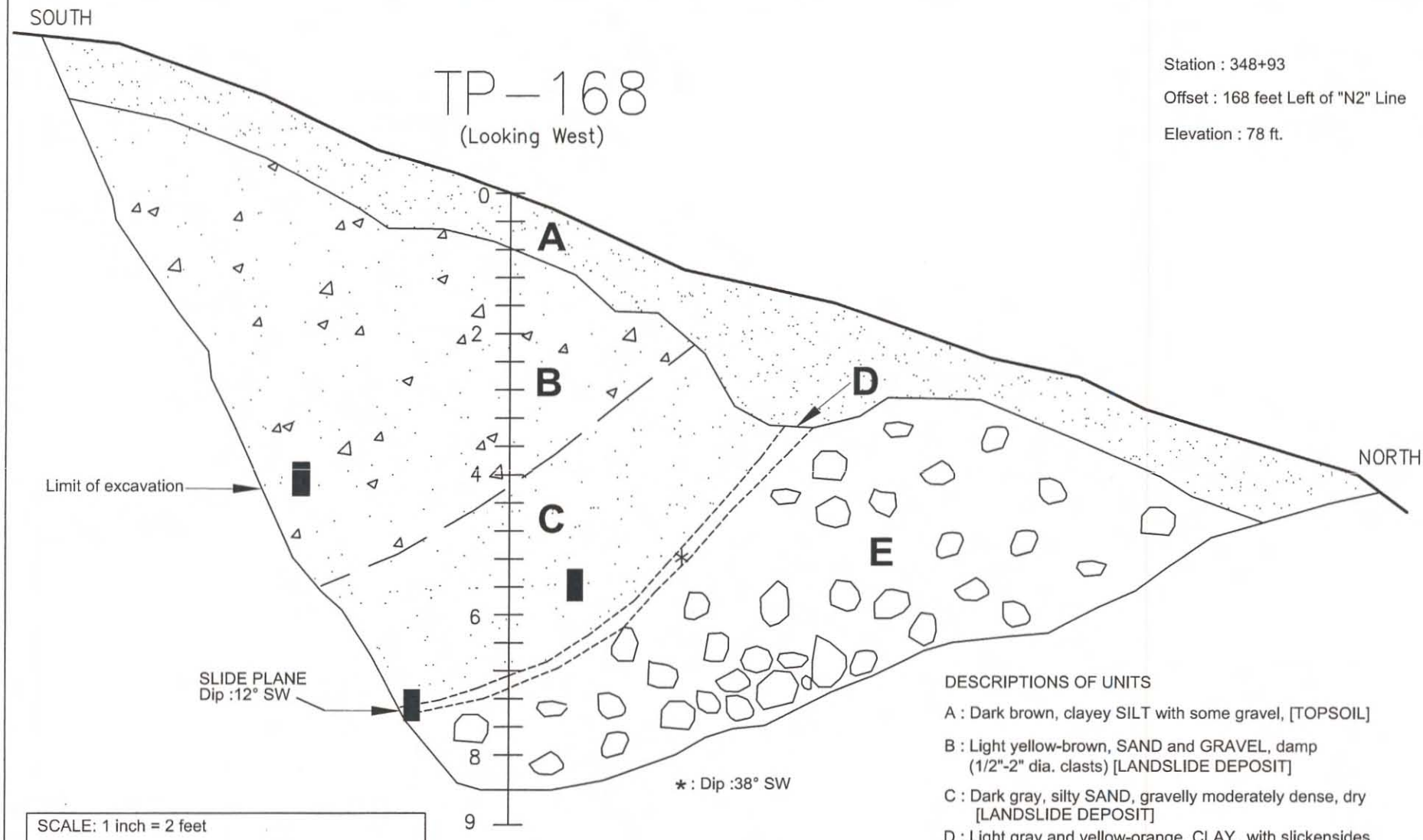
GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-264074

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
10/03/11					



DESCRIPTIONS OF UNITS

A : Dark brown, clayey SILT with some gravel, [TOPSOIL]

B : Light yellow-brown, SAND and GRAVEL, damp (1/2"-2" dia. clasts) [LANDSLIDE DEPOSIT]

C : Dark gray, silty SAND, gravelly moderately dense, dry [LANDSLIDE DEPOSIT]

D : Light gray and yellow-orange, CLAY, with slickensides [Slide Plane gouge]

E : Light yellow-orange, silty SANDSTONE boulders (6"-30" dia.), very hard in CLAY matrix [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

LEGEND
■1 Sample Location

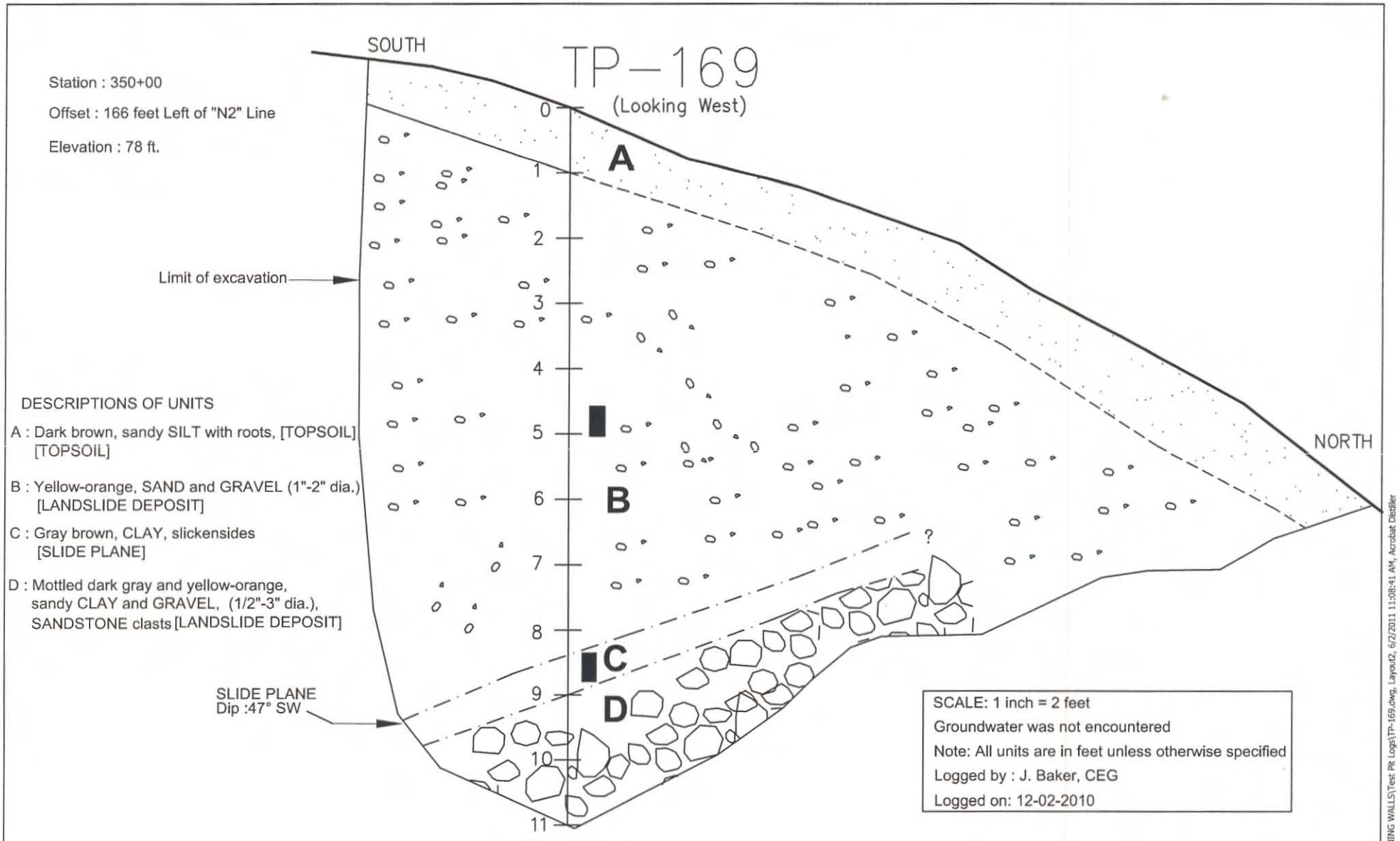
LOG OF TEST PIT TP-168

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO. 8

S:\Ongoing\Partha Sircar\2008-140-GDR\RETAINING WALLS\Test Pit Logs\TP-168.dwg, Layout2, 6/2/2011 11:08:14 AM, Acrobat Distiller



LOG OF TEST PIT TP-169

LEGEND

■1 Sample Location

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO. 9

S:\Ongoing\Partha Sircar\2008-140-GDR\RETAINING WALLS\Test Pit Logs\TP-169.dwg, Layout2, 6/2/2011 11:08:41 AM, Acrobat Distiller

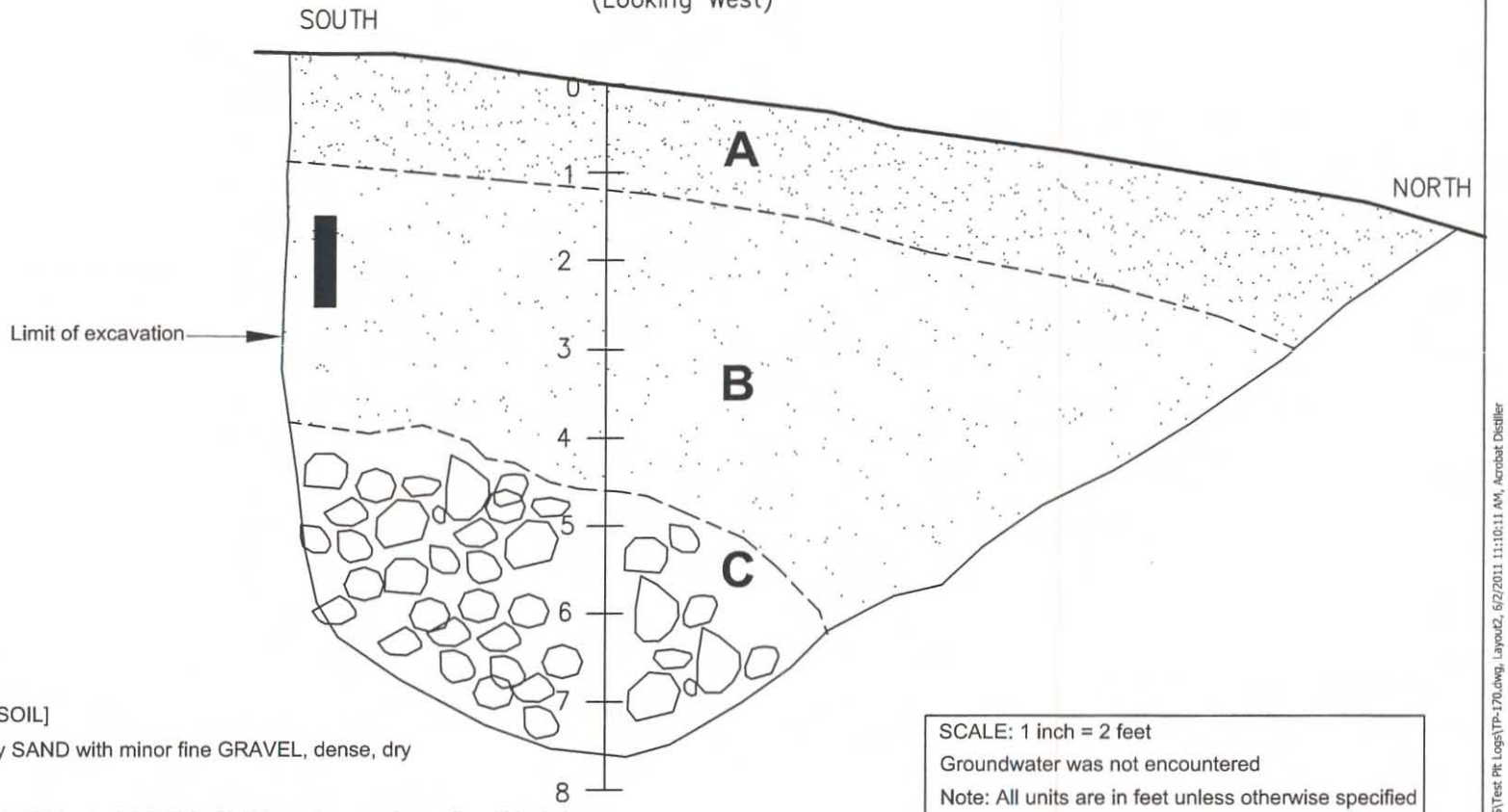
Station : 350+00

Offset : 155 feet Left of "N2" Line

Elevation : 81 ft.

TP–170

(Looking West)



DESCRIPTIONS OF UNITS

A : Dark brown, sandy SILT, [TOPSOIL]

B : Light yellow-orange, silty clayey SAND with minor fine GRAVEL, dense, dry [LANDSLIDE DEPOSIT]

C : Light yellow-orange, SANDSTONE blocks (1"-24") in CLAY matrix, very dense (hard blocks) [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 12-02-2010

LOG OF TEST PIT TP-170

LEGEND

■1 Sample Location

PARIKH CONSULTANTS, INC.

GEOTECHNICAL CONSULTANTS

MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1

REDWOOD LANDFILL INTERCHANGE PROJECT

MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET

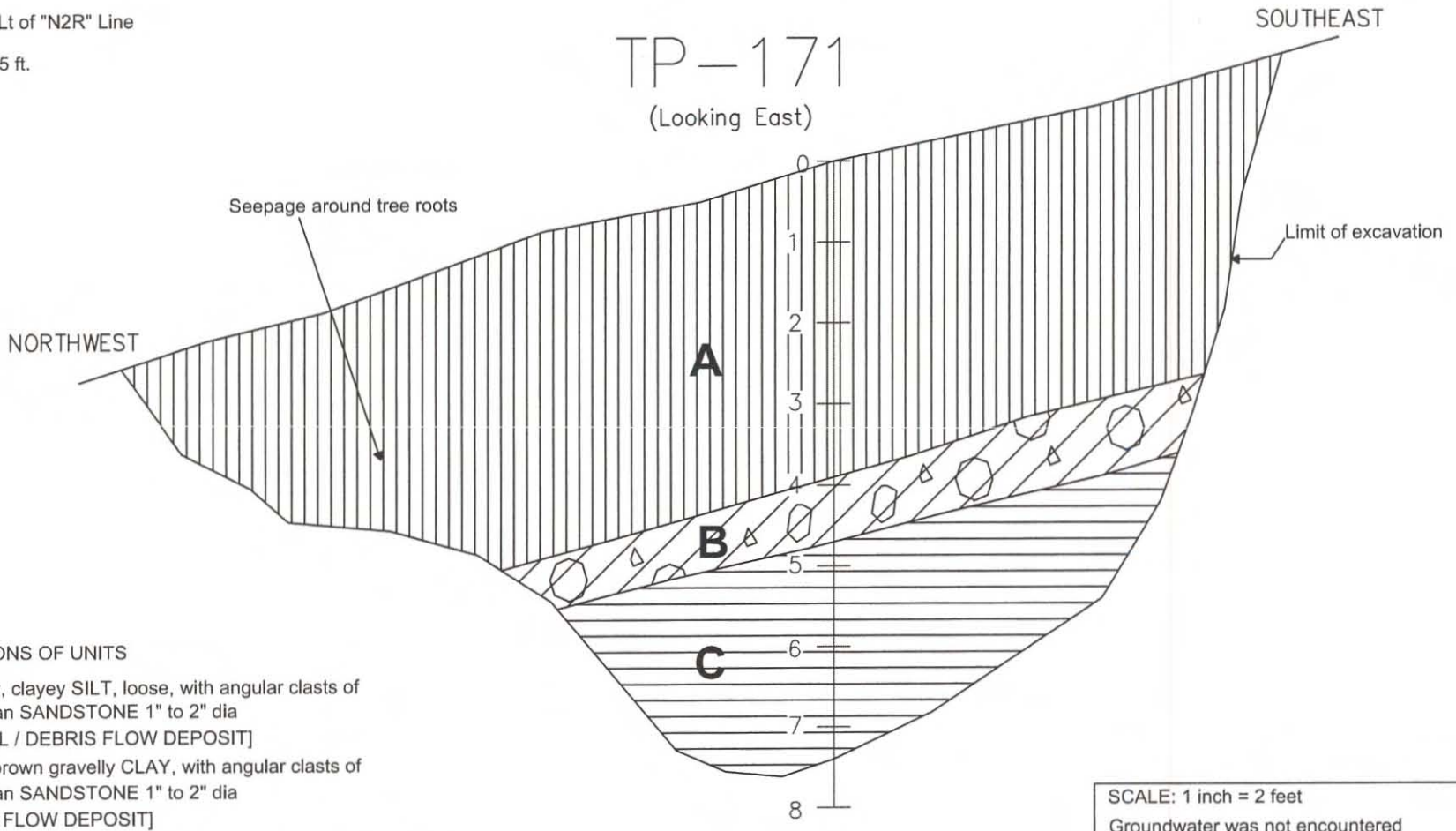
PLATE NO. 10

S:\Ongoing\Partha Sircar\2008-140-GDR\RETAINING WALLS\Test Pit Logs\TP-170.dwg, Layout2, 6/2/2011 11:10:11 AM, Acrobat Distiller

Station : 339+10

Offset : 300 Lt of "N2R" Line

Elevation : 75 ft.



DESCRIPTIONS OF UNITS

A : Dark gray, clayey SILT, loose, with angular clasts of Fransiscan SANDSTONE 1" to 2" dia [TOPSOIL / DEBRIS FLOW DEPOSIT]

B : Yellow - brown gravelly CLAY, with angular clasts of Franciscan SANDSTONE 1" to 2" dia [DEBRIS FLOW DEPOSIT]

C : Medium brown graywacke SANDSTONE, hard, fractured (bedding planes dip=22 degrees NNE) 2" to 4" spacing

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

LOG OF TEST PIT TP-171

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET

PLATE NO. 11

S:\Ongoing\Partha Sircar\2008-140-GDR\RETAINING WALLS\Test Pit Logs\TP-171.dwg, Layout2, 6/2/2011 11:10:33 AM, Acrobat Distiller

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2A, "Plasticity Chart".

Grain Size Classification

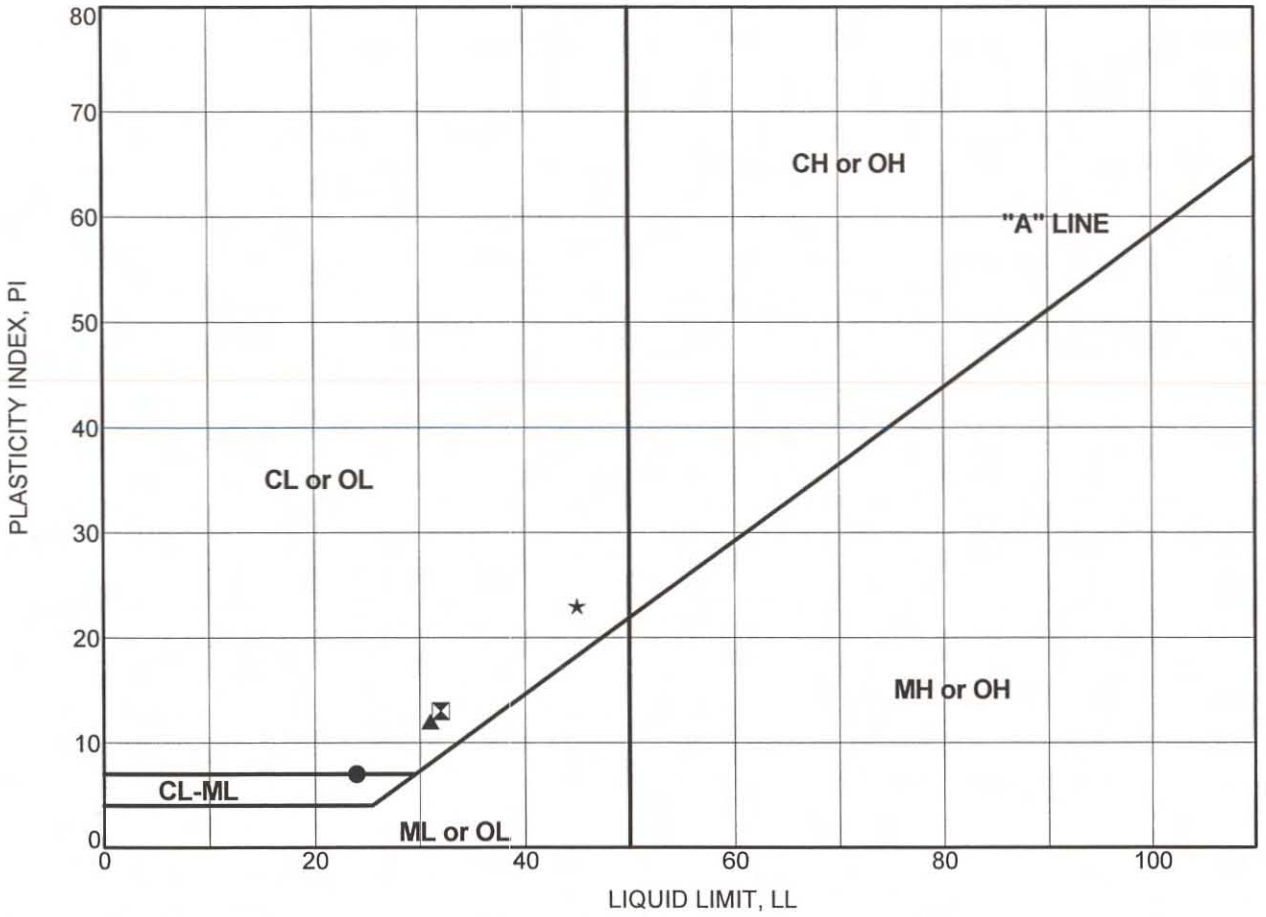
Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results presented on Plate B-3A thru Plate B-3B, "Grain Size Distribution Curves".

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The tests results are presented on Plate B-4A and Plate B-4D.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Test Borings" and Plate B-5A and Plate B-5B.



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-114	MC-2	9.5	●	17	24	17	7	SILTY CLAY (CL-ML)
A-09-134	MC-1	4.5	⊠	16	32	19	13	SANDY LEAN CLAY (CL)
A-10-158A	MC-1	2.0	▲	24	31	19	12	Lean CLAY (CL)
TP-168		5.5	★		45	22	23	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

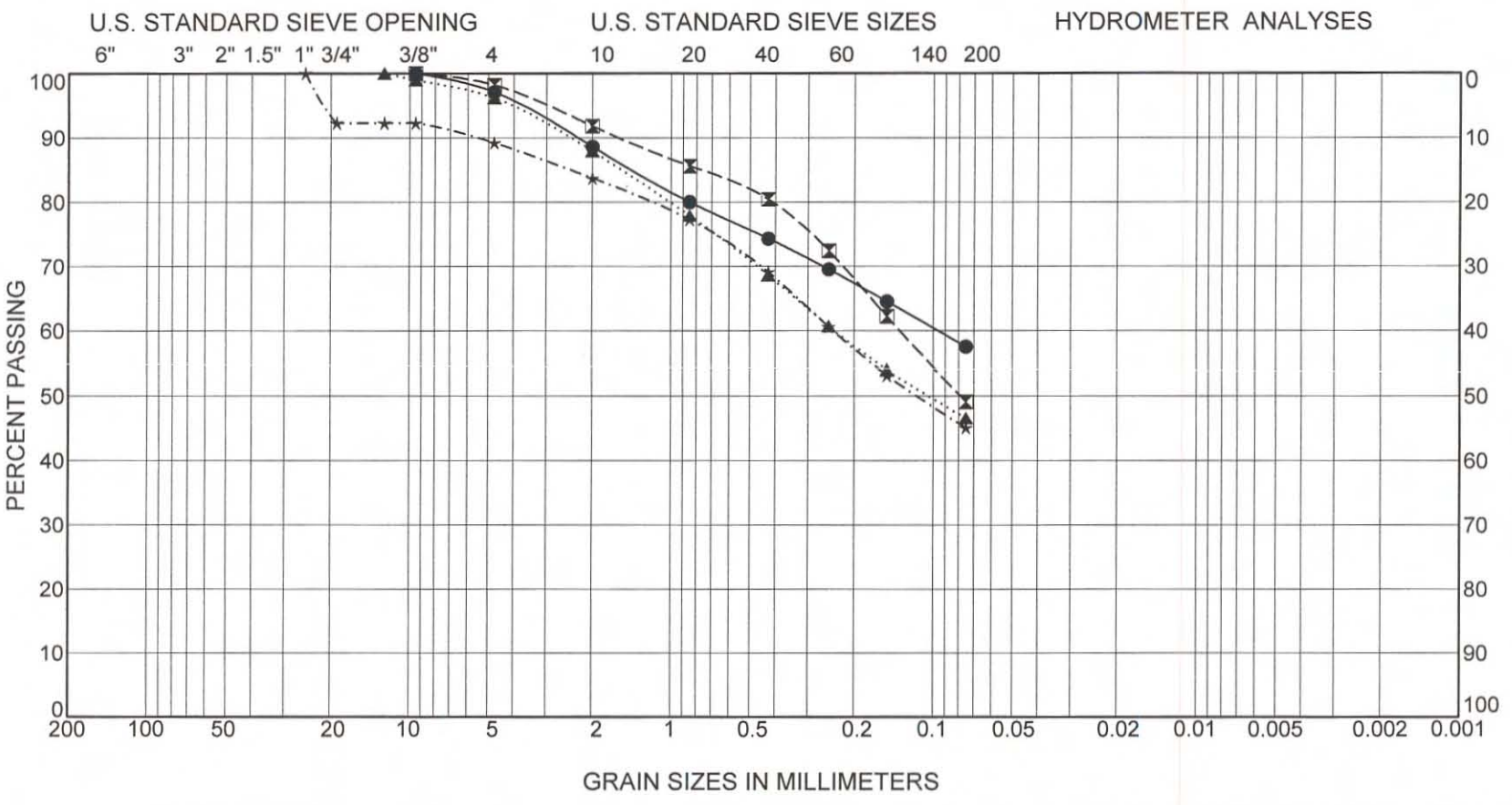
MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.RET | PLATE NO: B-2

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

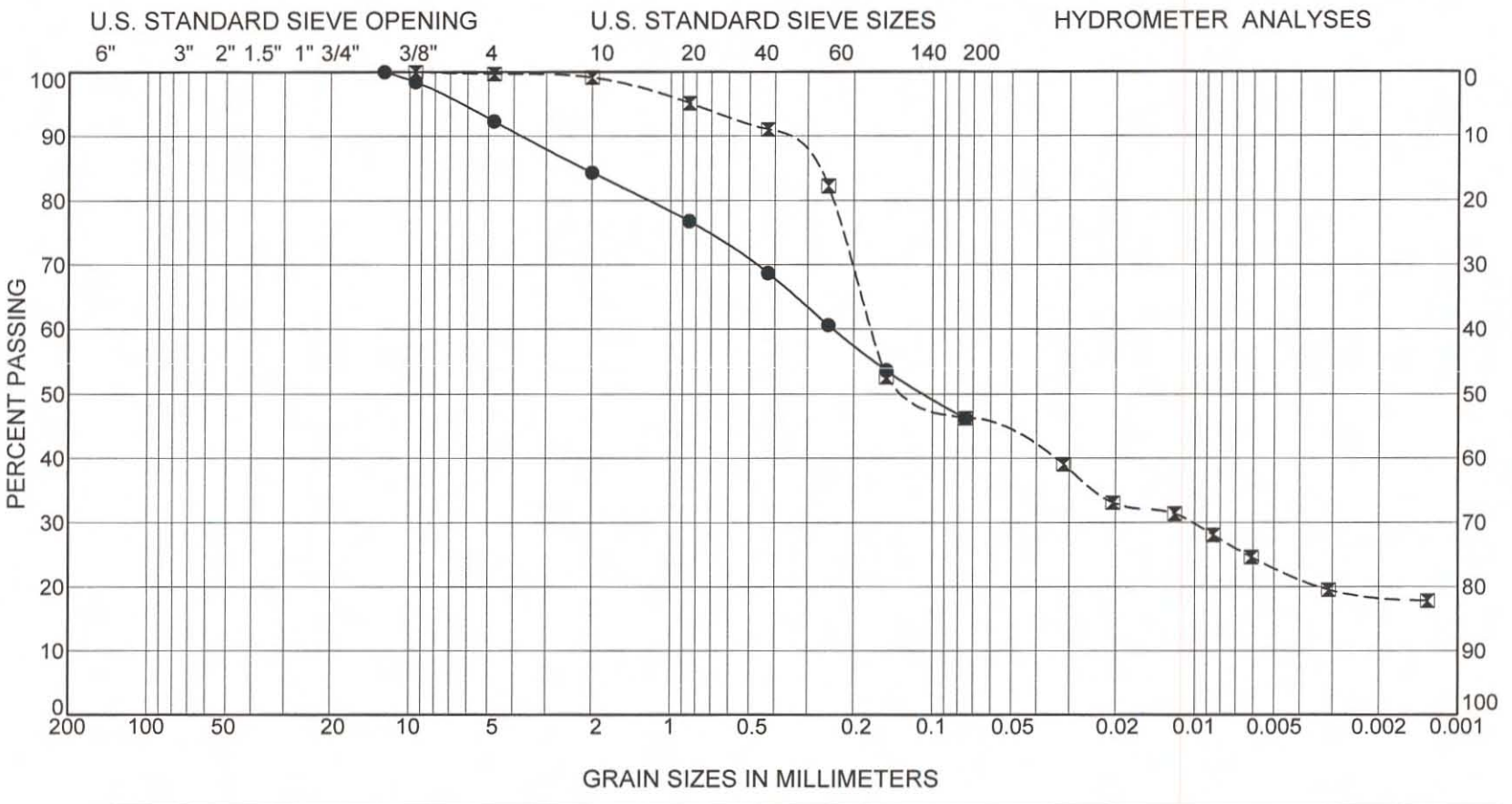


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-001	MC-2	4.5	●			SANDY LEAN CLAY (CL)
A-09-114	MC-3	14.5	⊠			CLAYEY SAND (SC)
A-09-129	MC-1	2.0	▲			SILTY SAND WITH GRAVEL (SM)
A-09-135	MC-2	4.5	★			SILTY SAND (SM)

MARIN-SONOMA NARROWS CONTRACT B-1/REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
JOB NO: 208140.RET
PLATE NO: B-3A

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-136	MC-1	4.5	●			CLAYEY SAND (SC)
TP-170		1.5	⊠			CLAYEY SAND (SC)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.RET

PLATE NO: B-3B

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : B114 #1@4'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112901.

EVALUATION FOR SOIL CORROSION

Soil pH	4.10		
Minimum Resistivity	7.50 ohm-cm (x1000)		
Chloride	8.0 ppm	00.00080	%
Sulfate	4.1 ppm	00.00041	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL - 4 2009
By

Plate B-4A

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B129 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113591.

EVALUATION FOR SOIL CORROSION

Soil pH	5.18		
Minimum Resistivity	5.36 ohm-cm (x1000)		
Chloride	13.4 ppm	00.00134	%
Sulfate	1.9 ppm	00.00019	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B134#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113085.

EVALUATION FOR SOIL CORROSION

Soil pH	5.47	
Minimum Resistivity	2.57 ohm-cm (x1000)	
Chloride	20.3 ppm	00.00203 %
Sulfate	15.9 ppm	00.00159 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009
By

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B135 #3@9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113589.

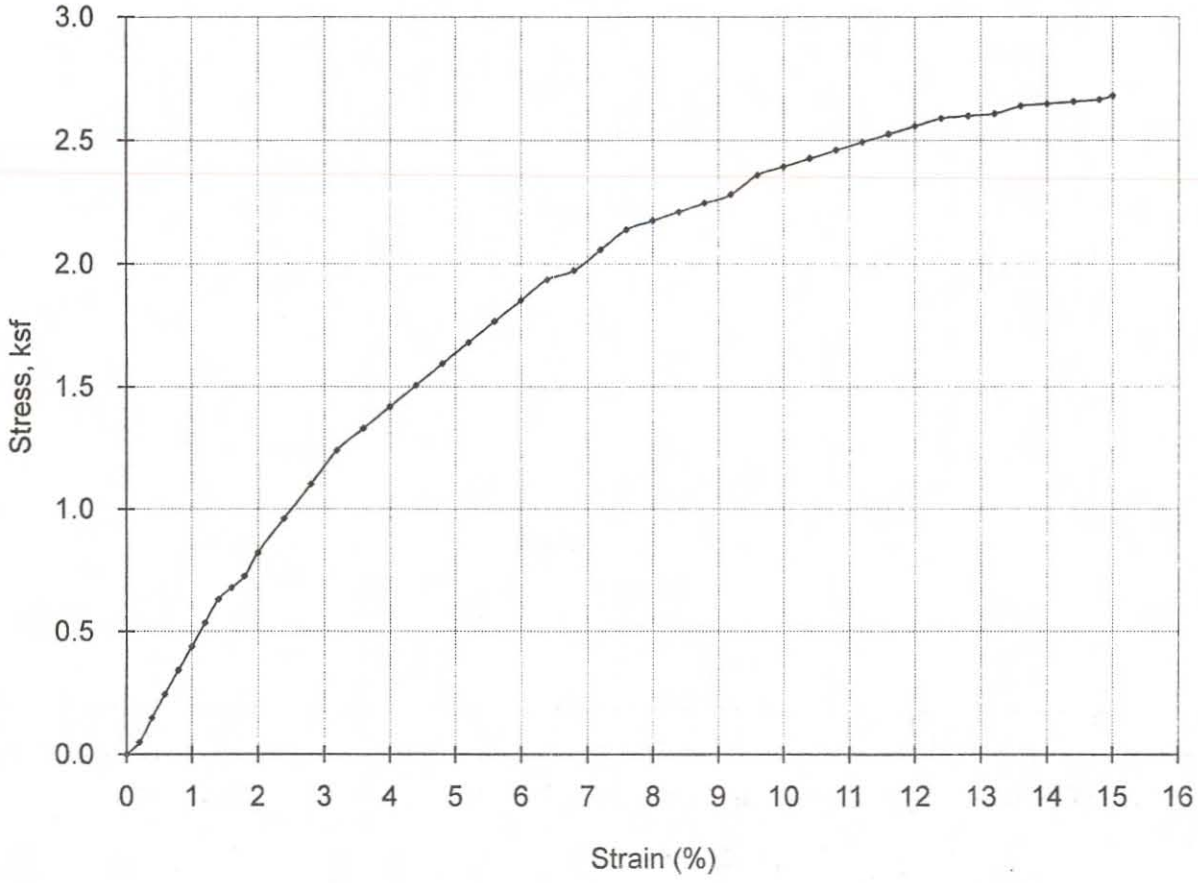
EVALUATION FOR SOIL CORROSION

Soil pH	4.23	
Minimum Resistivity	2.68 ohm-cm (x1000)	
Chloride	57.1 ppm	00.00571 %
Sulfate	6.4 ppm	00.00064 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 2 1 2009

UNCONFINED COMPRESSION TEST



Boring No.: A-10-158A

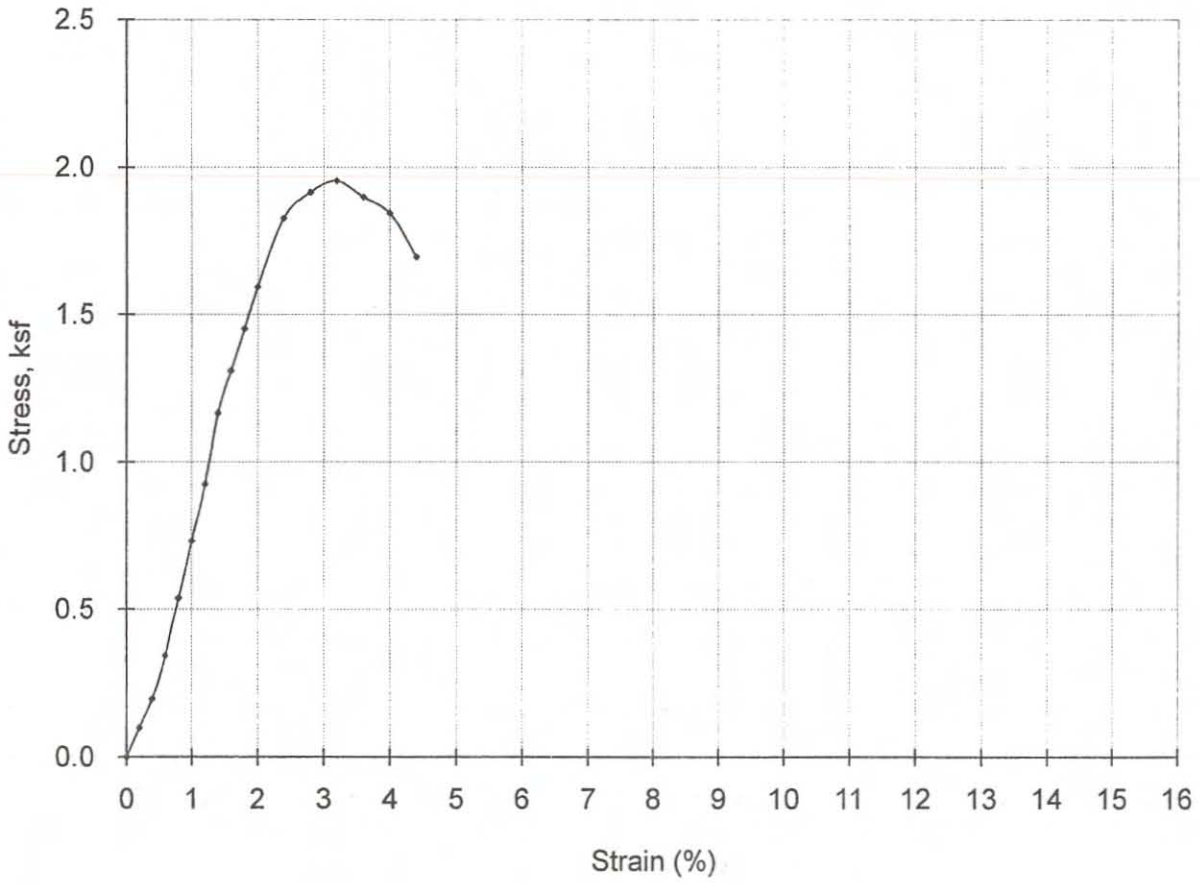
Sample No. : 1 **Strength (ksf):** 2.68

Depth (feet): 2 **Strain (%):** 15.00

Material Description:
Stiff, Lean Clay

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	REDWOOD LANDFILL INTERCHANGE PROJECT MARINE COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-GDR	PLATE NO.:

UNCONFINED COMPRESSION TEST



Boring No.: A-10-158A

Sample No. : 2 **Maximum Strength (ksf):** 1.95

Depth (feet): 5 **Strain @ Failure (%):** 3.20

Material Description:
Firm, Sandy Lean Clay with Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	REDWOOD LANDFILL INTERCHANGE PROJECT MARINE COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-GDR	PLATE NO.:

APPENDIX C

SLOPE STABILITY ANALYSES

PROCEDURE FOR SLOPE STABILITY ANALYSIS
RETAINING WALL NO. 7

The analyses were performed using the computer program SLOPE/W; conventional circular failure surfaces were used. The following procedure was employed:

a) A stability analysis was performed for the condition representing the configuration prior to occurrence of the landslide. The **"pre-slide"** cross-section was developed by our Engineering Geologist, based on geomorphology (the terrain contours and other pertinent field observations). This analysis was performed to establish a slide zone and the strength characteristics of the slide zone material for a factor of safety of 1 (e.g. incipient failure of the landslide mass)

b) A **"post-slide"** cross-section was then developed representing the presently existing configuration. The location of the slide zone and the strength characteristics of the slide zone material from "preslide condition were replicated and an analysis was performed. The analysis yielded a factor of safety of 1.429.

c) A final analysis was performed to investigate the effects of introduction of the proposed cut and retaining wall (**"existing with cut/wall"**) . The analyzed cross-section was essentially identical with the "post-slide" cross-section, except the presence of the vertical cut for the wall. The analysis yielded a factor of safety of 1.428.

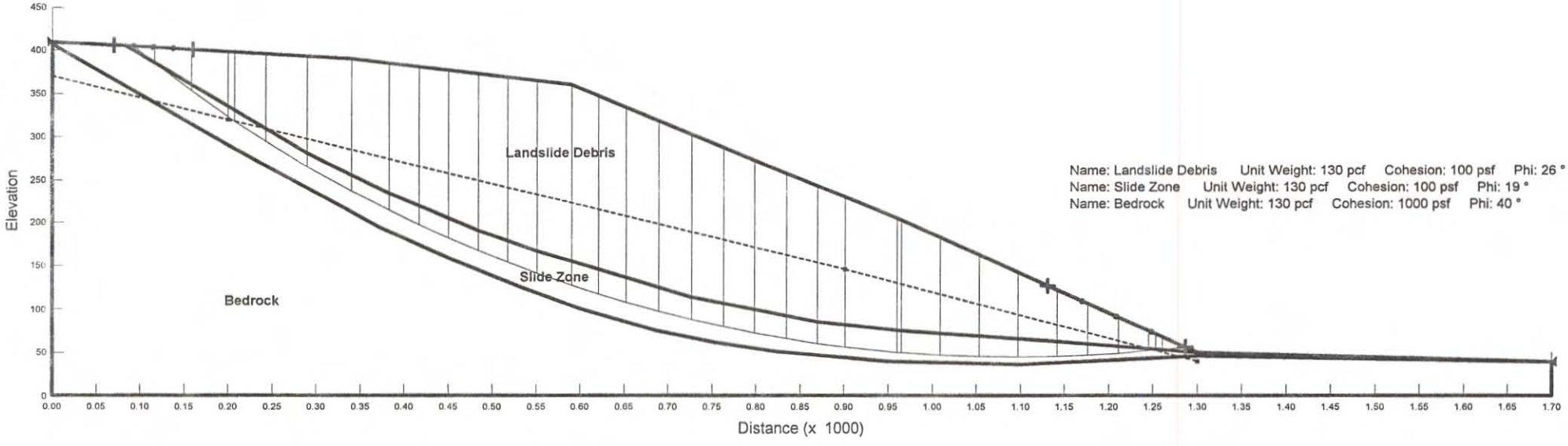
Soils in the cross-sections consisted of:

- Landslide Debris;
- Slide Zone; and
- Bedrock

The cross-sections analyzed and the results of the analyses (e.g. factors of safety) are presented in the following pages. As may be noted, there is very little difference in the cross-sections for b) and c), relative to the slide plane. Hence, the factors of safety for the two cases are essentially identical.

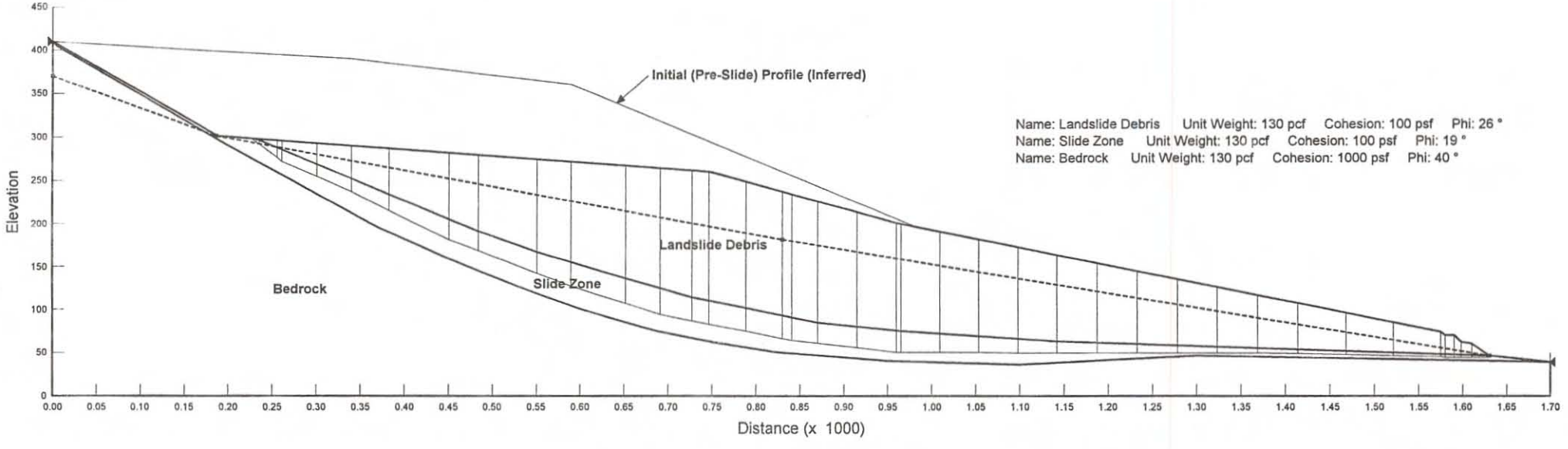
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
RETAINING WALL NO. 7
INITIAL (PRE-SLIDE)

1.001



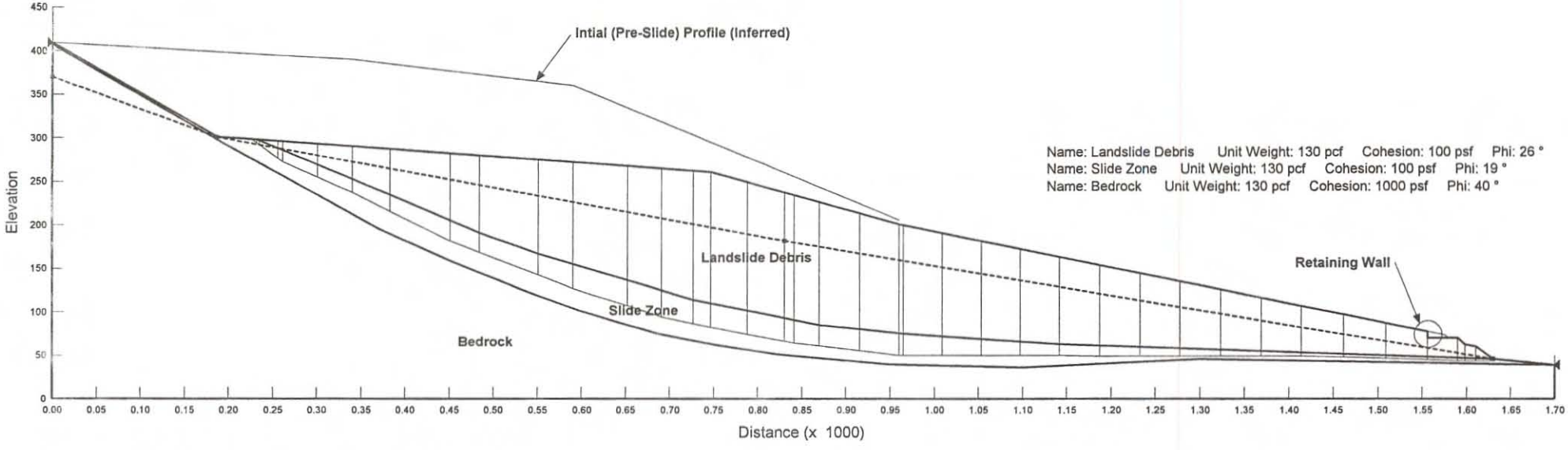
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
RETAINING WALL NO. 7
POST-SLIDE (EXISTING)

1.429



MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
RETAINING WALL NO. 7
EXISTING WITH CUT/WALL

1.428



TIEBACK DESIGN

(Wall Nos. 4 & 5)

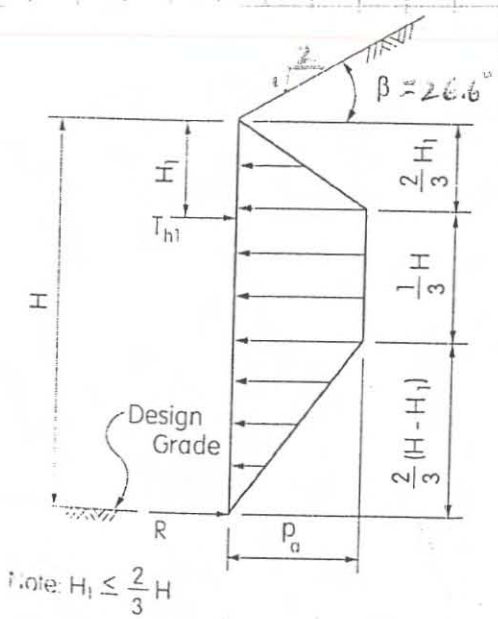
PARIKH
Practicing in the Geosciences

JOB 208140.GDR
SHEET NO ____ OF ____
CALCULATED BY PS DATE ____
CHECKED BY YSW DATE 2/10
SCALE ____

MSW - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4 & 5

Lateral Earth Pressures



Note: $H_1 \leq \frac{2}{3}H$

a) Wall with a single level of anchors

$P_a = 54\,H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum)

Ultimate Bond Strength = 80 psi (Allowable = 40 psi (FS = 2)) (See attached)

Coefficient of Passive Pressure (K_p) = 9.0

Unit Weight = 135 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 × eff. width of soldier pile)

Allowable Unit Skin Friction (For Soldier Piles) = 2.0 ksf

(Backup Calculation Follows)

RECOMMENDATIONS

3. Minerals in the rock which may "lubricate" the bond zone or reduce the grout strength.

4. Method of drilling and cleaning the drill hole

5. Drill hole diameter

6. Strength of the grout

7. Grouting procedure

The typical values shown in Table 6.1 are not intended for final design. Working bond stresses shall be established on a project-by-project basis after review of geologic data, rock cores and previous experience.

Each rock anchor shall be tested in order to verify the load carrying capacity of the anchor and to preload the tendon (see Chapter 8).

For anchors in weak or weathered rock masses, pressure grouting techniques may be used to successfully enhance grout to rock bond values.

COMMENTARY

anchor grout can be approximated by using a value of 10% of the unconfined compressive strength of the rock, up to a maximum value of 3.1 MPa (450 psi).

ROCK	AVERAGE ULTIMATE BOND STRESS-ROCK/GROUT	
	MPa	PSI
Granite & Basalt	1.7 - 3.1	250 - 450
Dolomitic Limestone	1.4 - 2.1	200 - 300
Soft Limestone	1.0 - 1.4	150 - 200
Slates & Hard Shales	0.8 - 1.4	120 - 200
Soft Shales	0.2 - 0.8	30 - 120
Sandstones	0.8 - 1.7	120 - 250
Weathered Sandstones	0.7 - 0.8	100 - 120
Chalk	0.2 - 1.1	30 - 155
Weathered Marl	0.15 - 0.25	25 - 35
Concrete	1.4 - 2.8	200 - 400

Table 6.1 Typical Average Ultimate Bond Stresses-Rock/Grout

6.7.2 Soil Anchors

6.7.2.1 General Considerations

The existing theoretical and empirical methods for predicting anchor capacity should only be used for preliminary design estimate purposes. The final anchor capacity shall be verified by field testing each anchor.

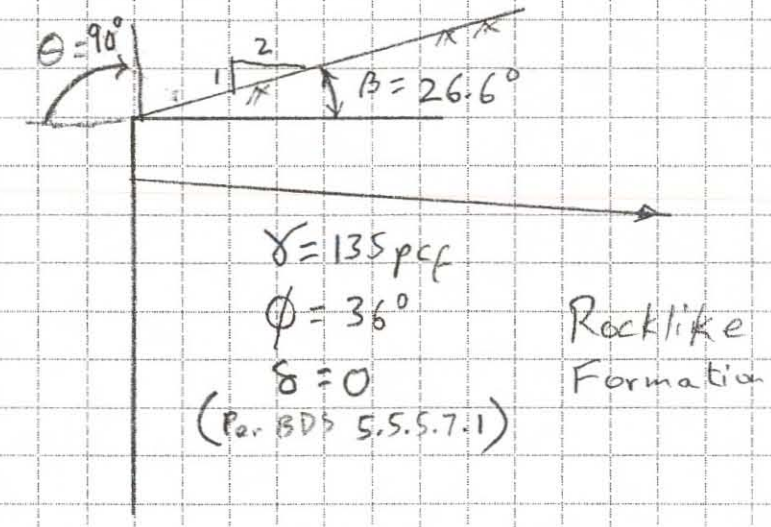
Actual bond length dimensions for specific design loads are based on installation techniques and should be determined by the specialty anchor contractor.

Normally, the bond length for soil anchors is in the range of 6-12m (20-40 ft). Bond lengths greater than 15m (50 ft) in soil may not be necessary and are not effective unless provisions are taken to allow transfer of the load to the bottom of the bond zone.

Used 80 psi

Tieback Walls for Wall Nos. 4 & 5 (Walls in Rocklike Formation)

(Based on BDS 5.5.5.7)



From BDS Section 5.5.5.3

$$\text{Active Earth Pressure, } k_a = \frac{\sin^2(\theta+\phi')}{\Gamma\left(\sin^2\theta \sin(\theta-\delta)\right)}$$

$$= \frac{\sin^2(90^\circ+36^\circ)}{\Gamma\left(\sin^3(90^\circ)\right)} = \frac{0.6545}{\Gamma(1)}$$

$$= \frac{0.6545}{\Gamma}$$

$$\Gamma = \left[1+\left(\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}\right)^{0.5}\right]^2$$

$$= \left[1+\left(\frac{\sin 36^\circ \sin(36^\circ-26.6^\circ)}{\sin 90^\circ \sin(90+26.6^\circ)}\right)^{0.5}\right]^2$$

$$= \left[1+\left(\frac{(0.5858)(0.1633)}{(1)(0.8942)}\right)^{0.5}\right]^2$$

$$= \left[1+0.3271\right]^2 = 1.761$$

$$\therefore K_a = \frac{0.6545}{1.761} = 0.372$$

$$P_a = \frac{P_{Total}}{\frac{2}{3}H}$$

$$= \frac{1.44 P_a}{\frac{2}{3}H}$$

$$= \frac{1.44 \times \frac{1}{2}(0.372) H^2 \times 135}{\frac{2}{3}H}$$

$$= 54.24H$$

PARIKH
Practicing in the Geosciences

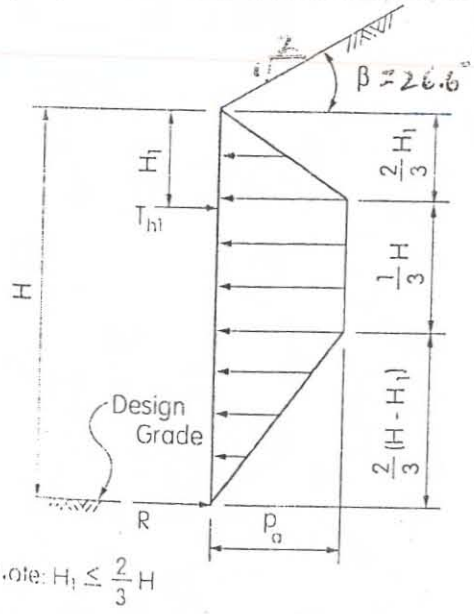
JOB 200170.1-
SHEET NO ____ OF ____
CALCULATED BY P. Sircar DATE 2/11
CHECKED BY YDW DATE
SCALE

MSW - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4

(Tieback in Debris Flow (Block-Poor Bimrock))

Lateral Earth Pressures



a) Wall with a single level of anchors

$P_a = 80\ H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum)

Ultimate Bond Strength = 40 psi (Allowable 2.0 psi (FS=2))

Coefficient of Passive Pressure (K_p) = 3.5

Unit Weight = 130 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 x eff. width of soldier pile)

Allowable Unit Skin Friction (For Soldier Piles) = 1.0 Ksf

(Calculations follow)

manner as a straight shaft anchor drilled in cohesive soils, except that the allowable working shaft friction will commonly be much higher.

B. Pressure Grouted Anchors (Straight Shaft)

Pressure grouted anchors in cohesionless soil develop capacities far in excess of the load expected from applying conventional soil mechanics theory. Pressure grouting can be achieved either through the casing or auger. Overburden pressure, angle of internal friction, density and grain size of the soil particles, hole diameter, grout pressure, grout take and method of drilling are very significant factors in the development of load carrying capacity. The resistance of this type of anchor to pullout develops from shaft friction along the grout body.

guide value for τ_w, when the average depth of overburden is 4.5m (15 ft) or more, at the bond zone location.

As a rough guide, Table 6.3 may be used for calculating the ultimate load for small diameter (75-150mm) (3 to 6 in.) pressure grouted (0.35 to 2.8 MPa) (50 to 400 psi) anchors installed in cohesionless soils with an average depth of overburden of 4.5m (15 ft).

ANCHOR TYPE	AVERAGE ULTIMATE BOND STRESS-SOIL/GROUT	
	MPa	PSI
• Gravity Grouted Anchors (Straight Shaft)	0.07 - 0.14	10 - 20
• Pressure Grouted Anchors (Straight Shaft)		
- Fine-Med. Sand, Med. Dense-Dense	0.08 - 0.38	12 - 55
- Med.-Coarse Sand (w/gravel),Med. Dense	0.11 - 0.66	16 - 95
- Med.-Coarse Sand (w/gravel),Dense - Very Dense	0.25 - 0.97	35 - 140
- Silty Sands	0.17 - 0.41	25 - 60
- Dense Glacial Till	0.30 - 0.52	43 - 75
- Sandy Gravel,Med. Dense-Dense	0.21 - 1.38	31 - 200
- Sandy Gravel,Dense-Very Dense	0.28 - 1.38	40 - 200

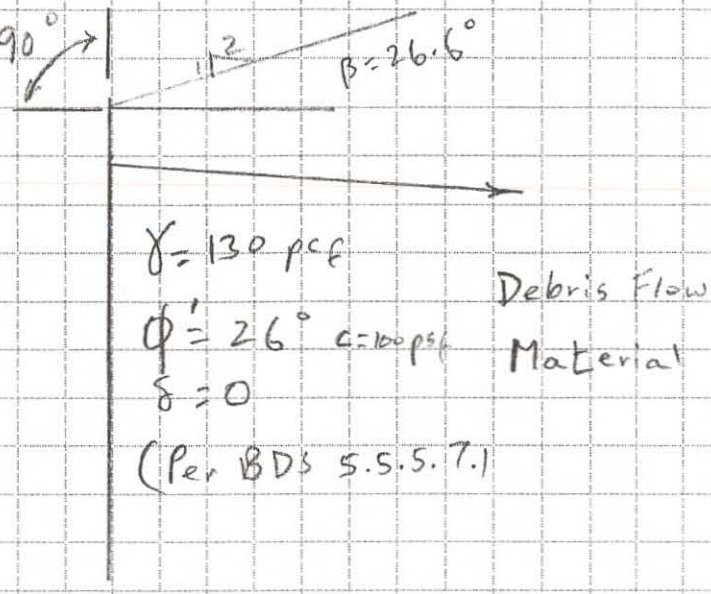
Table 6.3 Typical Average Ultimate Bond Stresses-Cohesionless Soils

Note: *Actual values for pressure grouted anchors depend on the ability to develop high pressures in each soil type.*

Used 40 psi

Tieback Wall for Wall No. 4 (Wall in Debris Flow Material)

(Based on BDS 5.5.5.7)



From BDS Section 5.5.5.3

Active Earth Pressure, $K_a = \dfrac{\sin^2(\theta+\phi')}{\Gamma\left(\sin^2\theta \sin(\theta-\delta)\right)}$

$$= \frac{\sin^2(90+26^\circ)}{\Gamma \sin^3(90^\circ)} = \frac{0.899}{\Gamma}$$

$$\Gamma = \left[1+\left(\frac{\sin(\phi'+\delta)\sin(\phi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}\right)^{0.5}\right]^2$$

Using $\beta = 18^\circ$ (1:3 slope, since c=100psf)

$$\Gamma = \left[1+\left(\frac{\sin^2 26^\circ \sin(26^\circ-18^\circ)}{\sin 90^\circ \sin(90^\circ+18^\circ)}\right)^{0.5}\right]^2$$

$$= \left[1+\left(\frac{(0.438)(0.139)}{(1)(6.951)}\right)^{0.5}\right]^2$$

$$\Gamma = [1 + 0.253]^2 = 1.57$$

$$\therefore K_a = \frac{0.899}{1.57} = 0.572$$

$$P_a = \frac{P_{Total}}{\frac{2}{3} H}$$

$$= \frac{1.44\, P_a}{\frac{2}{3} H} = \frac{1.44 \times \frac{1}{2} (0.572) \times H^2 \times 130}{\frac{2}{3} H}$$

$$= 80\, H$$

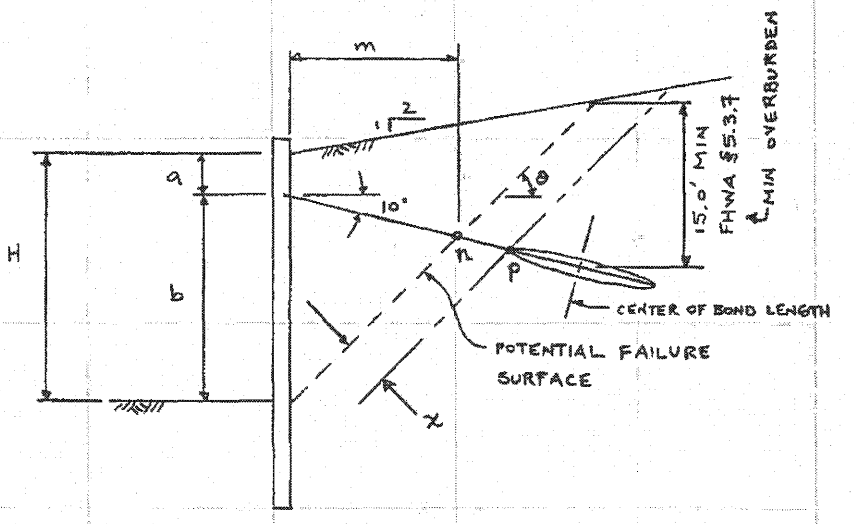
CALCULATION OF UNBONDED LENGTHS FOR TIEBACKS

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

RETAINING WALL No. 4

REQ'D UNBONDED LENGTH, PER FHWA-IF-99-015 §5.3.2 IS FROM WALL TO POINT p:



$$\theta = 45^\circ + \frac{\phi'}{2}$$

$$x = \frac{H}{5} \geq 5'$$

$$ELEV_n = b - m\tan(10^\circ) = m\tan\theta$$

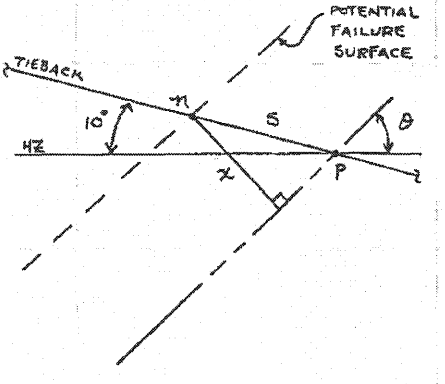
$$b - m\tan(10^\circ) = m\tan(\theta)$$

$$m = \frac{b}{\tan(10^\circ) + \tan(\theta)}$$

LENGTH OF TIEBACK TO n $= \dfrac{m}{\cos(10^\circ)}$

ADD'L LENGTH FROM n TO p (S):

$$S = \frac{x}{\sin(\theta + 10^\circ)}$$



TOTAL REQ'D LENGTH = "LENGTH TO n" + "S"

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

RETAINING WALL No. 4

MIN OVERBURDEN DISTANCE - CONT'D:

ASSUMED LENGTH OF EMBEDMENTS FOR CONFIRMATION OF 15.0' MIN DEPTH OF ℄ ANCHOR BOND LENGTH PER FHWA-IF-99-015 §5.3.7

↳ SHORTER LENGTH = MORE CONSERVATIVE FOR 15.0' MIN COVER DETERMINATION

∴ ASSUME DIA BOND ZONE = 8" (PROBABLY 6" ∴ CONSERV.)

AREA/LENGTH = $\pi D = \pi (8")$

$= 25.13\ in.^2/in. \times 12"/ft$

$= 301.6\ in.^2/ft$

BOND STRENGTH = 40 psi (GEOTECH: ALLOWABLE BOND STRENGTH)

TIEBACK ANCHOR TENSILE DEMAND = 140 k (MIN)

$$\text{LENGTH REQ'D (MIN)} = \frac{140^k \times 1000^\#/_k}{40\ psi\ (301.6\ in^2/ft)}$$

$= 11.60\ ft$

$\frac{1}{2}$ LENGTH REQ'D = $\frac{1}{2}(11.60')$

$= 5.8\ ft$

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

RETAINING WALL No. 4

MIN OVERBURDEN DISTANCE - CONT'D

VERTICAL DIST FROM FG TO ℄ BOND LENGTH:

$$= a + \left(\tfrac{1}{2}\ \text{BOND LENGTH}\right)\sin 10^\circ + \frac{1}{2}\left[m + \left(\left(\tfrac{1}{2}\ \text{BOND LENGTH}\right) + S\right)\cos 10^\circ\right]$$

FG SLOPE BEHIND WALL

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

CHECK FOR REQUIRED UNBONDED LENGTH - POTENTIAL FAILURE SURFACE CLEARANCE

RETAINING WALL NO. 4													
Tieback Type	Pile No. with Greatest H	H	Φ'	θ	a	b	χ	m	L to n	s	Total Unbonded Length Req'd	
		ft	°	°	ft	ft	ft	ft	ft	ft	ft	
A_I	47	16.9	36°	63°	7	9.9	5.0	4.6	4.7	5.2	9.91	10'-0"
A_{II}	52	15.5	26°	58°	7	8.5	5.0	4.8	4.8	5.4	10.24	10'-6"
B	18	25.1	36°	63°	9	16.1	5.0	7.5	7.6	5.2	12.87	13'-0"
C	34	23.5	36°	63°	9	14.5	5.0	6.8	6.9	5.2	12.10	12'-6"
D	27	29.6	36°	63°	11	18.6	5.9	8.7	8.9	6.2	15.05	15'-6"
E	24	31.1	36°	63°	13	18.1	6.2	8.5	8.6	6.5	15.08	15'-6"

CHECK FOR REQUIRED UNBONDED LENGTH - MINIMUM OVERBURDEN DISTANCE

RETAINING WALL NO. 4										
Tieback Type	Modified Total Unbonded Length*		Tieback Dia	Tieback Force	Bond Strength	Min Bond Length	1/2 Bond Length	Vert Dist from FG to CL Bond Length	Check
	ft		in.	kips	psi	ft	ft	ft	>15'
A_I	9.91	10'-0"	8	140	40	11.6	5.8	16.46	OK
A_{II}	10.24	10'-6"	8	140	20	23.2	11.6	19.54	OK
B	12.87	13'-0"	8	140	40	11.6	5.8	20.43	OK
C	12.10	12'-6"	8	210	40	17.4	8.7	21.34	OK
D	15.05	15'-0"	8	210	40	17.4	8.7	25.31	OK
E	15.08	15'-6"	8	210	40	17.4	8.7	27.33	OK

*MANUALLY ADJUSTED TO OBTAIN MINIMUM 15'-0" VERTICAL DISTANCE FROM FG TO CL BOND LENGTH

CHECK FOR REQUIRED UNBONDED LENGTH - SUMMARY

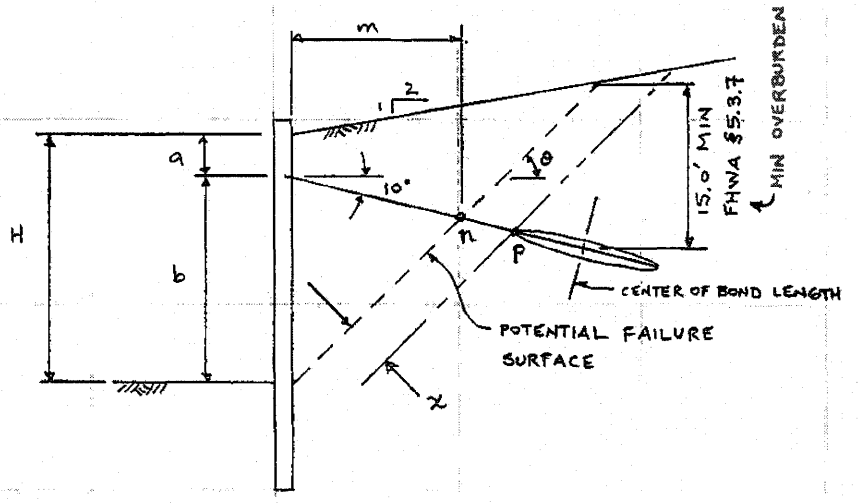
RETAINING WALL NO. 4				
Tieback Type	Length Potential Failure Surface	Length Min Overburden	Min per Geotech	**Length on Plans**
A_I	10'-0"	10'-0"	15'-0"	**15'-0"**
A_{II}	10'-6"	10'-6"	15'-0"	**15'-0"**
B	13'-0"	13'-0"	15'-0"	**15'-0"**
C	12'-6"	12'-6"	15'-0"	**15'-0"**
D	15'-6"	15'-0"	15'-0"	**15'-6"**
E	15'-6"	15'-6"	15'-0"	**15'-6"**

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

RETAINING WALL No. 5

REQ'D UNBONDED LENGTH, PER FHWA-IF-99-015 §5.3.2 IS FROM WALL TO POINT p:



$$\theta = 45^\circ + \frac{\phi'}{2}$$

$$x = \frac{H}{5} \geq 5'$$

$$\text{ELEV}_n = b - m\tan(10^\circ) = m\tan\theta$$

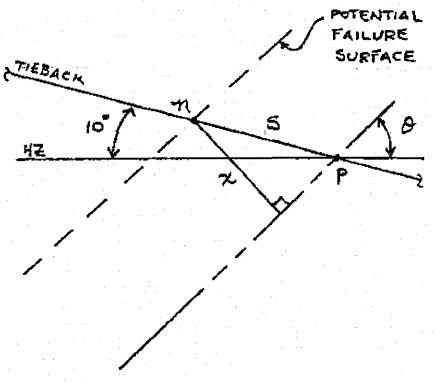
$$b - m\tan(10^\circ) = m\tan(\theta)$$

$$m = \frac{b}{\tan(10^\circ) + \tan(\theta)}$$

$$\text{LENGTH OF TIEBACK TO } n = \frac{m}{\cos(10^\circ)}$$

ADD'L LENGTH FROM n TO p (s):

$$s = \frac{x}{\sin(\theta + 10^\circ)}$$



TOTAL REQ'D LENGTH = "LENGTH TO n" + "s"

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

RETAINING WALL No 5

MIN OVERBURDEN DISTANCE

ASSUMED LENGTH OF EMBEDMENTS FOR CONFIRMATION OF 15.0' MIN DEPTH OF ℄ ANCHOR BOND LENGTH PER FHWA-IF-99-015 §5.3.7

↳ SHORTER LENGTH = MORE CONSERVATIVE FOR 15.0' MIN COVER DETERMINATION

∴ ASSUME DIA BOND ZONE = 8" (PROBABLY 6" ∴ CONSERV.)

AREA/LENGTH = πD = π (8")

= 25.13 in^2/in × 12"/ft

= 301.6 in^2/ft

BOND STRENGTH = 40 psi (GEOTECH: ALLOWABLE BOND STRENGTH)

TIEBACK ANCHOR TENSILE DEMAND = 70 k

$$\text{LENGTH REQ'D (MIN)} = \frac{70^k \times 1000^{\#}/k}{40\ psi\ (301.6\ in^2/ft)}$$

= 5.80 ft

½ LENGTH REQ'D = ½ (5.80')

= 2.90 ft

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

RETAINING WALL No. 5

MIN OVERBURDEN DISTANCE - CONT'D

VERTICAL DIST FROM FG TO ℄ BOND LENGTH:

$$= a + \left(\tfrac{1}{2}\ \text{BOND LENGTH}\right)\sin 10^\circ + \tfrac{1}{2}\left[m + \left(\left(\tfrac{1}{2}\ \text{BOND LENGTH}\right) + S\right)\cos 10^\circ\right]$$

FG SLOPE BEHIND WALL

Project Title: MARIN SONOMA NARROWS REDWOOD LANDFILL INTERCHANGE – SEGMENT B1	Facility/Component: RETAINING WALLS		
Firm: BIGGS CARDOSA ASSOCIATES INC.	Designed: DSR	Date: 8/11/2011	Calc No.
Discipline: STRUCTURAL	Checked:	Date:	Rev No.
Subject/Description: STRUCTURAL DESIGN CALCULATIONS			Sheet No.

TIEBACK UNBONDED LENGTH

CHECK FOR REQUIRED UNBONDED LENGTH - POTENTIAL FAILURE SURFACE CLEARANCE

RETAINING WALL NO. 5														
Tieback Type	Pile No. with Greatest H	H	Φ'	θ	a	b	χ		m		L to n	s	Total Unbonded Length Req'd	
		ft	°	°	ft	ft	ft		ft		ft	ft	ft	
N/A	11	15.3	26°	58°	5	10.3	5.0		5.8		5.9	5.4	11.29	11'-6"

CHECK FOR REQUIRED UNBONDED LENGTH - MINIMUM OVERBURDEN DISTANCE

RETAINING WALL NO. 5										
Tieback Type	Modified Total Unbonded Length*		Tieback Dia	Tieback Force	Bond Strength	Min Bond Length	1/2 Bond Length		Vert Dist from FG to CL Bond Length	Check
	ft		in.	kips	psi	ft	ft		ft	>15'
N/A	18.0	18'-0"	8	70	40	5.8	2.9		15.12	OK

*MANUALLY ADJUSTED TO OBTAIN MINIMUM 15'-0" VERTICAL DISTANCE FROM FG TO CL BOND LENGTH

CHECK FOR REQUIRED UNBONDED LENGTH - SUMMARY

RETAINING WALL NO. 5				
Tieback Type	Length Potential Failure Surface	Length Min Overburden	Min per Geotech	**Length on Plans**
N/A	11'-6"	18'-0"	15'-0"	**18'-0"**

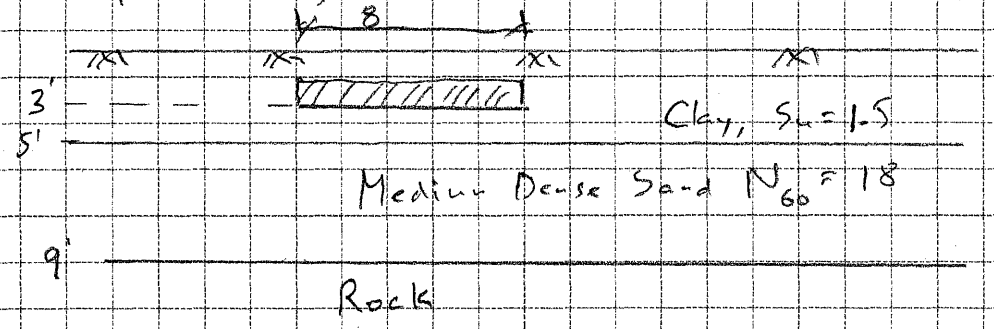
RETAINING WALL NO. 2

SETTLEMENT AND BEARING CAPACITY

PARIKH
Practicing in the Geosciences

JOB 208140. RET
SHEET NO ____ OF ____
CALCULATED BY Partha Sircar DATE 10/13/11
CHECKED BY ____ DATE ____
SUBJECT ____

Settlement of Retaining Wall No. 2 (based on Boring A-11-158A)



For a 14' high wall, the footing width is 8' per Caltrans Std. Plans

Assuming conservatively that the footing is underlain by 6 ft of stiff clay (S_u = 1.5 Ksf)

$E = 350 \times 1.5 = 525$ Ksf

Pressure (q) = 3.3 Ksf (allowable toe pressure per Caltrans Std. Plans)

$$\text{Settlement} = I_0 I_1 \frac{qB}{E}(1-\nu^2)$$

$I_0 \simeq 1.0$; $H/B = 6/8 = 0.75$; $I_1 = 0.4$; $\nu = 0.35$

$$\therefore \text{Settlement} = 1 \times 0.4 \times \frac{3.3 \times 8}{525}(1-(0.35)^2)$$

$$= 1 \times 0.4 \times \frac{3.3 \times 8}{525} \times 0.88 = 0.018' = \underline{0.21 \text{ inches}}$$

Bearing Capacity of Retaining Wall No. 2

$$(S_u)_{\text{equivalent}} = \frac{2}{1.5} + \frac{4}{2.5} = \frac{6}{S_u}$$

$$\therefore 1.33 + 1.6 = \frac{6}{S_u}$$

$$\therefore S_u = \frac{6}{2.93} = 2.05 \text{ Ksf}$$

$\therefore$ Bearing Capacity = $5.14 \times 2.05 = 10.5$ Ksf. Allowable = $10.5/3 = \underline{3.5 \text{ Ksf}}$

APPENDIX D

*Following section is identical to the section Appendix D in GDMR report. Except plates D-1, D-2, D-3, D-6 and D-7

APPENDIX D

SITE GEOLOGY – INTERPRATIONS AND MAPPING

D.1 PREVIOUS GEOLOGIC MAPPING

Dickerson (1922) originally mapped the Petaluma, Santa Rosa, and Point Reyes 15' quadrangles, focusing exclusively on Tertiary and Quaternary rocks. Aside from the volcanic rocks of Burdell Mountain, most Tertiary rocks were not distinguished as separate units in Dickerson's (1922) study. The Novato Conglomerate (now known to be Cretaceous) was mapped as a member of the "Pliocene" Sonoma Volcanics. (In 1922, the beginning of the Pliocene was considered to be ~10 million years before present.)

Weaver's (1949) map of the Petaluma Quadrangle is one of nine 15-minute geologic quadrangle maps in his report of the geology north of San Francisco Bay. Weaver informally named the Novato Conglomerate and tentatively assigned it a Cretaceous(?) age. Weaver assigned all Mesozoic rocks, excluding the Novato Conglomerate, to the "Franciscan group", then considered to be entirely of Late Jurrassic age. Weaver identified volcanic rocks in the vicinity of Burdell Mountain as "Pliocene" Sonoma volcanics.

Weaver's (1934) reconnaissance-level studies in the vicinity of Burdell Mountain led to the first generalized map of the area. He was the first to identify the Burdell Mountain fault trace, which he mapped for a distance of about 20 km, from San Francisco Bay northwestward to the northeastern flank of Burdell Mountain, similar to how the fault is depicted on recently published maps.

Rose (1955; 1958) described the petrology of the volcanics of Burdell Mountain area (designated Sonoma Volcanics) and the stratigraphy of the Franciscan (Complex), and Great Valley (Group) (e.g., Knoxville Formation and Novato Conglomerate). Rose (1955) was also the first to describe the Tertiary strata that underlie the volcanic rocks at Burdell Mountain, which he correlated to the Merced Formation.

Rice (1973 and 1975) produced the most complete and detailed maps of the Burdell Mountain and Novato area. Although Rice's (1973) report primarily focused on landslide features and related hazards, he also included detailed studies of the rock units and geologic structure of the

area. Rice mapped large areas on all sides of Burdell Mountain as "Quaternary landslides". Small areas of intact bedrock exposed in the landslide scarps and drainages were not mapped by Rice. Many of these exposures are critical for understanding the stratigraphic relations and geologic structure at Burdell Mountain.

Blake's *et al* (2000) map that encompasses the Burdell Mountain area is the USGS 1:125,000-scale Geologic map of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California. The map and database are largely compilations that, for the Burdell Mountain and Novato area, include or are based on the previous mapping described above.

Wagner's (2002) map shows landslides scarps located approximately 470 feet north of the locations on Rice's 1975 map and the toes of the landslides "trimmed" southward. We brought this apparent error to the attention of the California Geological Survey; they informed us that they intended to correct the error when they published the regional map of the Napa 30 x 60 degree map in 2010.

Ford's (2007) map shows two traces of the Burdell Mountain fault slightly differently than did previous geologic maps. Landslide scarps mapped northeast of the fault are located 470 feet north of the locations shown on Rice's 1975 map (just like Wagner's 2002 map, which Ford worked on).

The most recently published geologic map of the area was compiled by Wagner and Gutierrez (2010). The map is presented as Plate 3A in the main body of the report. They shifted the landslides southward so that their headscarps returned to the locations originally mapped by Rice (1975); however, they did not restore the northward extent of the toes of those slides as Rice had mapped them. The two traces of the Burdell Mountain fault are shown at the same locations mapped by Ford (2007).

All of the available geologic maps are more or less in agreement that bedrock northeast of the Burdell Mountain fault is Franciscan Complex and mélange, while bedrock southwest of the fault is Burdell Mountain Volcanics (andesite) on top of Tertiary Sandstone and Franciscan Complex which have been involved in large-scale landsliding to various degrees.

Our interpretation of the site geology, based on the latest published bap and our engineering geologist's examination of air photos and detailed topographic contours, is presented in Plates D-1 through D-7. Detailed discussions of the pertinent rock units for the project site as indicated in

the plates are presented in Section D.2 under appropriate era. An explanation of the map symbols is presented on Plate D.

D.2 STRATIGRAPHY

Bedrock units of project area consist of the Jurassic and Cretaceous Franciscan Complex and melange, Tertiary sedimentary rocks, and Miocene volcanic rocks of the Burdell Mountain volcanic field which unconformably overlie the other units. The boundaries of underlying bedrock units are difficult to define precisely due to poor exposures and some similar lithologies. Surficial deposits in the Burdell Mountain area are dominated by Quaternary landslide deposits that blanket both the east and west flanks of Burdell Mountain. Landslide deposits, along with colluvium, alluvium, and vegetation commonly obscure underlying stratigraphic relationships. On Burdell Mountain itself, exposures of intact andesite flows are almost entirely restricted to the mountain top, within steep, narrow drainages, or in exposures along landslide scarps.

D.2.1 Jurassic and Cretaceous Units

The Franciscan Complex in the northern Coast Ranges has been divided into the northwest-trending Coastal, Central, and Eastern tectonic belts. (Irwin, 1960) In Marin County, the Franciscan is mostly composed of relatively coherent gently northeast-dipping thrust sheets of the Eastern Metamorphic and Central Mélange belts that range in age from Early Jurrassic to Late Cretaceous. (Blake *et al.,* 1984)

The Eastern Metamorphic belt generally consists of schistose or phyllitic metagraywacke, metachert, and metabasalt. These rocks commonly contain abundant blueschist-facies minerals such as lawsonite, jadeite, pyroxene, and metamorphic aragonite. (Blake *et al.*, 1984) The Central Mélange belt is lithologically heterogenous and consists of a complex structural assemblage of graywacke, metagraywacke, radiolarian chert, metachert, gabbro, serpentinite, and medium to high-grade blueschist, eclogite and amphibolite in a highly-sheared shaley matrix. In the vicinity of Burdell Mountain, the Franciscan Complex includes rocks assigned to both the Eastern Metamorphic belts and Central Melange.

In the San Francisco Bay Area, serpentinite occurs within the Franciscan Complex and the Great Valley Group as accreted, exotic fragments of oceanic crust (ophiolite) and often marks the base of thrust zones or tectonic boundaries. (Warhaftig, 1989) Serpentinite generally forms tabular and elongate bodies along shear zones in the Burdell Mountain area.

The Great Valley Group consists of a thick accumulation of latest Jurassic to early Paleocene marine clastic sedimentary rocks that were deposited in an extensive, elongate, north-trending forearc basin, originally located between the Sierran magmatic arc and the Franciscan subduction complex. The Great Valley Group was deposited within a complex depositional system ranging from fluvial-deltaic in the east to deep-sea fan and basin plain in the west. (Bailey *et al.*, 1964) In contrast to the Eastern Metamorphic and Central Mélange belts of the Franciscan Complex, the Great Valley Group strata are unmetamorphosed and relatively unaffected by deformation associated with subduction and accretion.

Franciscan Complex schist, phyllite, and semischist (KJfsch)

Schistose rocks of the Franciscan Complex in the Burdell Mountain area have been assigned to the Eastern Metamorphic belt (i.e., the Yolla Bolly terrane of Bailey *et al.* [1964]). These rocks form two subparallel, northwest-trending belts located northeast and southwest of Burdell Mountain. All rocks of this unit have blueschist facies, high-pressure low-temperature alteration. (Wakabayashi, 1992) Rocks include meta-sandstone ranging from very low grade and weakly foliated to moderate low-and moderate-grade phyllite and schist, shale, chert, basalt, minor greenstone, and rare blocks of amphibolite and blueschist, which are found as isolated bodies found within or near serpentinite.

Near Burdell Mountain, the Franciscan Complex schist is generally a slope former. The predominate geomorphic feature of this unit is a northwest-striking ridge which is bounded to the southwest by the Burdell Mountain fault west of Highway 101. The unit is generally exposed on steep slopes and ridges and is responsible for the most extensive landslides, which range from hummocky surficial deposits to mega-scale rotational slump blocks.

Franciscan Complex mélange (KJfm)

Franciscan Complex rocks of the Central Melange belt are found in the Burdell Mountain area in thin, elongate, fault-bounded blocks along the Burdell Mountain fault zone. The unit is bounded between two sub-parallel strands of the Burdell Mountain fault zone and is juxtaposed against Franciscan Complex schist (KJfsch) to the northeast and Burdell Mountain volcanic rocks (Tbv) to the southwest.

At Burdell Mountain, the Franciscan Complex mélange (KJfm) consists almost entirely of sandstone with only minor outcrops of chert and greenstone. The sandstone is primarily light-brown to greenish-gray lithic wacke (informally known as greywacke) that is fine to coarse

grained, moderately indurated, and it is thickly bedded to massive. The sandstone is exposed mostly in areas of low relief and in drainages, but in some areas it forms steep slopes where it has been protected upslope by more resistant rocks or it has been uplifted or folded near fault contacts. Remnants of Burdell Mountain volcanics along this ridge suggest that these more resistant rocks have preserved the morphology of the ridge. However, the proximity of two sub-parallel shear zones, and near vertical fractures with similar orientations to the shear zones within the sandstone, suggest that the relief may be fault related.

Landsliding is far less widespread within the Franciscan mélange (KJfm) than within the Franciscan schist (KJfsch) in the map area. This is interpreted to be due to the higher concentration of relatively resistant and massive sandstone rather than sheared rock that comprises the mélange in other areas in the region.

Serpentinized Ultramafic Rocks (sp)

Serpentinite associated with the Franciscan Complex and possibly with the Coast Range ophiolite (Warhaftig, 1989) forms elongate bodies along the northeast, southwest and south flanks of Burdell Mountain. It is commonly associated with fault contacts between rocks of differing lithologies and metamorphic facies. Most conspicuously, serpentinite can be traced continuously along the Burdell Mountain fault zone for several kilometers. Rocks mapped as serpentinite consist of partially to entirely serpentinized peridotite, with minor vestiges of gabbro and pyroxenite occuring locally. Silica-carbonate, a hydrothermal alteration product of serpentinite, is also found locally along fault zones, and it occurs in bold, jagged, variegated exposures with distinct green, yellow, and white colors. The rocks stand out conspicuously as linear resisistant outcrops along the easternmost trace of the Burdell Mountain fault zone south of San Antonio Road and extensively along the top of the narrow ridge that is parallel to the Burdell Mountain ridge. In the map area, the silica carbonate is largely composed of quartz or opal and calcium carbonate (and perhaps other carbonate minerals) and is a very hard, fine-grained, black, green, and white silicified rock containing intersecting veinlets of carbonate which are sometimes stained with limonite. It commonly has fault-parallel shear fabric, slickensides, and gentle to open folds that are approximately 1-10 cm in amplitude with fault-parallel hingelines.

D.2.2 Tertiary Units

Tertiary rocks at Burdell Mountain consist of sedimentary rocks of probable early to middle Miocene age and middle Miocene Burdell Mountain volcanic rocks that both lie unconformably

over rocks of the Franciscan Complex.

Rocks of the Burdell Mountain volcanic field are found only west of the Burdell Mountain fault zone and are primarily andesite (Tbv).

Tertiary Sandstone (Ts)

A relatively thin sequence of Tertiary sedimentary rocks lie stratigraphically between underlying rocks of the Franciscan Complex and overlying Burdell Mountain volcanics. The unit reaches a maximum thickness of approximately 40 m along the west flank of Burdell Mountain, but appears to pinch out stratigraphically between over and underlying units. Strata within this unit consist primarily of buff weathered sandstone with minor siltstone, pebble conglomerate, and coquina.

The composition of the sandstone is subarkose. It is light gray and tan to nearly white, with localized yellow and brown oxidation and pale green weathering. The sandstone is generally fine grained, with well-sorted, sub-angular to rounded grains, thick bedded to massive and locally planar, and is moderately fractured, friable to moderately hard, locally fossiliferous and diatomaceous, and tuffaceous along the upper part of the unit. The siltstone has similar color and weathering properties as the sandstone, although the siltstone is more thinly bedded and friable. Channelized and matrix-supported pebble conglomerate makes up a very minor part of the map unit. The clasts consist of sub-angular to well-rounded black shale, red and black chert, and quartzite, all less than 10 mm in diameter.

Burdell Mountain Andesite (Tbv)

Andesitic rocks (Tbv) make up the vast majority of the Burdell Mountain volcanics. They consist primarily of lava flows that cover an area of about 12 km^2 and are approximately 200 m thick. Along with the underlying Miocene sandstone, these volcanic flows form a gently northeast-dipping homocline that caps the northwest-trending summit ridge of Burdell Mountain and is truncated by the Burdell Mountain fault zone to the east. Smaller areas of andesitic volcanics are also found as a ridge capping unit ~2 km southeast of the southern part of Burdell Mountain and as a relatively down-dropped, fault-bounded block between two strands of the Burdell Mountain fault zone in the southeast part of the map area. The unit consists of a series of gently east-dipping lava flows that primarily rest on the Tertiary sandstone, but locally overlie faulted and folded Franciscan Complex rocks.

Twelve separate lava flows have been recognized in the southern part of the mountain: ten pyroxene andesite flows, one basalt and one biotite dacite flow locally overlying a basal tuff (this study). The andesites are porphyritic with small (1-3 mm) subhedral to euhedral phenocrysts of hypersthene, augite, and zoned plagioclase embedded in a hemi-crystalline groundmass consisting mainly of plagioclase and glass. Individual flows are 6 to 25-m-thick and consist of a massive zone underlain and overlain by non-vesicular and poorly-jointed flow breccia. The rock is moderately to deeply weathered and commonly stained red by hematite. Montronite and opal are common coatings and partial fillings of vesicles.

The age of the andesite is constrained by $^{40}Ar/^{39}Ar$ analyses of plagioclasts that yielded cooling/crystallization ages of approximately 11 million years.

D.2.3 Quaternary Units

In the project area, Quaternary deposits consist primarily of landslide deposits along the flanks of Burdell Mountain, alluvium found primarily in the lowlands overlying rocks of the Francisican Complex, and muddy sediments along the margin of San Pablo Bay. Surficial deposits are divided into units based on the type of deposit and (in the case of landslide deposits) the relative age of the deposits. The units are: mega-landslide deposit (Qlsv), landslide deposit (Qls), colluviums (Qc) including debris flow deposits (Qdf), alluvium (Qa), and bay mud (Qhbm). The surficial units were primarily mapped on aerial photographs.

Mega-landslide deposits (Qlsv)

Large-scale landslides (i.e., mega-landslides) at Burdell Mountain have drawn the interest of previous workers. In particular, Rice (1975) provided descriptions of the landslides and some of the Quaternary deposits on and near Burdell Mountain in his hazards report for Marin County and the Novato area. Ages of the older mega-landslides are unknown.

Both the northeast and southwest slopes of Burdell Mountain ridge consist of large, arcuate landslide scarps of up to 1 km across rooted near contact with the volcanic rocks and the underlying Tertiary strata and Franciscan Complex. These apparently ancient blocks of more resistant volcanic rock of up to 1 km^2 form several knobs and other areas of high relief around the base of Burdell Mountain and several large (0.5 km^2) terraces particularly high on the southwest flank of the mountain.

On the southwest slope, the large landslides are generally rotational slump-block type that have

arcuate head scarps and appear to be more deeply rooted, suggesting that slide planes cut across foliation and bedding of the Burdell Mountain volcanics and the Tertiary Sandstone strata respectively. The ages of the mega-landslides are unknown but they appear to be related to the uplift and faulting of the mountain itself, which dates back to the initiation of the East Bay fault system in the middle Miocene, although it is possibly that the preserved landslide features are Quaternary in age.

Landslide deposits (Qls)

Landslides denoted Qls include debris flow, mudflow, and block slump landslides mostly within Franciscan Complex. These are distinguished from older and larger mega-landslides by their relatively young (Holocene?) appearance, their size and slide plane depth. In general, these deposits are less than 300 feet across and/or have slide planes shallower than 30 feet. Landslide boundaries are based on surficial mapping techniques and are approximate.

Alluvium (Qa)

Due to relatively high relief and rugged terrain in the Burdell Mountain area, Quaternary alluvium is generally restricted to the large drainages, lowlands, and valleys. Quaternary alluvium is mapped primarily in the very western portion of the map area in the headwaters of San Antonio Creek and Bowman Canyon and along Highway 101 in lowlands along the eastern transition of the Burdell Mountain and the San Pablo Bay.

The alluvium consists of Pleistocene to Holocene gently sloping to horizontal, fan, terrace, and basin deposits. Generally, the alluvium is composed of sandy-clayey gravel with sub-angular to well-rounded pebbles and cobbles with a few boulders of Burdell Mountain volcanic and Franciscan Complex rocks.

Bay Mud (Qhbm)

The eastern portion of the map area is dominated by bay mud consisting of Quaternary silt, clay, peat, and fine sand deposited at or near sea level in San Pablo Bay. The flat plains of the eastern part of the Petaluma River and Novato Quadrangles east of Burdell Mountain are former marine marshlands (Rice, 1975). Bay Mud deposits are mostly several feet below mean sea level, and were regularly inundated by high tides. Tidewater from San Pablo Bay was excluded from the marshlands by a system of dikes constructed in the early 1900's (Rice, 1975). Soft Bay Mud rests on unconsolidated but compacted older stream channel and colluvial deposits.

D.3 REFERENCES

Atwater, T., 1970, Implications of plate tectonics for the Cenozoic tectonic evolution of western North America: Geological Society of America Bulletin, v. 81, p. 2513-3536.

Atwater, T., 1989, Plate tectonic history of the northeast Pacific and western North America: The Geology of North America, Vol. IV, Geological Society of America, Boulder, CO. p. 21-72.

Bailey, E.H., Irwin, W. P., Jones, D. L., 1964, Franciscan and related rocks and their significance in the geology of western California: California Division of Mines and Geology Bulletin 183, p.177.

Blake, M.C. Jr.; Bartow, J.A.; Frizzell, V.A. Jr.; Schlocker, J.; Sorg, D.; Wentworth, C.M.; and Wright, R.H.; 1974; Preliminary Geologic Map of Marin and San Francisco Counties and Parts of Alameda, Contra Costa and Sonoma Counties, California; U.S.Geological Survey, Miscellaneous Field Studies Map MF 574.

Blake, M.C., Jr., Howell, D.G., and Jayko, A.S.; 1984; Tectonostratigraphic terranes of the San Francisco Bay Region, in Blake, M.C., Jr., eds., Franciscan geology of northern California: Pacific Section of Economic Paleontologists and Mineralogists, v. 43, p. 5-22.

Blake, M.C. Jr., Graymer, R. W., and Jones, D. L.; 2000; Geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California, 1:125,000. U.S. Geological Survey, MF-2337.

Dickerson, R.E.; 1922; Tertiary and Quaternary history of the Petaluma, Point Reyes, and Santa Rosa quadrangles: California Academy of Science Proceedings, series 4, v. 11, n. 19, p. 527-601.

Dickinson, W.R., and Snyder, W.S.; 1979a; Geometry of subducted slabs related to the San Andreas transform: Journal of Geology, v.87, p. 609-627.

Dickinson, W.R., and Snyder, W. S.; 1979b; Geometry of triple junctions related to the San Andreas transform: Journal of Geophysics. Res., 84(B2), p. 561-572.

Ford, E.W.; 2003; Mesozoic and Tertiary Stratigraphy of the Burdell Mountain Area and Implicaitons for Slip along the East Bay fault System, Marin County California; Field Trip Guidebook; Northern California Geological Society

Ford, E.W.; 2007; Burdell Mountain Stratigraphy and Implications for Long-term Slip along the East Bay Fault System, California; M.S. Thesis at San Francisco State University.

Fox, K.F.; 1983; Tectonic setting of late Miocene, Pliocene, and Pleistocene rocks in part of the Coast Ranges north of San Francisco, California: U.S. Geological Survey, Professional Paper 1239, p. 33.

Fox, K.F. Jr., Fleck, R. J., Curtis, G. H., and Meyer, C. E.; 1985; Implications of the

northwestwardly younger age of the volcanic rocks of west central California: Geological Society of America Bulletin, v. 96, p. 647-654.

Grahman, S.A., Stanley, R.G., Bent, J.V., and Carter, J.B.; 1989; Oligocene and Miocene paleogeography of central California and displacement along the San Andreas fault system, Geological Society of America Bulletin, v. 101, p. 711-730.

Huffman, O.F.; 1972; Lateral displacement of upper Miocene rocks and the Neogene history of offset along the San Andreas fault in central California: Geological Society of America Bulletin, v. 83: p. 2913-2946.

Irwin, W.P.; 1960; Geologic reconnaissance of the northern Coast Ranges and Klamath Mountains, California: California Division of Mines and Geology Bulletin 179, p. 79.

Jones, D.L.; 1994; Neogene transpressive evolution of the California Coast Ranges: Tectonics, v. 13, n. 2, p. 561-574.

Mankinen, E.A.; 1972; Paleomagnetism and potassium-argon ages of the Sonoma volcanics, California: Geological Society of America Bulletin. v. 83, p. 2063-2072.

McLaughlin, R.J., Sliter, W. V., Sorg, D. H., Russell, P. C., Sarna-Wojcicki, A. M.; 1996; Large-scale right–slip displacement on the East San Francisco Bay region fault system, California: Implications for location of late Miocene to Pliocene Pacific plate boundary. Tectonics, v. 15, 18 p.

Medly, E.W.; 2008; Engineering the Geological Chaos of Franciscan and other BIMrocks; American Rock Mechanics Association, 08-316

Page, B.M., Thompson, G.A., and Coleman, R.G.; 1998; Late Cenozoic tectonics of the central and southern Coast Ranges of California Geological Society of America Bulletin. v. 110, p. 846-876.

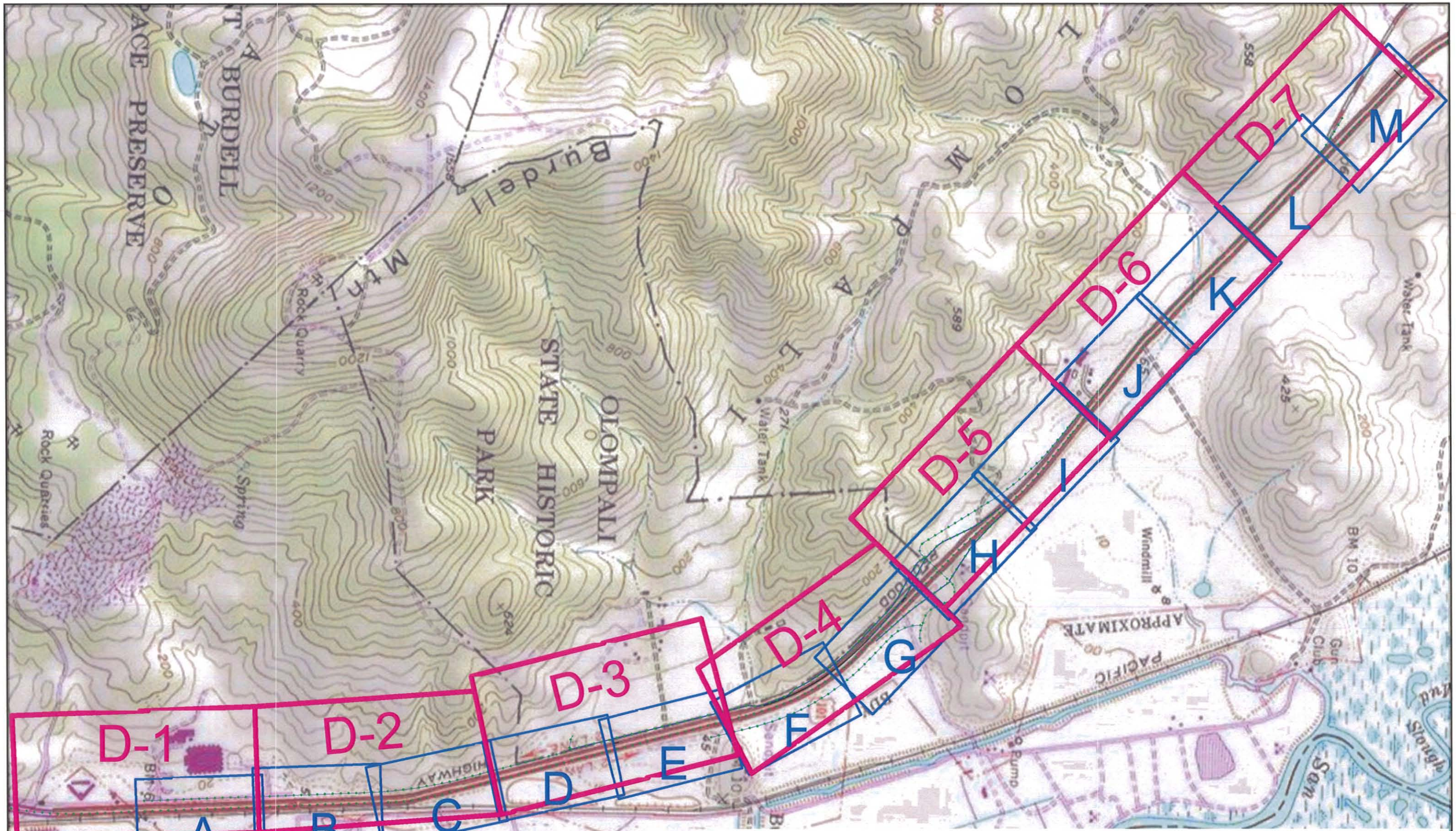
Rice, S.J.; 1973; Geology and Geologic Hazards of the Novato Area, Marin County, California. Scale 1:12,000. California division of Mines and Geology, Preliminary Report 21, 47 p.

Rice, S.J.; 1975; Geology for Planning Novato Area, Marin County, California: California Division of Mines and Geology Open-File Report 76-1, Plate 1 East - Geology, Eastern Part of the Novato Area, scale 1:12,000.

Rose, R.L.; 1958; Pre-Tertiary stratigraphy near Petaluma, California: Geological Society of America Bulletin. v. 69, p. 2.

Wagner, D.L., Rice, S.J., Bezore, S.P., Randolph-Loar, C.E., Allen, J.E. and Witter, R.C.; 2002; Geologic map of the Petaluma River 7.5' Quadrangle, Marin and Sonoma counties, California: A digital database: California Geological Survey website, http://www.conservation.ca.gov/-cgs/rghm/rgm/preliminary_geologic_maps.htm

Wakabayashi, J.; 1992; Nappes, tectonics of oblique plate convergence and metamorphic evolution related to 140 million years of continuous subduction, Franciscan Complex,



INDEX - Site Geologic Map Sheets

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140. RET

PLATE NO.: D

Qa
KJf
KJf
KJf
Qc
Qaf
RW-2
Qc
KJf
Qc/Qa
Qc
Qaf
Qaf
Qc
Qaf
Qa
Qa
Qc/Qa
KJf

SITE GEOLOGIC MAP - SHEET D-4

0 50 100 200 300 400 500 600 Feet

See Plate D-8 for Explanation.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: D-4

KJf
KJf
KJf
Qls
Qls
KJf
KJf
Qls
Qls
KJf
KJf
KJf
Qls
Qls
Qls
Qls
RW-4
Qc
Qc/Qa
Qc/Qa
Qa
RW-7
Qaf
RW-5
Qaf
Qaf
KJf
Qa
Qa
Qa

0 50 100 200 300 400 500 600 Feet

See Plate D-8 for Explanation.

SITE GEOLOGIC MAP - SHEET D-5

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: D-5

EXPLANATION FOR SITE GEOLOGIC MAPS

- Burdell Mt. Fault (Ford; 2007)

- contact (inferred)

Qaf - artificial fill

Qc - colluvium
(including debris flow deposits)

Qa - alluvium

Qls - landslides

Qls (Tv) - large landslides composed of Burdell Mountain Volcanics

Tv - Burdell Mountain Volcanics (andesite)

Ts - Tertiary Sandstone

KJgv - Great Valley Sequence

KJf - Franciscan Complex melange
(including graywacke sandstone, shale, chert, and serpentinite)

- Top of Proposed Cut Slope

- Toe of Proposed Fill Slope

- Proposed Retaining Wall

- Project Alignment

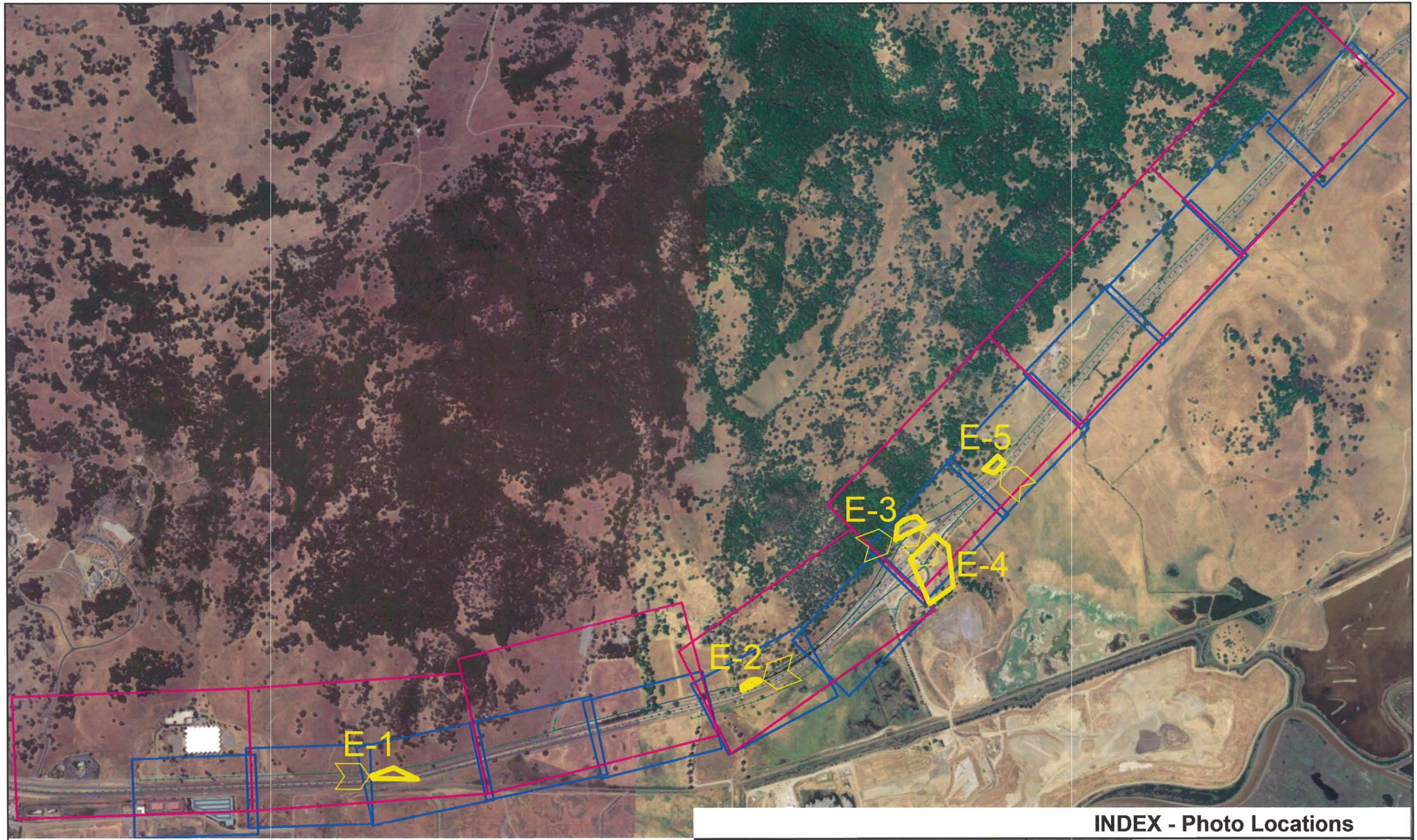
- Boring location

- Test Pit location

- shear zone

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.RET	PLATE NO.: D-8

APPENDIX E



0 250500 1,000 1,500 2,000 2,500 3,000 Feet

INDEX - Photo Locations

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: E

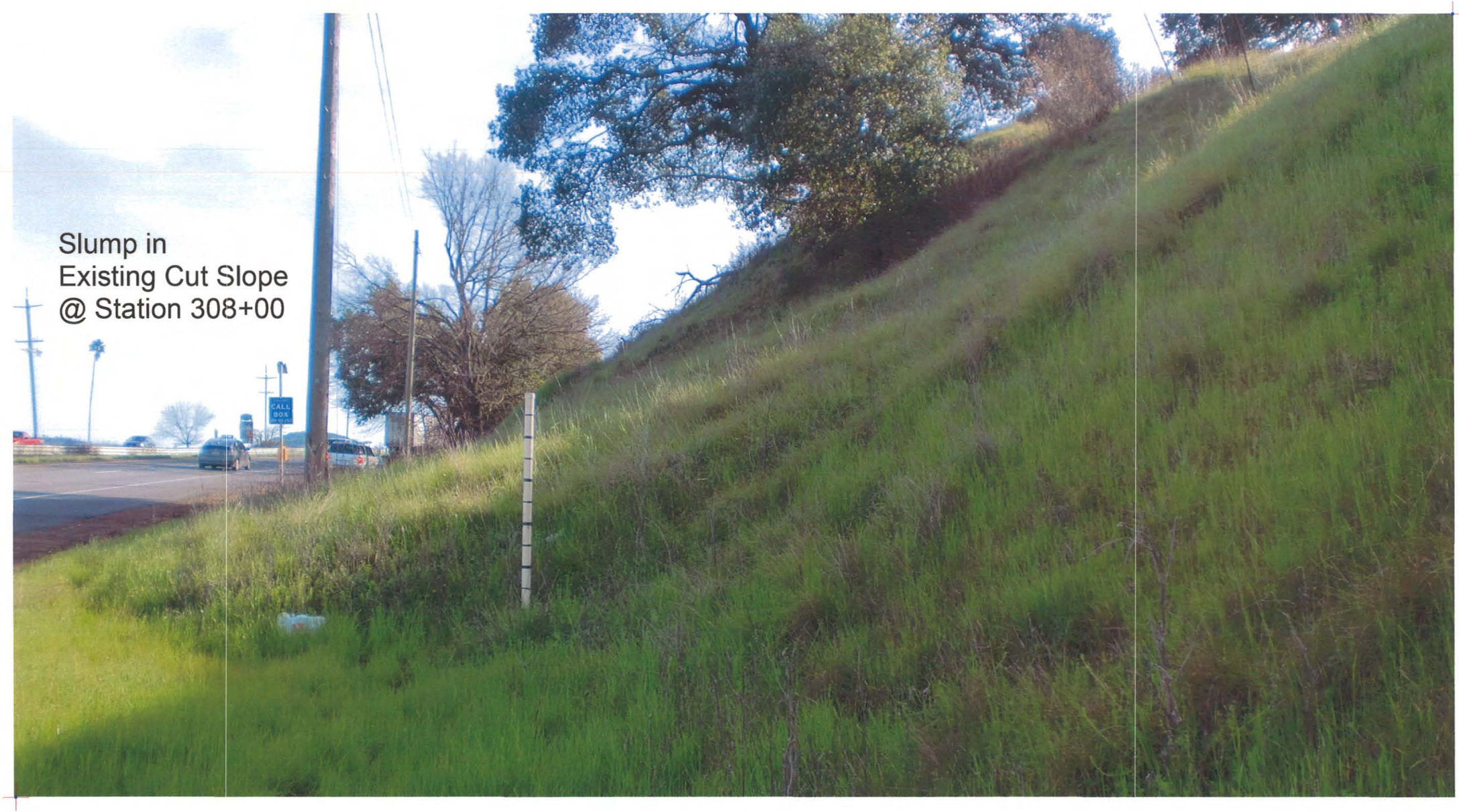


PHOTO #2

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: E-2

Proposed
Retaining Wall #4

PHOTO #3

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.RET	PLATE NO.: E-3

Chert exposed in
Existing Cut Slope
@ Station 338+00

PHOTO #4

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.RET | PLATE NO.: E-4

Erosion and slumping of
Existing Cut Slope
@ Station 360+00

PHOTO #5

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.RET	PLATE NO.: E-5

APPENDIX F

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 **EA:** 264701 **Project Name:** Redwood Landfill I/C **OSFP Liaison:** Tracy Bertram **Phone:** 916-227-8397 **e-mail:**_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for RW-6th review **Structure Information** (Use when necessary to document comments by individual structure) **Structure Name:** RW 2,4,5,7 **Br No:** ____	**Reviewer Name:** Betty Lee/Mahmood Momenzadeh **Functional Unit:** GS **Phone Number:** 510-286-4825 **e-mail:** betty_lee@dot.ca.gov **Date of Review:** 11/30/2011

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
____	Parikh Inc.	____	____	____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
5	FR		Our comment remains the same as for our review of 9/20/11.	The response for RW2 and RW7 has been included in the 10/14/2011 report. The settlement discussion is included on pages 17 and 25 for RW2 and RW7 respectively. Settlement calculations for RW7 are found in the last page of Appendix C. Additionally, it should be noted that this issue was discussed and determined that no additional work was required in the December 2nd meeting.	
9	FR		The FR says the unbounded length is minimum of 15 ft. The structural engineer's calculations on Appendix C show the minimum required unbounded length to be 15' 6".	The Foundation Report requires a 15-foot minimum unbonded length. This is based on FHWA-IF-99-015. The specific unbonded length is based on structural design which considers the geometry of the wall (wall height, depth to tiebacks, potential soil failure surface, etc). As noted in Appendix C of the Foundation Report and the structure plans (Foundation Report	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

				Plate 7-A-1 and Plate 7-B-1), the unbonded length established by the structural design varied from 15-ft to 18-ft depending on the stationing/location along the retaining wall. These unbounded lengths established by the structural design meets or exceeds the minimum unbounded length cited in the Foundation Report	
14	FR		Our comment remains the same as for our review of 9/20/11.	Per the November 2, 2011 teleconference (Caltrans OSFP, Caltrans GS, BKF, BCA, PCI), the seismic design calculations were performed for RW #5 in the vicinity of the existing Verizon cellular facility. The calculations were based on AASHTO LRFD Design Specifications with Caltrans Amendments and supplemental information extracted from Geotechnical Engineering Circular No. 4, NCHRP Report 611 and FHWA-NHI-11-032, as applicable. The seismic calculations were submitted via email to Tracy Bertram on November 10, 2011. No changes to the current design/details were required based on the seismic calculations. This topic is also referenced in #25 below.	
15			See #9 above.	See response #9 above.	
16	FR		Our comment remains the same as for our review of 9/20/11.	The pile data table has been calculated and provided by the structural designer based on the geotechnical design input included in the Foundation Report. Tables with specific pile lengths has been reviewed and included in the Foundation Report in Plates 7-A-1, 7-A-2, 7-B-1 and 7-B-2 found prior to Appendix A.	
20			Our comment remains the same as for our review of 9/20/11.	See response to #5 above.	
22	FR		Please see #9 above.	See response to #9 above.	
24	FR		Our comment remains the same as for our review	On page 29 of the Foundation Report, it is cited that	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			of 9/20/11.	overexcavation limits are shown on Appendix F of GDMR. Please note the plans shown in Appendix F of GDMR comply with direction received by the DOE on format and specific information to/not to be provided.	
25	Memo (11/9/11) from Parikh to Biggs		This is in regards to the seismic calculations for Retaining Wall #5. Parikh provided Biggs parameters for the calculations. The assumption that it is level ground behind the wall is wrong. The FR states that there is a 2H:1V slope up to 16 ft high behind the wall.	As discussed during the teleconference (11/02/11), we performed the requested seismic calculation for Retaining Wall #5 at the location of concern at the existing Verizon facility. In general, Retaining Wall #5 is characterized as having a 2:1 back slope of varying height; except at the existing Verizon facility which is located in an existing saddle which is predominately flat and requires very little regrading. This predominately flat slope is reflected in the structural calculations and the geotechnical parameters. Additionally, wall expansion joints have been provided to further separate the wall segment at the existing Verizon facility from the remaining portion of the wall. As discussed at the teleconference (12/05/11) it is our understanding that the seismic calculations for the portion of wall of concern near the existing Verizon facility have been reviewed and no changes or exceptions were noted and that additional seismic calculations are not required.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264701 **Project Name: Redwood Landfill I/C** **OSFP Liaison: Tracy Bertram** **Phone: 916-227-8397** **e-mail:**	☐ PSR/PDS (Review No.) ☐ APS/PSR (Review No.) ☐ APS/PR (Review No.) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No.) ☐ Construction Support ☒ Other: Foundation Report for RW-5th review **Structure Information** (Use when necessary to document comments by individual structure) **Structure Name: RW 2,4,5,7** **Br No:**	**Reviewer Name: Betty Lee/Mahmood Momenzadeh** **Functional Unit: GS** **Phone Number: 510-286-4825** **e-mail: betty_lee@dot.ca.gov** **Date of Review: 9/20/2011**

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	**Structure Consultant Firm** Parikh Inc.	**Phone Number**	**e-mail**	**Response Date**

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
5	FR		We do not concur. Required toe pressures in Caltrans Standard Plans are for bearing capacity, not for settlement. Differential settlement must be quantified.	Retaining Wall No. 2,: For a toe pressure of 3.3 ksf (the allowable toe pressure per Caltrans Standard Plans), a total settlement on the order of 0.2 inch is a conservative estimate for the southern end of the wall, assuming 6 feet of stiff clay under the footing. From the center of the wall to the northern end, the wall is founded on rock, and thus the settlement is essentially 0. Thus, there is a maximum differential settlement on the order of 0.2 inch. Retaining Wall No. 7 is founded on dense silty and clayey sand. Thus, the total settlements, and consequently the differential settlements will be negligible.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

9	FR		Please justify the unbounded tie-back lengths—show calculations. RW#4 is 31 ft high, RW#5 is 19 ft high. The Plans show only 1 tieback at these lengths. Is one tieback adequate for these heights?	Calculations for required unbonded tieback lengths are presented in Appendix C. They are based on the procedures recommended in the FHWA Manual and the friction angles of the retained soil. The walls have been designed by the Structural Engineer based on the pertinent geotechnical parameters provided in the report. Wall design parameters, wall layouts, member sizes and structural designs are different at each wall. Structural Calculations and Independent Structural Check Calculations were generated and submitted to Tracy Bertram (Caltrans OSFP) for distribution and review. The Structural Engineer has adequately responded to and resolved all structural review comments related to the walls. The walls have sufficient factors of safety as currently designed.	
13	FR		The unit weights for bimrock-rich and bimrock-poor soils are the same (135 pcf). Please explain.	The unit weight for block-rich bimrock is assumed as 135 pcf and for block-poor bimrock it is 130 pcf. This is consistent with the calculations. The '135 pcf' for block poor bimrock on Page 19 is a typo.and has been corrected in the revised report.	
14	FR		We do not concur. Seismic conditions must be addressed even during WSD (working stress design), before the implementation of LRFD.	Reasons for requesting seismic design of these walls is unclear from the comments. Seismic design was not scoped or budgeted for this project since seismic design has not traditionally been required for non-critical walls that do not support critical structures. The retaining wall design has remained consistent with the approved Type Selection which did not require seismic design of the walls and the Type Selection approval predates the recent Caltrans requirement to use LRFD design (which includes seismic design for walls). This issue has been referred to Tracy Bertram (Caltrans OSFP-Senior Liaison Engineer) for resolution.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

15			See #9 above.	See response for #9 above.	
16	FR		We do not concur. The geotechnical requirements for pile embedment should be provided by the Geotechnical engineer.	Geotechnical requirements for pile embedment: Coefficient of Passive Resistance; Maximum Arching Ability; and Allowable Skin Friction for the soldier piles for Wall Nos. 4 and 5 have been provided on pages 20 and 23, respectively. Values have been used by the Structural Engineer to determine the required pile embedment depths for the loads on the walls as calculated by him. Structural Calculations and Independent Structural Check Calculations were generated and submitted to Tracy Bertram (Caltrans OSFP) for distribution and review. The Structural Engineer has adequately responded to and resolved all structural review comments related to the walls. The walls have sufficient factors of safety as currently designed.	
20			Settlement magnitudes must be justified. Caltrans Standard Plans are not relevant to settlement issues.	Agreed. See response to #5.	
22	FR		Please see #9 above.	See response to #9 above.	
24	FR		These are not found in the Plans or FR or GDR.	The overexcavation limits are presented in sheets EX-1 through EX-15 and X-1 through X-15 in Appendix F of the GDMR.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264071 Project Name: REDOOD LANDFILL IC - Retaining Walls 2,4,5&7 OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail: tracy bertram@dot.ca.gov	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. 1) ☐ Construction Support ☒ Other: FR (FINAL) **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Redwood Landfill IC - Retaining Walls Br No: ____	Reviewer Name: Rifaat Nashed Functional Unit: GS Phone Number: 510-622-1773 e-mail: rifaat_nashed@dot.ca.gov Date of Review: 09/29/11

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Response
1	FR (FINAL)	Report Reviewed Title (General)	FINAL Foundation Report For Retaining Walls-Marine-Sonoma Narrows Contract B-1,Redwood Landfill Interchange At Route 101,Marin County, California 04-Mrn-101 EA 264071 August31, 2011		The comment form attached to the report belongs to the Geology comments on GDR not FR Agreed. Will correct.
2	FR (FINAL)	**SITE GEOLOGY** Page 7	1- To be consistent with the Geologic Map (Plate 3A) , the following rock units should be added: - Artificial fill placed over baymud (afbm) - Unnamed taffaceous sediments (TS). - Schist and semischist (block within Franciscan mélange). - Great Valley Sequence (KJgv).	1- Description of the units will be added.	1- The Symbol "Ts" denote to" unnamed taffaceous sediments" and not "unnamed Tertiary sandstone" Agreed. Text has been revised.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			2- The following rock units should be omitted: - Undifferentiated volcanic rock (TV). - Franciscan mélange (fm). 3- The Geologic Map (Plate 3A) is blown up too much, that the most of geologic unit symbols located in the project site became out of the map limits and unreadable.	2- Tv cannot be omitted as it is the Burdell Mountain Volcanics which cap Burdell Mountain itself. And are involved in large landslides which have deposited andesite boulders just west of the highway at the Redwoodlandfill Overcrossing 3- Per suggestion from Caltrans (Rifaat), the map will be enlarged to 1:50,000 scale to make the geologic units and symbols readable	2- Agreed, however, the transported rocks are not considered part of the site geology. But they are part of the rocks present at the site and thus part of the geologic setting. 3- Our comment dated 7/19/11 has been adequately addressed
3	FR (FINAL)	**Information from Soil Borings and Test Pits** Page 8	For the statement" The sandstone and claystone are generally blocks within the Franciscan Complex (e.g. blocks-in matrix)" how could you come to that conclusion and they are not intact rocks, from borings.	The conclusion is based on our extensive investigation, which included literature review, geomorphic interpretation, examination of existing cut slopes and test pits in addition to the soil borings.	Agreed, that these LOTB's exhibition are modified field logs.
4	FR (FINAL)	**Bimrocks (Blocks-in-matrix)**	This item should be omitted except the last two paragraphs concerning the internal friction angle and the characteristics of	Agreed. Statement will be added in the updated report indicate that	This item still remains the same without updating The description was

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

		Page 10	bimrocks for excavation, which does not serve the scope and the goal of the report.	detailed discussion on bimrocks is included in the GDMR and only pertinent sections as noted in the comments will be included the updated report	shortened in the previous version and has been shortened further in the present version.
5	FR (FINAL)	**Seismic Sources** Page 14	Attach the ARS curve	Attach the ARS curve	Why you use the value of the shear wave velocity (Vs 30) = 400m/s? Used Boring A-09-001
6	FR (FINAL)	**Liquefaction** Page 16	Define the project limits on the attached Liquefaction Map (plate 5).	Agreed. Project Limits will be added to the Liquefaction Map (Plate5).	Our comment dated 7/19/11 has been adequately addressed
9	FR (FINAL)	**APPENDIX A**	All the LOTB's do not include the bench mark for their location as the Soil/Rock classification Manual stated.	Agreed. Bench Marks for the locations will be included on all LOTB sheets	Our comment dated 7/19/11 has been adequately addressed

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264701 Project Name: Redwood Landfill I/C OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for RW-4nd review **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: RW 2,4,5,7 Br No: ____	Reviewer Name: Betty Lee/Mahmood Momenzadeh Functional Unit: GS Phone Number: 510-286-4825 e-mail: betty_lee@dot.ca.gov Date of Review: 7/1/2011

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
____	Parikh Inc.	____	____	____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
			Consultant responses should be reflected in the FR text. Please indicate the page numbers where the revisions are found.	*Response locations (page numbers) will be identified as requested once the revised FR Reports are finalized (following the PS&E submittal).*	
5	FR		Insufficient answer. Different settlement not justified. Must also address all other retaining walls.	Wall Nos. 2 and 7 are Standard Walls per Caltrans Standard Plans (2006). It is inherent in the design that the required toe pressures are less than the recommended allowable toe pressures the total settlements and consequently differential settlements will be tolerable. In the present case, Wall No. 2 is only 14.2 feet tall and underlain by very stiff clay on one side and rock on the other and Wall No. 7 is underlain by dense to very dense silty and clayey sand. The total and consequent differential settlements will therefore not be significant. (See Pages 17 and 25)	
6	FR		BKF to check.	*The station identified in Parikh's response for the Verizon Wireless Building at RL2 337+00, 40' RT is*	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓ = Comment Resolved (for Reviewer's use)

				correct. Parikh will make sure the station is identified in the text and GDMR exhibits .(See Page3 and Plate 2B)	
9	FR		This is not found in the Structural Plans.	*Biggs Cardosa Associates (Structural Designers) has incorporated the following changes to the structural plans (RW 4 and 5 specifically):* *1. Added soil parameter information to include phi angle., with applicable input from Parikh* *2. Added Tie-back table on RW 5.* *3. Recalculated/Updated Unbonded Tie-back Lengths (based on FHWA and Mahmood's recommendations).* *4. Used proper tieback symbol on retaining wall developed elevation view.* (Retaining Wall Layout Plans in Plates 7A and 7B	
10	FR		Why is this info not in the FR text?	The footing for RW#7 will be founded on dense to very dense silty/clayey sand. The recommended allowable bearing capacity is 1.3B in ksf, where B is the width of the footing in feet. This will be noted in the report. (sse Page 25)	
13	FR	P. 20, 22	Please indicate friction angles in the FR text.	Agreed. Friction angles will be included in the text. See pages 19 and 22 and Plates 6A and 6B)	
14	FR, Plans		Seismic requirements need to be addressed.	Consideration of seismic loadings for the design of the retaining walls is not required for this project *as confirmed by Biggs Cardosa Associates in their e-mail. The reason for this is that the Type Selection for the project took place before October 1, 2010, the effective date after which all retaining wall design should be per LRFD and seismic loading should be included.* (See attached e-mail)	
15	FR		Must specify the **required** unbounded length, not the minimum.	*The required unbonded lengths will be established by the Structural Designer per the requirements of the FHWA Manual (Sabatini, 1999), with a minimum of 15 feet. The required unbonded lengths as determined by the Structural Designer will be noted on the*	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

				Structural Plans and also will be included in the Retaining Wall Foundation Report .as applicable. (See pages 20 and 23 and Plates 7A-I and 7B-1)	
16	FR, Plans		Should be addressed by Geotechnical Engineer.	The required pile lengths will be provided by the Designer for inclusion in the GDMR. (See Plates 7A and 7B)	
17			Inadequate answer.	*The design loads for tiebacks based on geotechnical requirements will be provided by the Structural Designer and included in the report.*	
19	FR, Plans		Table not found in Plans for RW#5.	*See Item No 9 response.*	
20			Settlement magnitudes must be justified.	Settlement is not a design consideration for walls designed per Caltrans Standard Plans (2006), e.g. Wall Nos. 2 and 7. Wall Nos. 4 and 5 are soldier pile/lagging walls or tieback walls founded on piles, and therefore settlement is also not consequential.	
21	FR		Must put this info in FR text.	*The recommended phi angle and delta angle for tieback wall design will be incorporated in the updated report.* (See Pages 19 and 22)	
22	FR, Plans		Need required unbounded length, not minimum. 15' may not be adequate. Please show that 15' is adequate.	See response in Item No. 15.	
23	FR	P. 25	Why is the slide plane not confirmed if it is only 15 ft beneath highway? This is easily done with a boring.	The proposed slope cut has no measurable impact on the stability of the slope. This has been provided through the stability analyses. Before and after cut stability remain essentially the same. Therefore, further investigation other than the geomorphic interpretation was not deemed necessary. (See Page 25)	
24	FR, Plans		FR and GDR discussed the need for over-excavation of unsuitable subgrade material (soft soil, organics, etc.) Please indicate on Reports	*Per meeting on 8/5/11, we will work with CT Geotech and DOE to adjust the current plans (which showed the limits on the Layout Sheets) to try to present the*	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			and Plans the locations, depths, and lateral limits of over-excavation.	*over-ex limits, depths, and quantities and accomplish biddable/constructible documents.* ***Following this meeting – we met with DOE on 8/9/11; we will show limit lines in our layout sheets and depth information on our typical sections, and likely (TBD) quantify the material as bid item (separate from Roadway Ex).*** *GDMR will be updated to reflect these limits shown on the layouts* (See Page 29)	
25	FR	P. 25	What is the bearing capacity of the material below RW #7? Please state in FR text.	Same response as Item No. 10.	
26	Plans		No tieback data table.	*Tieback data table is included in the plans as applicable. See response to Item No. 9.*	
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓ = Comment Resolved
(for Reviewer's use)

Partha Sircar

From: Anthony Notaro [anotaro@BiggsCardosa.com]
Sent: Thursday, August 18, 2011 2:38 PM
To: Partha Sircar
Cc: Gary Parikh; Daniel Rosellini; Praneeth Gongidi; 'Tracy Bertram'; 'Gordon Sweet'
Subject: MSN B1: Seismic Design of Retaining Walls

Partha:
The following is a summary of the Retaining Wall Design Development relative to the issue of seismic design as requested for your use in coordinating with Caltrans Geotechnical Services:

- Structural design was based on Caltrans BDS LFD Version dated April 2000. Per BDS 5.5.4, "the effects of earthquakes shall be considered in the design of retaining walls which support bridge abutments, buildings, soundwalls, critical utilities, or other installations for which there is a low tolerance for failure." Since the MSN B1 retaining walls do NOT support any critical facilities, seismic design was not performed for the walls.
- Type Selection Approval for the Redwood Landfill Overcrossing and the Non-Standard Retaining Walls was received from Caltrans OSFP on May 6, 2010.
- The AASHTO LRFD Bridge Design Specifications, Fourth Edition and California Amendments, which requires seismic design for retaining walls, is not applicable for our project. Per the implementation requirements "Earth retaining structures and buried structures will follow the AASHTO LRFD Bridge Design Specifications effective April 1, 2010, for structures designed internally by the State and October 1, 2010, for structures designed by local agencies and consultants."
- Therefore, since the Type Selection for our project predates the use of AASHTO LRFD Bridge Design Specifications, Fourth Edition and California Amendments, and our project does not support any critical utilities, retaining wall design for seismic effects was not required.

Tracy:
Please let me know if you do not concur with my summary of the design development.

Anthony P. Notaro, PE
Engineering Manager
anotaro@biggscardosa.com

Biggs Cardosa Associates, Inc.
865 The Alameda
San Jose, CA 95126
P: (408) 296.5515 x1150
F: (408) 296.8114

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 **EA:** 264071 **Project Name:** REDOOD LANDFILL IC - Retaining Walls 2,4,5&7 **OSFP Liaison:** Tracy Bertram **Phone:** 916-227-8397 **e-mail:** tracy bertram@dot.ca.gov	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. 1) ☐ Construction Support ☒ Other: FR (FINAL) **Structure Information** (Use when necessary to document comments by individual structure) **Structure Name:** Redwood Landfill IC - Retaining Walls **Br No:** ____	**Reviewer Name:** Rifaat Nashed **Functional Unit:** GS **Phone Number:** 510-622-1773 **e-mail:** rifaat_nashed@dot.ca.gov **Date of Review:** 07/19/11

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	**Structure Consultant Firm**	**Phone Number**	**e-mail**	**Response Date**

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR (FINAL)	Report Reviewed Title	FINAL Foundation Report For Retaining Walls-Marine-Sonoma Narrows Contract B-1,Redwood Landfill Interchange At Route 101,Marin County, California 04-Mrn-101 EA 264071 June 3, 2011	N/A	
2	FR (FINAL)	**SITE GEOLOGY** Page 7	1- To be consistent with the Geologic Map (Plate 3A) , the following rock units should be added: - Artificial fill placed over baymud (afbm) - Unnamed taffaceous sediments (TS). - Schist and semischist (block within Franciscan mélange). - Great Valley Sequence (KJgv). 2- The following rock units should be	1. . Descriptions of the units will be added. 2. Tv cannot be omitted as it is the Burdell	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			omitted: - Undifferentiated volcanic rock (TV). - Franciscan mélange (fm). 3- The Geologic Map (Plate 3A) is blown up too much, that the most of geologic unit symbols located in the project site became out of the map limits and unreadable.	Mountain volcanics which cap Burdell Mountain itself. And are involved in large landslides which have deposited andesite boulders just west of Highway 101. Franciscan mélange (fm) is mapped east of the highway at the Redwood Landfill Overcrossing. 3. Per suggestions from Caltrans (Rifaat), the map will be enlarged to 1:50,000 scale to make the geologic units and symbols readable.	
3	FR (FINAL)	**Information from Soil Borings and Test Pits** Page 8	For the statement" The sandstone and claystone are generally blocks within the Franciscan Complex (e.g. blocks-in matrix)" how could you come to that conclusion and they are not intact rocks, from borings.	The conclusion is based on our extensive investigation, which included literature review, geomorphic interpretation, examination of existing cut slopes and test pits in addition to the soil borings.	
4	FR (FINAL)	**Bimrocks (Blocks-in-matrix)** Page 10	This item should be omitted except the last two paragraphs concerning the internal friction angle and the characteristics of bimrocks for excavation, which does not serve the scope and the goal of the report.	Agreed. Statements will be added in the updated report to indicate that detailed discussion on bimrocks is included in the GDMR and only pertinent sections as noted in the comments will be included in the updated report.	
5	FR (FINAL)	**Seismic Sources** Page 14	Attach the ARS curve	Agreed. The ARS curve will be attached.	
6	FR (FINAL)	**Liquefaction** Page 16	Define the project limits on the attached Liquefaction Map (plate 5).	Agreed. The project limits will be indicated on the Liquefaction Map (Plate 5).	
9	FR (FINAL)	**APPENDIX A**	All the LOTB's do not include the bench mark for their location as the Soil/Rock classification Manual stated.	Agreed. Bench Marks for the locations will be included on all LOTB sheets.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264701 Project Name: Redwood Landfill I/C OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Foundation Report for RW-3nd review **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: RW 2,4,5,7 Br No: ____	Reviewer Name: Betty Lee/Mahmood Momenzadeh Functional Unit: GS Phone Number: 510-286-4825 e-mail: betty_lee@dot.ca.gov Date of Review: 5/4/2011

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
____	Parikh Inc.	____	____	____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1			PLEASE PROOFREAD before submittal. There are too many typos, inconsistencies and mislabeling.	Agreed.	
2	FR	P. 16, 17	Borehole labels inconsistent. A-10 in report, A-11 in Plans?? Please proofread before submittal.	Agreed. The table is revised to A-11 to make it consistent.	
3	Plans	LOTB	Borehole A-11-158A used for RW 2: What's the box to the far left (1.35)? Please be clear with legend.	The number 1.35 is unconfined compressive strength in tsf. Legend is revised to clarify.	
4	FR	17	2nd paragraph: What is the bearing capacity of the "material below"?	The allowable bearing capacity of the material below is 2.3 ksf at the southern end and greater than 7 ksf at the center and northern ends, where the wall will be founded on rock.	
5	FR	17	Please address differential settlement.	Wall No. 2 is a cut wall founded on rock or stiff clay. Cut depths are only about 10 feet. There will therefore be no issue of differential settlements.	
6	FR	21	What is the stationing of the Verizon Tower? Please describe locations by stationing.	The stationing at Verizon Tower is Sta. 337+00 - "RL2" Line, 40' Rt (Offset). It will be indicated	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

				in the report and also in the Site Plans.	
7	FR	21	Was surcharge added as indicated in the FD?	Yes. Surcharge was added in Retaining Wall No. 5 design for the Verizon Tower as shown in the appropriate Structural Plan,	
8	FR		Where is Plate 6A and 6B?	They are in the report after Plate 5.	
9	FR, Plans	P. 19- 21	Need to discuss and show tieback specifics in the FD and Plans. (Rows, spacing, height, bonded and unbounded lengths, etc.)	Tieback specifics (rows, spacing, height, bonded and unbounded lengths, etc.) will be presented in the Structural Plans.	
10	FR	P. 22	Retaining Wall 7: What is the bearing capacity of the foundation soil?	The foundation soil under Retaining Wall No. 7 is dense to very dense silty/clayey sand. The recommended allowable bearing capacity is 1.3B in ksf, where B is the width of the footing. For a 12-ft high wall, the footing width is 7'-3"". The allowable beating capacity is 9.5 ksf.	
11	Plans		LOTB does not match legend.	LOTB and Legend have been matched.	
12	FR, Plans		LOTB for Borehole R-09-135 (for RW 7): Description appears incorrect, SPT of 72 is labeled "dense", whereas, SPT of 32 is labeled as "very dense".	Agreed. The LOTB has been corrected.	
13	FR		The material strength and unit weight for all soil layers (within active and passive zones) shall be defined.	Agreed. They will be noted in the report, similar to for soil nail walls.	
14	FR		The static and seismic earth pressure diagrams used shall be included.	The static earth pressure distributions are noted on Plates 6A and 6B. Seismic designs for the walls are not required.	
15	FR		The unbounded tieback lengths for all layers shall be indicated.	The tieback unbonded lengths are noted on Plates 6A and 6B. They will be restated in the body of the report. As required by Caltrans (unless you tell us otherwise), the tieback design length, diameter, etc. should be removed from the Final Report, since the design will be a performance specification.	
16	FR		The pile length (embedment length) for geotechnical requirement shall be defined.	Required pile length (embedment) will be determined by the Structural Designer, based on the input provided in Plates 6A and 6B, and will be reported in the Structural Plans.	
17	FR		The design load for tiebacks based on geotechnical requirement shall be indicated.	The recommended ultimate and allowable bond strengths for the tiebacks are presented in Plates 6A	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

				and 6B. They will be also indicated in the text of the report.	
18	FR		Please indicate the purpose of each retaining wall. Is it for slope stability or for retaining soil only?	The purpose of the retaining walls are to retain the soils behind the walls, which are vertical. The soils would fail (slope instability) if not retained by the walls. Whether the walls are cut or fill walls are indicated in Table 3 and in discussions for each wall.	
19	FR, Plans		Tieback loads should be tabulated if there are slide areas.	Tieback wall loads should be tabulated in the Structural Plans. There are no slide areas.	
20	FR		For all wall types, especially standard walls, please address subgrade adequacy, settlement, stability, drainage requirements, and backfill requirements.	The subgrade adequacy has been addressed for the walls. For standard walls, settlement, drainage and backfill requirements are automatically satisfied if the Caltrans Standard Plans are conformed to. Stability has been addressed where appropriate, as for Wall No. 7.	
21	FR		Foundation Report, Pages 19, 21: What is the phi angle (internal friction angle)? And what is the delta angle (wall friction angle)?	The phi angle assumed for Block Rich Bimrock is 36 degrees; for block poor bimrock the phi angle assumed is 26 degrees. Delta is assumed as zero per BDS 5.5.5.7.1. These values are shown in the calculations in Appendix C.	
22			Foundation Report, Plate 6a, 6b: How did you come up with Unbonded Length of 15 ft? Also, please cite reference for Ultimate Bond Strength.	The 15-foot (min.) unbounded length is based on latest AASHTO LRFD Manual. As revised by Caltrans. It is specified in Plates 6A and 6B. The Ultimate Bond Strengths are based on "Recommendations for Prestressed Rock and Soil Anchors" by Post Tensioning Institute. The relevant tables are attached in Appendix C.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

6. Geotechnical Design and Materials Report

FINAL
GEOTECHNICAL DESIGN
& MATERIALS REPORT
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
AT RTE 101
MARIN COUNTY, CALIFORNIA
04-MRN-101 R23.2/27.1 EA 264071
Project No. 040000073 Phase 1

For

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A,
San Jose, CA 95131
(408) 452-9000

October 17, 2011 Job No. 208140.GDR

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

October 17, 2011

Attn: Ms. Natalina Bernardi

Sub: GEOTECHNICAL DESIGN & MATERIALS REPORT (FINAL)
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
04-MRN-101 R23.2/27.1 EA 264071
PROJECT NO. 0400000733 PHASE 1

Dear Ms. Bernardi:

Transmitted herewith is the Geotechnical Design & Materials Report (Final) for the subject project. The report was prepared in accordance with the scope of work outlined in our proposal. The report is for submittal to Caltrans for their review and approval.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning our findings or conclusions, please feel free to contact this office at (408) 452-9000.

Very truly yours,
PARIKH Consultants, Inc.

Gary Parikh, P.E., G.E.
Project Manager

Attachment: Geotechnical Design & Materials Report

"Approved as to impact on State facilities and conformance with applicable State standards and practices, and the technical oversight were performed as described in the California Department of Transportation A&E Consultant Services Manual."

Caltrans _____

Title _____

Date _____

Caltrans _____

Title _____

Date _____

TABLE OF CONTENTS

Page

Title Page i
Letter of Transmittal ii
Legal Protection of Design Immunity for State iii
Table of Contents iv
List of Tables viii
List of Plates viii

1 INTRODUCTION 1
2 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS 2
3 PERTINENT REPORTS AND INVESTIGATION 4
4 PHYSICAL SETTING 4
4.1 Climate 4
4.2 Topography and Drainage 5
4.3 Man-Made and Natural Features of Engineering and Construction Significance 6
4.4 Regional Geology and Seismicity 6
5 EXPLORATION 9
5.1 Field Exploration 9
5.1.1 Drilling and Sampling 10
5.1.2 Test Pit Excavations 13
5.1.3 Cone Penetrometer Testing (CPT) 14
5.2 Geologic Interpretation and Mapping 15
5.3 Geophysical Studies 15
5.4 Instrumentation 15
5.5 Exploration Notes 16
6 GEOTECHNICAL TESTING 16
6.1 In-Situ Testing 16
6.2 Laboratory Testing 17
7 GEOTECHNICAL CONDITIONS 17
7.1 Site Geology 17
7.1.1 Lithology 18
7.1.2 Structure 18
7.1.3 Existing Slope Stability 19
7.2 Subsurface Soil and Geologic Conditions 20

7.2.1 Information from Soil Borings, Test Pits and CPTs 20
7.2.2 Cut Slopes and Rock Outcrops 21
7.2.3 Geologic Interpretation 22
7.2.4 Bimrocks (Blocks-in-matrix) 24
7.3 Water 27
7.3.1 Surface Water 27
7.3.1.1 Scour 27
7.3.1.2 Erosion 28
7.3.1.3 Groundwater 28
7.4 Project Site Seismicity and Potential Seismic Hazards 29
7.4.1 Ground Motions 29
7.4.2 Ground Rupture 31
7.4.3 Liquefaction 31
8 GEOTECHNICAL ANALYSIS AND DESIGN 32
8.1 Cuts and Excavations 32
8.1.1 Erosion Control & Mitigation Measures 37
8.1.2 Subsurface Drainage Mitigation 38
8.1.3 Rippability 39
8.1.4 Grading Factor 40
8.2 Embankments 40
8.2.1 General 40
8.2.2 Subsurface Soil Conditions 40
8.2.3 Embankment Settlements 42
8.2.4 Evaluation of Embankment Stability 47
8.2.5 Mitigation of Surface and Subsurface Drainage 47
8.3 Earth Retaining Systems 47
8.4 Corrosion Investigation 55
8.5 Culverts 57
8.5.1 Concrete Box Culverts 58
9 STRUCTURAL PAVEMENT SECTIONS 60
10 MATERIAL SOURCES 65
11 MATERIAL DISPOSAL 65
12 CONSTRUCTION CONSIDERATIONS 66
12.1 Construction Advisories 66
12.2 Construction Consideration that Influence Specifications 68

12.3 Construction Monitoring and Instrumentation 68
12.4 Hazardous Waste Considerations 68
12.5 Differing Site Conditions 69
13 RECOMMENDATIONS AND SPECIFICATIONS 69
13.1 Summary of Recommendations 69
13.2 Recommended Materials Specifications 70
13.2.1 Standard Specifications 70
13.2.2 Special Provisions 70
14 INVESTIGATION LIMITATIONS 73
REFERENCES 75
AERIAL PHOTOGRAPHS 75

APPENDICES

Appendix A

Log of Test Borings
As-built Log of Test Borings (Miller Pacific Engineering)
Table for Shallow Borings for Pavement Design
Logs of Test Pits

Appendix B

Laboratory Tests ..... Plates B-1A and B-1B
Plasticity Chart ..... Plates B-2A and B-2B
Particle Size Distribution Curves ..... Plates B-3A thru B-3E
Corrosion Tests ..... Plates B-4A thru B-4V
R-Value Tests ..... Plates B-5A thru B-5O
Consolidation Test ..... Plates B-6A thru B-6C
Consolidated Undrained Triaxial Test ..... Plates B-7A and B-7B
Unconfined Compression Tests ..... Plates B-8A thru B-8F
Direct Shear Tests Test ..... Plates B-9A and 9-B
Unconsolidated Undrained Compression Test ..... Plate 10

Appendix C

Settlement Analyses
Slope Stability Analyses
Tieback Design (Wall Nos. 4 & 5)
PIPE/CULVERT Design (AltPipe Output)
Pavement Design

Appendix D

Index Map ..... Plate D
Geologic Maps ..... Plates D-1 thru D-7

Appendix E

Index – Photo Locations
Onsite Photographs ..... Photo Nos. 1 thru 5

Appendix F

Potential Areas of overexcavation ..... Plates EX-1 thru EX-15
As-built and Proposed Structural Pavement Sections ..... Plates X-1 thru X-15

Appendix G

Caltrans Comments and Responses

LIST OF TABLES **Page**

TABLE 1A: DEEP BORINGS 10
TABLE 1B: SHALLOW BORINGS FOR PAVEMENT DESIGN (No LOTB)..... 12
TABLE 1C: TEST PITS 13
TABLE 1D: CONE PENETROMETER TESTS (CPT) 14
TABLE 2: SEISMIC SOURCES..... 30
TABLE 3: SUMMARY OF MAXIMUM FILL THICKNESS..... 40
TABLE 4: SUMMARY OF PROPOSED RETAINING WALLS..... 48
TABLE 5: SUMMARY OF CORROSION TEST RESULTS..... 56
TABLE 6A: SUMMARY OF R-VALUE TEST RESULTS BY PARIKH (2010) 61
TABLE 6B: SUMMARY OF ADDITIONAL R-VALUE TEST RESULTS..... 61
TABLE 7A: RECOMMENDED PAVEMENT SECTIONS - New Mainline Shoulder..... 63
TABLE 7B: RECOMMENDED PAVEMENT SECTIONS - Ramps And West Frontage Road 64
TABLE 7C: RECOMMENDED PAVEMENT SECTIONS - Provided By Caltrans..... 65
TABLE 8: SOURCES OF ASPHALT AND AGGREGATE MATERIAL..... 65

LIST OF PLATES

Project Location Map..... Plate 1
Site Plan ..... Plate 2
Site Plan Sheets..... Plates 2A thru 2M
Index to Site Plan Sheets..... Plate 2N
Area Geologic Map..... Plates 3A and 3B
Regional Fault Map..... Plate 4A
Design ARS Curve..... Plate 4B
Liquefaction Susceptibility Map..... Plate 5
Tieback Design Recommendations for Wall Nos. 4 & 5..... Plates 6A and 6B

FINAL
GEOTECHNICAL DESIGN & MATERIALS REPORT
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT AT RTE 101
MARIN COUNTY, CALIFORNIA
04-MRN-101 R23.2/27.1 EA 264071
PROJECT NO. 040000073 PHASE 1

1 INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed "Improvements at the Redwood Landfill Interchange on Rte 101 from 1.0 mile north of North Novato Overhead to 0.6 mile south of Sonoma County Line" in the City of Novato and adjacent incorporated areas in Marin County, California, hereinafter referred to as the "PROJECT". The work described in this report was performed in general accordance with the scope of work outlined in our proposal to BKF Engineers (Designer). The general location of the project site and its limits are shown on Plate 1 - Project Location Map.

The report addresses geotechnical design recommendations for earth retaining systems, embankments, cut slopes, corrosion potential, culverts, and structural pavement sections. The investigation included review of readily available soils and geologic literature pertaining to the site including as-built information and "Log of Test Borings" (LOTB) and pavement as-built data, site reconnaissance, geologic mapping, obtaining representative samples and logging soil and rock materials encountered in exploratory borings and test pits, performing cone penetrometer tests (CPT), laboratory testing of the representative samples, performing engineering analyses, as well as preparation of this report, including illustrations and maps.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the roadway portions of the project including slopes, culverts and retaining walls. A separate Foundation Report for the widening of the existing Redwood Landfill Road Overcrossing (OC) (Bridge No. 27-0115) has been submitted.

This report is intended for use by the project roadway design engineer, construction personnel, bidders and contractors for information and reference purposes only and should not be construed as project specifications.

2 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

Existing facilities and proposed improvements are noted on the Site Plans - Plates 2A through 2M (an index for the Site Plan sheets is presented on Plate 2).

Existing Facilities

The proposed project site is located in the city of Novato and adjoining incorporated areas in Marin County from 1.0 mile north of North Novato Overhead (Rte 101 "N2R" Line, Sta. 224+38) to 0.6 mile south of Sonoma County line (Rte 101 "N2R" Line, Sta. 421+97). Rte 101 is a north-south interstate highway. Within the project limits, the freeway is a four-lane facility with two travel lanes in each direction and shoulders separated by a median. The extent of the proposed project is shown on Plate 1 – Project Location Map.

The Redwood Landfill Road Overcrossing (Bridge No. 27-0115) is within the project limits. The existing overcrossing is a two-span cast-in-place concrete box girder structure, approximately 253'– 6" long and 34'- 4" wide. The bridge carries one lane of traffic each in the southwest and northeast directions.

Proposed Improvements

The proposed project generally consists of the following design elements:

1. Widening of the northern side of the Redwood Landfill Road Overcrossing to accommodate the placement of standard shoulders (addressed in a separate Foundation Report);
2. Placement of new shoulders along Rte 101 as follows (all stationing along "N2R" Line):
    - Southbound between Sta. 273+50 and 288+00: 10-ft wide outside shoulder
    - Northbound between Sta. 326+01 and 342+15: 10-ft wide outside shoulder
    - Southbound between Sta. 328+05 and 343+80: 10-ft wide outside shoulder
    - Southbound between Sta. 399+02 and 411+84: 10-ft wide outside shoulder
    - Northbound between Sta. 403+82 and 415+59: 5-ft wide inside shoulder
    - Southbound between Sta. 407+20 and 410+78: 5-ft wide inside shoulder

Prior to placement of the new shoulders, the acceleration and deceleration lanes and hook ramps from the Olompali State Historic Park, and from the Redwood Sanitary Landfill Road; and the Rte 101/San Antonio Road Intersection will be removed, as applicable.

3. Construction of new diagonal on-ramps and off-ramps (both north and south bound) to and from Rte 101 at the Redwood Landfill Road Overcrossing;
4. Construction of three new frontage roads and an access road as follows:
   - On the west side of Rte 101, starting from the Redwood Landfill Road Overcrossing and connecting to San Antonio Road (Northwest Frontage Road);
   - On the west side of Rte 101, starting from Sta. 226+00 ("FR1" Line) and ending at the gate to the Olompali Park Historic site at Sta. 280+70 ("FR1" Line) (Southwest Frontage Road); and
   - On the east side of Rte 101, starting from Sta. 300+15 ("FR2" Line) and ending at the Redwood Landfill Road Overcrossing (East Frontage Road)
   - Access/Maintenance Road at Olompali Park from Sta. 280+70 to Sta. 304+10 ("BK" Line)
5. Construction of a new Class 1 bike path running parallel to Rte 101 on the western side of the freeway, from Sta. 304+10 to Sta. 334+37 ("BK" Line);
6. Extension or construction of several pipe culverts and reinforced concrete box culverts including one "new" livestock tunnel;
7. Retaining walls are proposed at the following locations (stationings for the retaining wall locations are presented in Table 4):
   - Retaining Wall No. 2 (Type 1 Wall) – Approximately 258 feet long, on the western edge of the proposed new bike trail. Typical wall height ranges from 4 feet to 10.6 feet.
   - Retaining Wall No. 4 (Combination of Soldier Pile-Lagging Wall and Tieback Wall) – Approximately 429 feet long, running along the southwestern edge of the proposed new frontage road, starting from Redwood Landfill Overcrossing. The wall height ranges from 3 to 31 feet.

- Retaining Wall No. 5 (Combination of Soldier Pile-Lagging Wall and Tieback Wall) – Approximately 273 feet long, running along the northeastern edge of the northbound on-ramp. The wall height ranges from 3 to 16 feet.
- Retaining Wall No. 7 (Type 1 Wall) – Approximately 223 feet long, running along the southwestern edge of the proposed new frontage road north of Retaining Wall No. 4. The wall height is up to 12 feet.

3 PERTINENT REPORTS AND INVESTIGATION

The following geotechnical investigation reports and Caltrans as-built plans were also reviewed to supplement the subsurface soil information for the project:

- Caltrans as-built Log of Test Borings for Redwood Landfill Road OC (Bridge No. 27-0115) (2002)
- Caltrans as-built Log of Test Borings for Redwood Landfill Road Retaining Wall (Bridge No. 27E0001) (2002)
- Miller Pacific Engineering Group, April 2004, "Foundation Report, Redwood Landfill Overcrossing (EA No. 285000, 04-MRN-101, PM 25.55)"
- Caltrans, August 2005, "Preliminary Geotechnical Report for Marin/Sonoma Narrows HOV Lane and Proposed Improvements (4-MRN / SON-101 PM MRN 18.3/SON 7.5)"
- Caltrans, August 15, 2005, "Preliminary Materials Recommendation", Memo to Sean Charles, Chief, Design Branch R1 from Michael Stapleton, Materials Engineer, North Region.

4 PHYSICAL SETTING

4.1 Climate

The climate at the project site and the surrounding area is characterized by mild winters, cool summers, small daily temperature ranges, moderate precipitation, and medium to high humidity. Based on Western Regional Climate Center of NOAA, the temperature at the site typically ranges from 52°F to 79°F in summer and 40°F to 56°F during winter.

The average annual rainfall is approximately 24.7 inches per year in the project area; most of the rainfall occurs in the months of October through April.

4.2 Topography and Drainage

At the project location, existing Rte 101 cuts across the toes of several steep slopes and gently sloping valleys and plains adjacent to Petaluma River marshes to the east. Elevations of Rte 101 range from approximately Elev. 10 feet at the southern end of the project, to approximately 110 feet at the northern end. On the western side of Rte 101, the terrain rises from the road level throughout the alignment within project limits. Steepest slopes (approximately 2H:1V) are present in several locations with slope heights up to 40 feet higher than adjacent grade (e.g. at Sta. 344+50 ("N2R" Line)). On the eastern side, south of Landfill Access Road (approximately Sta. 329+00 ("N2R" Line)), the terrain is relatively flat (Elevation +2.0). To the north beyond Sanitary Landfill Road to approximately Sta. 341+00 ("N2R" Line), a ridge is present. The slopes of the ridge are around 2H:1V. Beyond Sta. 341+00, the terrain is significantly less steep, rising gently to the east. A small hill, approximately 40 feet higher than the adjacent grade of Rte 101 is present about 150 feet east of the travel way at approximate Sta. 338+00 ("N2R" Line).

Per the Designers, there are 10 existing seasonal creeks/stream locations within the project limits, which are conveyed into cross culverts that pass below Rte 101. These are listed below (all stationing are per "N2R" Line):

- 246+40 – 36" x 18" CMP Arch
- 250+00 – 30" HDPE
- 253+70 – 24" RCP
- 275+70 – 4' x 2' RCB
- 293+65 – 6' x 3' RCB (Olompali Creek)
- 305+23 – 12' x 4' RCB
- 341+50 – 24" CMP
- 370+40 – 4' x 2' RCB
- 383+20 – 6' x 5' RCB (Deer Creek)
- 401+00 – 18" CMP

The names of two of the creeks are noted above at their appropriate locations. The creeks are also identified in the Site Plans. The other eight creeks are unnamed.

4.3 Man-Made and Natural Features of Engineering and Construction Significance

Man-made features within and in the vicinity of the project site that have potential engineering significance to this project include:

- The Verizon Wireless Cellular Tower building (Sta. 337+00 - "RL2" Line, 40' Rt.)
- Several livestock tunnel structures
- Forty-three cross culverts (21 will be extended)
- Water Pipelines (NMWD)
- PG&E gas pipeline
- PG&E overhead electric line
- Overhead telephone lines (Verizon and AT&T)
- Fiber Optic Line (Verizon Wireless)
- Retaining wall on the eastern edge of Rte 101 (Sta. 336+ 08 to Sta. 339+52 ("N2R" Line))
- Existing cut slopes along the western side of Rte 101 at several locations discussed later in the report in Section 7.1.3.

4.4 Regional Geology and Seismicity

The project region is located within the Coast Ranges Geomorphic Province, which contains mountain ranges and valleys with long axes oriented northwest to southeast. The topography is the result of erosion along fault zones and folds that are also oriented northwest/southeast.

The Coast Ranges are primarily thrust-bounded fault blocks or bounded by strike-slip faults with a significant component of vertical slip. However, in many cases the ranges are not bound or uplifted along obvious structures, and are likely the result of folding and uplift along blind thrust or reverse faults.

The bedrock and surficial deposits in the region are the result of a long history of tectonic plate movements, regional uplift, large-scale slope failures, erosion, and deposition that is recorded in the composition, structure, and geometry of rock and soil units exposed at the current ground surface.

Along the central California coast, the Franciscan Complex consists of a heterogeneous assemblage of detrital sedimentary rocks (sandstone, shale, chert, and minor limestone), igneous rocks (primarily mafic and ultra-mafic rocks), and metamorphic rocks (including serpentinite and schist) (Blake et al., 1984). Mineral assemblages within the Franciscan Complex rocks have recorded a complex, polymetamorphic history of subduction and accretion (Wakabayashi, 1999). The Franciscan Complex is structurally complicated and is subdivided into regionally extensive northwest-trending terranes that are lithologically distinct from adjacent terranes (Blake et al., 1984; 2000). The eastern Yolla Bolly and Central (mélange) terranes of Franciscan Complex account for most of the basement rock in the Burdell Mountain area. Franciscan Mélange consists of a disrupted assemblage of large and small masses of various sedimentary, metamorphic, and igneous rock types embedded in and separated from each other by more or less intensely sheared or crushed material. This sheared material represents one or more ancient fault zones, where broad zones of bedrock were broken and sheared as a result of the interaction between tectonic plates of the earth's crust driven in opposing directions by convective forces deep within the earth's mantle.

During the last 12 million years, the San Andreas transform evolved into the complex system of northwest-striking, generally subparallel strike-slip faults that are still active today. Since development, the San Andreas transform fault system is believed to have accommodated as much as 1000 km of right-lateral motion between the Pacific and North American plates (Wakabayashi, 1999).

During the development of the San Andreas fault system, the California coastal region experienced widespread volcanism. The volcanic rocks exhibit a distinct northward-younging progression.

Volcanic rocks of Tertiary age are also present within the region. Generally, these consist of rhyolitic tuff and breccia deposits that resulted from explosive eruptions from volcanic vents located in the northern portions of the region. Locally, Tertiary marine sediments underlie the volcanic units.

Colluvium, derived from weathering and decomposition of the bedrock, accumulates on or at the base of the slopes by gravitation or slope wash processes. These deposits are weak and subject to creep and landsliding, particularly when saturated. Within the region, there are numerous debris flow and avalanche type deposits that originated in the thick colluvium deposits located on steeper slopes.

Alluvial soils underlie the broad stream and valley bottoms in the project area. These deposits are of Quaternary Age and vary in thickness over bedrock from a few feet to several hundred feet where they have filled in previously eroded valleys. Young Bay Mud has been deposited in the broad valley that has been submerged by rising sea level during the past 5,000 years that formed the San Francisco Bay salt water estuary. The thickness of Bay Mud varies from a few feet at the current bay margins to over 100 feet in the central portions of the bay.

Faults in the vicinity of the project site with a moderate to high potential for surface rupture include the Rodgers Creek Fault and the San Andreas Fault Zone (north coast section). Significant earthquakes, which have occurred in the region, are generally associated with crustal movements along well-defined active fault zones. A Regional Fault Map (based on Caltrans, 2007), showing the project site location relative to the major active faults in the region, is presented on Plate 4. It should also be noted that the potentially active Burdell Mountain Fault Zone is not identified in the Regional Fault Map. However, the Burdell Mountain Fault is shown on the Area Geologic Map (Plate 3A). Where it crosses the central portion of the project area, the fault is concealed (represented by a dotted line) beneath landslide deposits and has no identifiable geomorphic expression at the ground surface (Ford, 2007).

In the past, numerous earthquakes have originated from the active faults within the region and produced strong ground shaking throughout the area. A report (Reference No. 7) has been released by the United States Geological Survey (USGS), which updates all previous results in the light of new information or understanding or by a necessity to conform to a uniform statewide approach and with the NSHMP (National Seismic Hazard Mapping Program) assessment. Per the report, there is a 63% probability that an earthquake of 6.7 magnitude or greater will be released from one of the active faults within San Francisco Bay Area during the next 30 years. The probability of an earthquake of magnitude 6.7 or greater over Northern California is 93 percent. Such an event will likely produce strong ground shaking at the project location. A table showing the 30-year probability of a magnitude 6.7 earthquake or greater occurring on each of the relevant faults, per Reference No. 7 is presented below.

Fault	WGCEP Mean Probability	Maximum / Minimum Probability
Hayward-Rodgers Creek Fault	31%	67% / 12%
North San Andreas Fault	21%	39% / 6%
Calaveras Fault	7%	22% / 1%

5 EXPLORATION

5.1 Field Exploration

Based on the preliminary plans, discussions with the design team, and readily available geotechnical data in the vicinity of the project area, 54 borings were initially drilled at selected locations within the project limits in 2009. Thirty seven borings were drilled to depths ranging from 10 to 60.5 feet below the existing ground surface. Seventeen borings were drilled to a depth of 5 feet to provide information for design of pavement sections for the project. Subsequent to the initial investigations, ten borings ranging in depth from 6 feet to 142 feet were drilled and nine test pits were excavated in November-December, 2010 to January, 2011 to allow for the design and alignment changes. Four cone penetrometer tests (CPT) were performed on February 23, 2011. A Site Plan showing the locations of exploration pertinent to the overcrossing and the retaining walls is presented in Plate 2 (Site Plan). The locations of all the borings, test pits and CPTs are presented in

the Site Plans (Plates 2A through 2M). An Index to the Site Plan Sheets is presented on Plate 2N.

5.1.1 Drilling and Sampling

Pertinent information for the deep borings (deeper than 5 feet) is summarized in Table 1A. Pertinent information for the 5-ft deep borings for pavement design is summarized in Table 1B. Boring logs for the deep borings (greater than 5 feet deep) are presented in the Log of Test Borings (LOTB) sheets in Appendix A. Appendix A also includes as-built LOTB sheets. Note that the detailed description, location, etc. for the shallow (5-foot deep) borings are listed in Table 1B. These are primarily bulk samples collected for pavement design (R-value) purposes. Soils encountered in the shallow borings are described in Table 1B and also in the Table: "Shallow Borings for Pavement Design" in Appendix A.

TABLE 1A: DEEP BORINGS

Boring No.	Station (ft.) "N2R" Line	Offset (ft.)	Drilling Method	Boring Depth (ft.)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)	Plate No.
A-09-149	250+35	65 Lt.	Hollow Stem Auger	15	19	*	A-4
R-10-167	254+83	136 Lt.	Rotary Wash	19	17	*	A-4
A-09-150	255+70	70 Lt.	Hollow Stem Auger	10	12	*	A-4
A-10-166	257+05	45 Lt.	Hollow Stem Auger	6	12	*	A-5
A-10-164	259+12	50 Lt.	Hollow Stem Auger	19	14	*	A-5
R-10-161	259+90	395 Lt.	Rotary Wash	142	92	*	A-6
R-10-162	259+63**	225 Lt.	Rotary Wash	62	65	*	A-6
R-10-162A			Rotary Wash	20			A-6
A-10-163	261+00	53 Lt.	Hollow Stem Auger	22.5	13	*	A-5
R-10-165	262+32	113 Lt.	Rotary Wash	16.5	19	*	A-5
A-09-151	270+50	75Lt.	Hollow Stem Auger	10	20	*	A-7
A-09-101	301+20	165 Rt.	Hollow Stem Auger	10	38.5	*	A-16
A-09-102	305+10	155 Rt.	Hollow Stem Auger	11	29	*	A-16
A-11-158A	306+80	60 Lt.	Hollow Stem Auger	10.5	34.5	*	A-8
A-11-158	307+90	65 Lt.	Hollow Stem Auger	8.5	34	*	A-8
A-11-158B	309+45	70 Lt.	Hollow Stem Auger	9.0	29	*	A-8
A-09-117	321+00	65 Lt.	Hollow Stem Auger	10	20	*	A-17
A-09-104	321+85	180 Rt.	Hollow Stem Auger	10	5	*	A-17

Boring No.	Station (ft.) "N2R" Line	Offset (ft.)	Drilling Method	Boring Depth (ft.)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)	Plate No.
A-09-105	326+25	275 Rt.	Hollow Stem Auger	20	10.5	*	A-18
A-09-108	326+45	75 Rt.	Hollow Stem Auger	15	24	*	A-18
A-09-109	330+00	95 Rt.	Hollow Stem Auger	38	26.5	-3.5	A-19
A-09-106	331+05	260 Rt.	Hollow Stem Auger	20	33	*	A-18
A-09-110	332+90	150 Rt.	Hollow Stem Auger	30	35	*	A-20
A-09-111	334+55	190 Rt.	Hollow Stem Auger	48	55	*	A-19
A-09-001	335+85	125 Rt.	Hollow Stem Auger	50	59	*	A-19
R-09-112	336+55	220 Rt.	Rotary Wash	40.5	84	*	A-20
R-09-113	338+60	185 Rt.	Rotary Wash	40.5	92	*	A-20
A-09-114	341+00	80 Rt.	Hollow Stem Auger	25	45	*	A-20
A-09-120	329+50	75 Lt.	Hollow Stem Auger	13	37	*	A-9
A-09-122	332+60	150 Lt.	Hollow Stem Auger	15	56	*	A-9
A-09-129	334+95	295 Lt.	Hollow Stem Auger	21.5	85	*	A-10
R-09-130	336+45	435 Lt.	Rotary Wash	60.5	120	*	A-10
A-09-125	336+85	230 Lt.	Hollow Stem Auger	22.5	71	*	A-11
R-09-131	338+25	385 Lt.	Rotary Wash	47.5	101	*	A-10
A-09-132	340+10	325 Lt.	Hollow Stem Auger	35	74	*	A-10
A-09-126	341+40	135 Lt.	Hollow Stem Auger	18.5	51	*	A-11
A-09-133	342+00	265 Lt.	Hollow Stem Auger	15	63	*	A-11
A-09-127	343+50	60 Lt.	Hollow Stem Auger	10	51	*	A-12
A-09-134	345+35	215 Lt.	Hollow Stem Auger	20	63	*	A-12
A-09-135	349+45	215 Lt.	Hollow Stem Auger	35	93	*	A-12
A-09-136	352+15	210 Lt.	Hollow Stem Auger	10	90	*	A-12
A-09-137	355+15	180 Lt.	Hollow Stem Auger	15.5	59	*	A-13
A-09-138	357+35	175 Lt.	Hollow Stem Auger	22.5	49	*	A-13
A-09-139	361+25	175 Lt.	Hollow Stem Auger	10	54	*	A-13
A-09-143	384+55	140 Lt.	Hollow Stem Auger	90	83	*	A-13
A-09-144	395+10	105 Lt.	Hollow Stem Auger	30	96.5	*	A-14
A-09-145	401+50	100 Lt.	Hollow Stem Auger	10	117	*	A-14
A-09-146	407+10	75 Lt.	Hollow Stem Auger	23.5	127	*	A-14
* Groundwater was not encountered in the boring during drilling ** Borings R-10-162 and R-10-162A were drilled within 5 feet of each other,							

TABLE 1B: SHALLOW BORINGS FOR PAVEMENT DESIGN (No LOTB)

Boring No.	Station (ft.) "N2R" Line	Offset (ft.)	Approx. Ground Elev. (ft)	Soil Description
A-09-147	228+50	65 Lt.	13	Lean Clay with some Gravel
A-09-148	238+70	60 Lt.	14	Lean Clay
A-09-152	279+05	110 Lt.	16	Lean Clay with some Gravel
A-09-153	289+15	85 Lt.	44	Silty Sand
A-09-154	299+05	80 Lt.	48	Lean Clay with traces of Gravel
A-09-155	305+05	90 Lt.	35	Silty Sand
A-09-103	311+65	115 Rt.	27	Sandy Silt
A-09-116	312+00	75 Lt.	27	Sandy Lean Clay with some Gravel
A-09-107	324+30	65 Rt.	20	Sandy Lean Clay
A-09-118	325+65	5 Lt.	23	Sandy Lean Clay with some Gravel
A-09-119	326+80	45 Lt.	28	Sandy Silt
A-09-124	344+00	45 Lt.	52	Sandy Silty with some Gravel
A-09-128	346+45	45 Lt.	48	Sandy Lean Clay with some Gravel
A-09-115	346+80	40 Rt.	48	Silty Sand with Gravel
A-09-140	364+50	150 Lt.	66	Sandy Lean Clay with Gravel
A-09-141	372+65	125 Lt.	69	Silty Sand
A-09-142	379+65	113 Lt.	76.5	Sandy Lean Clay
Note: All borings are 5 feet deep. Groundwater was not encountered in any of the borings.				

Most of the borings were drilled with truck-mounted drill rig using 8-inch-diameter hollow stem auger. At two locations that presented access difficulties, the borings were drilled using a portable drill rig using a 4-inch-diameter solid stem auger. Nine borings were drilled using a track-mounted rotary wash drill rig, using an approximately 5-inch diameter hole. Two 5-ft deep borings were drilled using a hand auger.

Soil samples were generally obtained by driving either a 2.5-inch I.D. (Modified California, MC) sampler or a 1.4-inch I.D. (Standard Penetration Test, SPT) sampler at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The blow counts are presented on the LOTB sheets in Appendix A. When correlating standard penetration data, the blow counts for the Modified California Sampler may be converted to equivalent Standard Penetration Test blow counts by

multiplying a factor of 0.65 (DMG Special Publication 117 (Guidelines for Analyzing and Mitigating Liquefaction). The samples were sealed and transported to our laboratory for further evaluation and testing. A few rock core samples were obtained using HQ diamond core barrels. The core barrel had a 2.4-inch ID and was advanced by hydraulic pressure.

The field investigation was conducted under the supervision of our field engineer/geologist who logged the soils encountered in the test borings during drilling and prepared the samples for subsequent laboratory testing and evaluation.

5.1.2 Test Pit Excavations

Test pits were excavated using a backhoe with a 30-inch bucket. The test pits ranged in depth from approximately 6 feet to 13 feet. Test pit excavations were conducted under the supervision of our Engineering Geologist who logged the soils encountered in the test pits during excavation and prepared the samples for subsequent laboratory testing and evaluation. Pertinent information for the test pits is summarized in Table 1C.

TABLE 1C: TEST PITS

Test Pit No.	Station (ft.) "N2R" Line	Offset (ft.)	Excavation Method	Test Pit Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
TP-156	268+12	242 Lt.	Backhoe	9.5	40	*
TP-157	274+50	155 Lt.		12	21	*
TP-159	331+40	300 Lt.		7.5	85	*
TP-160	334+40	500 Lt.		6	175	*
TP-168	348+36	184 Lt.		8.5	75	*
TP-169	349+80	175 Lt.		11	82	*
TP-170	352+20	164 Lt.		7.5	82	*
TP-171	339+10	300 Lt.		7.5	75	*
TP-172	343+65	204 Lt.		13	65	*

* Groundwater was not encountered in the test pit excavation (surface groundwater seepage was noted in some locations)

5.1.3 Cone Penetrometer Testing (CPT)

Four cone penetrometer tests (CPT) were performed for this project to augment the existing information primarily for assessment of potential for liquefaction in the alluvial soils. Pertinent information for the CPTs is presented in Table 2.

CPT work was performed by California Push Technologies Incorporated on February 23, 2011 using a track mounted CPT rig. The CPTs were conducted using a 60-degree cone attached to a 1.7-inch diameter rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure dissipation measurements during CPT operation. Detailed information from the CPT investigation is presented in Appendix A.

TABLE 1D: CONE PENETROMETER TESTS (CPT)

CPT No.	Station (ft.) "N2R" Line	Offset (ft.)	CPT Depth[(1)] (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Depth (ft)	Approx. Groundwater Elevation (ft)
CPT--11-S1	243+60	105.0 Lt.	37.5	11.0	4.0[(2)]	7.0
CPT-11-S2	360+36	122.5 Lt.	22.5	50.5	18.0[(3)]	32.5
CPT-11-S3	373+50	124.5 Lt.	29	71.5	10.0[(3)]	61.5
CPT-11-S4	383+40	131.0 Lt.	36	84.0	7.0[(3)]	77.0

Notes: (1) Refusal encountered, possibly bedrock encountered; (2) tape measured; (3) based on dynamic pore pressure profile

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

5.2 Geologic Interpretation and Mapping

Published geologic maps and other geologic information pertinent to the project were reviewed. In addition, apparent surface contacts between deep-seated landslides, debris flow deposits, alluvial fans, and "bedrock slopes" (area of thin soil over in-place bedrock) were mapped, based upon their distinctive geomorphic expressions in the photogrammetrically produced topographic contours and stereoscopically viewed aerial photographs. In general, such interpretations involved recognition of the intersections of different fan-shaped surfaces formed by accumulation of slopewash and debris flow deposits, as well as the lobate toes of the landslides.

Site visits were conducted and photographs were taken at various locations of interest to the project. Selected site photographs and a key map of the photograph locations are presented in Appendix E. On-the-ground observations enabled us to map the approximate extents of scarps and depositional lobes of localized slumps. This helped confirm the available information or modify it as appropriate. Project-specific geologic maps were thereby generated for use in the development of appropriate engineering recommendations for various elements of the project. The resulting geomorphic maps (presented as Plates D-1 through D-7 in Appendix D) show the inferred geologic contacts in the vicinities of the planned walls and cut slopes, presented on the project's topographic base map overlaid on recent orthophotos.

5.3 Geophysical Studies

Application of geophysical methods of exploration was considered not necessary; therefore, geophysical surveys were not made a part of our field investigation.

5.4 Instrumentation

Instrumentation for the project consisted of:

- Placement of slotted piezometer pipe in Boring No. A-10-161 to allow measurements of water depth. Clean sand backfill was placed in the annular space between the borehole and the piezometer pipe.

- Installation of an inclinometer casing in Boring No. A-10-162 to allow subsequent monitoring of ground displacements above the proposed cut slope at the location.

5.5 Exploration Notes

Existing roadway fill material consisting of sandy lean clay and/or clayey sand was typically encountered in the shallow (5 feet) borings. The other (deeper than 5 feet) exploratory borings encountered localized fill; alluvial and colluvial deposits consisting predominantly of firm to very stiff lean clay or medium dense to very dense sand; and weathered rock (sandstone or claystone).

6 GEOTECHNICAL TESTING

6.1 In-Situ Testing

In-situ testing consisted of recording blow counts during sampling in the field. The soil samples were obtained during drilling by driving a 2.5-inch I.D. Modified California sampler or a 1.4-inch I.D. Standard Penetration Test (SPT) Sampler into the subsurface soils under the impact of a 140-lb hammer falling through 30 inches. Based on our previous experience, when correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be converted to equivalent Standard Penetration Test blow counts by multiplying a factor of 0.65 (DMG Special Publication 117 (Guidelines for Analyzing and Mitigating Liquefaction). Based on the average values of the SPT-N values for the soil materials encountered in the field exploration, the subsurface overburden soils are classified generally as stiff to very stiff lean clays or medium dense to very dense clayey and silty sands. High blow counts in debris flow deposits appear to be the result of encountering isolated rock fragments embedded within the soil matrix. As expected, very high values of SPT-N were noted in the underlying rock units (generally sandstone or claystone). The in-situ test results are presented on the LOTB sheets in Appendix A.

6.2 Laboratory Testing

Laboratory tests performed for the study include the following: Laboratory determination of Moisture-Density (California Test Method 226), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), Unconsolidated Undrained (UU) and Consolidated Undrained (CU) Triaxial Tests, Direct Shear Test, R-value Test (California Test Method 301), Corrosion Test (California Test Method 643), and Consolidation Test . The laboratory test results are included in Appendix B. Laboratory test results for moisture content, unit weight and unconfined compression tests are presented on the LOTB sheets in Appendix A at the appropriate sample depths.

7 GEOTECHNICAL CONDITIONS

7.1 Site Geology

General geologic features pertaining to the site were evaluated by reference to the "Preliminary Geologic Map of the Napa 30' x 60' (100k) Quadrangle, California", compiled by Wagner, D. L. and Gutierrez, C. I. (California Geological Survey, 2010). A portion of the map that covers the project vicinity is shown on Plate 3A; a companion key to the map is presented on Plate 3B.

Based on the available geologic maps, the geologic units at the project location consist predominantly of Alluvium (Qa and Qhf), Colluvium (Qc), Franciscan Complex blocks-in-matrix schist and semi-schist (KJfsch), and Great Valley Sequence (KJgv). Presence of Undifferentiated Tertiary Volcanic Rock (Tv) unnamed tuffaceous sediments (Ts), and Franciscan Mélange (KJfm) is also noted in the vicinity of the project on the western side of Rte 101. Landslide Deposits, both deep-seated rotational slumps (Qlsv) and shallow debris flow deposits (arrows), occupy much of the lower slopes west of Rte 101. Bay Mud (Qhbm) is mapped in several places east of Rte 101, beneath a small portion of the freeway alignment, where it is buried by artificial fill (afbm). Published maps also note areas of Debris Flow Landslides and Block Slump Landslides. Detailed descriptions of the rock units are included in Appendix D. As noted in Section 5.2 (Geologic

Interpretation), project-specific geologic maps (Plates D-1 through D-7 in Appendix D) were generated for use in the development of appropriate engineering recommendations for various elements of the project.

7.1.1 Lithology

The geological units present at the project site consist of alluvial and colluvial deposits near the surface (gravel, sand, silt, and clay), underlain by hard fractured rock (generally graywacke sandstone and claystone with localized areas of chert, greenstone, serpentinite, schist and semi-schist) at relatively shallow depths beneath the surficial deposits. Landslide and debris flow deposits consist of rock fragments in a sand and/or clay matrix.

7.1.2 Structure

The predominant structural features within the Franciscan bedrock underlying the project area are the northwest/southeast trending shears and minor foliations that appear to be pervasive. Other structural discontinuities (such as bedding planes, fold axes, fractures, and joints) within the in-place rock masses beneath the project area generally strike parallel to Rte 101 (southeast to northwest) and dip steeply to near vertical. Orientations of bedding planes were exposed and measured at only a few places in the project area and may vary considerably elsewhere due to the deformation history of the Franciscan units (as described above). Consequently, bedding plane orientations are relatively "random" within the Franciscan bedrock beneath the project area. In general, structural discontinuities are not significant to most of the project improvements. However, there are several localized areas, where shear zones cross the project alignment (e.g. Retaining Wall No. 4 and the cut for Southwest Frontage Road between Sta. 256+50 and 261+97).

7.1.3 Existing Slope Stability

The slopes at the project site consist of natural slopes and man-made cut slopes on the hillsides and man-made embankment slopes at the existing bridge abutments. Most of the natural slopes have gradients of 2(H):1(V) or flatter and are covered with vegetation. However, except for some localized areas, the vegetation consists of natural grasses and oak trees, which are not a result of specific plantings. In general, the steep natural slopes (steeper than 3(H):1(V)) are underlain by hard rock (usually Franciscan Mélange) at relatively shallow depths except where debris flows or landslides have deposited significant thicknesses of deposits or where colluvium has accumulated.

Significant man-made cuts are noted at the following locations:

- A 2H:1V cut slope on the western edge of Rte 101 along the alignment between Sta. 256+58 and 260+97 ("FR1" Line). Several local slumps and erosion gullies are noted on the cut slope. (See Photo No. 1 in Appendix E)
- A 2H:1V cut slope on the western edge of Rte 101 along the alignment for Retaining Wall No. 2 (Sta. 306+39 to Sta. 308+97 ("BK" Line)). A few surficial slumps are noted on the slope. (See Photo No. 2 in Appendix E)
- A major cut slope along the west/southwest edge of the existing on-ramp to the Redwood Landfill Bridge from the southwestern side (Sta. 342+69 to Sta. 346+67 ("RLF" Line)). The slope is steeper than 2H:1V and is approximately 30 feet high. A few small scarps are noted on the slope. (See Photo No. 3 in Appendix E)
- A cut slope on the northeastern side of Rte 101, behind the existing retaining wall (Sta. 336+08 to Sta. 339+52 ("N2R" Line)). No slumps are noted. (See Photo No. 4 in Appendix E)
- Cut slopes on the southwestern edge of Rte 101 in the area of proposed Retaining Wall No. 7 (Sta. 358+96 to Sta. 362+20 ("RLF" Line)). Localized erosion and slumps are noted on the cut slopes. (See Photo No. 5 in Appendix E)

Additional information on the cut slopes (e.g. the exposed soil/rock) is discussed later in appropriate sections.

As noted above, there is evidence of shallow slumps in several locations within the project limits, particularly in the steeper cuts. It appears that the slumps have generally occurred in the debris flow deposits in areas which have been steepened by past construction activities. The slumps have probably been caused by emerging seepage of infiltrated surface water. One exception is the localized failure of a 25- to 30-foot wide portion of the existing cut slope located southwest of the Redwood Landfill Overcrossing, where a shear zone in Franciscan sandstone is exposed. (See Photo No. 3 in Appendix E)

7.2 Subsurface Soil and Geologic Conditions

Subsurface information for the project site consisted of (a) information from soil borings and test pits; (b) information from cuts and rock outcrops within the project limits and vicinity; (c) information from geologic maps and interpretations of the geologic maps in conjunction with geomorphology.

7.2.1 Information from Soil Borings, Test Pits and CPTs

General subsurface information as revealed by the soil borings is summarized below:

- In general, rock was encountered at relatively shallow depths – rock was encountered at the surface in several borings. The deepest depth to rock was 35 feet in Boring A-09-111, drilled on the lower embankment for the eastern abutment of the Redwood Landfill Overcrossing. Rock was not encountered in ten of the relatively deep borings (boring depths greater than 5 feet), all drilled to depths of 15 feet or less. Refusal (exceeding 20 tons thrust capacity) was encountered in all four CPTs, at depths ranging from 22.5 feet to 36 feet. It was inferred that rock or rocklike material was encountered at those depths. The rock was identified as weathered sandstone or claystone. There is evidence of mylonite below the sandstone (in boring A-09-132) west of the

freeway along the proposed Northwest Frontage Road. The sandstones and claystones are generally blocks within the Franciscan Complex (e.g. blocks-in-matrix (bimrocks)). The debris flow deposits and landslide deposits are also classed as bimrocks. Further discussion on bimrocks is presented in Section 7.2.4.

- The soils overlying the rock are alluvium, colluvium, or landslide deposits consisting predominantly of very stiff lean clays and sandy clays and medium dense to very dense silty and clayey sands with gravel. Significant portions of the colluvium have been identified as debris flow deposits.
- An 8-ft layer of firm sandy clay is noted below the ground surface in Boring A-09-104, south of the Redwood Landfill Road. A 5-foot layer of firm clay is noted at a depth of 8 feet below ground surface in Boring A-09-114 on the east side of Rte 101. Presence of soft clay (e.g. Bay Mud) was not revealed by any of the borings.
- Groundwater was encountered in two locations:
    - In Boring A-09-109 at a depth of 30 feet below ground surface (Elev. -3.5 feet). The boring is located on the northeastern side of Rte 101, between Redwood Landfill Sanitary Road and Landfill Access Road.
    - In CPT-11-S1 near the southern end of the project site, at a depth of 4 feet below ground surface (Elev. 7.0 feet).

7.2.2 Cut Slopes and Rock Outcrops

Soil/rock exposed by the cut slopes and the outcrops within the project area are discussed below.

- Apparent landslide deposits (containing rounded fragments of Burdell Mountain Volcanic rocks) are present at the ground surface above the existing cut off the slope along the western edge of Rte 101, at the proposed cut between Sta. 256+58 and Sta. 260+97 (“FR1” Line).
- Colluvium and debris flow deposits overlie Franciscan Complex rock in the southern end of the cut slope along the west/northwest edge of the existing on-ramp to the Redwood Landfill Bridge from the western side. The thickness of the colluvium increases to the north, where the cut face exposes debris flow

deposits over the full 8-foot height (see Photo No. 3 in Appendix D). A shear zone, approximately 25 feet wide was noted in the cut face and fragments of serpentinite was observed within the zone.

- The entire face of the existing cut slope above the existing retaining wall (Sta. 336+08 to Sta. 339+52 ("N2R" Line)) on the northeastern side of Rte 101, (where the northbound on-ramp is planned) exposes competent rock (Franciscan Chert (fch)).
- A knob of rock, identified as Franciscan Chert (fch) is noted on the eastern side of Rte 101at Sta. 268+00 ("RL2" Line"), near the Verizon Wireless facility. The knob falls within the alignment for proposed Retaining Wall No. 5. The rock appears to be hard, though it may be possible to excavate the rock by conventional equipment (including hoe ram) due to its bedded and fractured nature; however, extra drilling and excavation efforts should be expected. Controlled Blasting may be required at depth at this location. For drilling purposes, coring may also be required.

7.2.3 Geologic Interpretation

As noted in Section 4.4, the project site is underlain by the Franciscan Complex blocks–in-matrix rock (Franciscan Mélange (fm) (fch)), which consist of various rock types, having different origins, brought together during subduction beneath the westerly advancing North American Continental Plate. For the most part, within the project area, Franciscan Complex mélange rocks were the result of tectonic agglomeration of massive sandstone and alternating thin beds of sandstone and shale with minor chert. It appears that the predominant rock type on the northeastern side of Rte 101 is chert and on the southwestern side it is greywacke sandstone.

The geologic maps prepared by our geologist (Plates D-1 through D-7 in Appendix D) indicate the following in the areas of the proposed major "modifications":

- The Southwest Frontage Road alignment between Sta. 256+58 and Sta. 260+97 ("FR1" Line) lies partially within an area of a mapped landslide

deposits (Qls). As shown on Plate D-2, the toe of the landslide extends onto the upper portion of the proposed cut slope for the new Southwest Frontage Road.

- The Retaining Wall No. 2 alignment (Sta. 306+39 to Sta. 308+97 – "BK" Line) for the major part crosses the nose of a small ridge composed of Franciscan Mélange, flanked on both sides by alluvial deposits. As shown on Plate D-4, a small portion of the soil exposed in the upper portion of the existing cut slope has slumped onto the level shoulder of Rte 101.
- The cut slopes for the Bike Path between Sta. 328+91 and 334+37 ("BK" Line) cross over a ridge of Franciscan Mélange, flanked on both sides by colluvial slope wash deposits. As shown on Plates D-4 and D-5, the alignment is located within debris flow deposits, which is essentially similar to slopewash deposits but containing larger blocks within the sandy matrix.
- The Retaining Wall No. 4 alignment (Sta. 336+39 to Sta. 339+12 – "RL2" Line) crosses over an area of debris flow deposits. (See Plate D-5.) The debris flow deposits extended to the Highway prior to construction of the interchange. The geologic map is confirmed by the borings and the existing cut exposure discussed in the previous section, where the debris flow is underlain by greywacke sandstone within Franciscan Mélange.
- The Retaining Wall No. 5 alignment is underlain by chert within Franciscan Mélange. (See Plate D-5.) The rock type is confirmed by the outcrop and the existing cut slope exposure at the alignment location and vicinity discussed in Section 7.2.2.
- A cut (which includes Retaining Wall No. 7) is proposed on the west side of Northwest Frontage Road, north of Retaining Wall No. 4. As shown on Plate D-5, the cut slope will cross through a zone of landslide deposits, confirmed by test pits TP-168, 169, and 170.
- A significant cut slope will be located southwest side of Northwest Frontage Road, near the north end of the project boundary. The cut alignment (Sta. 413+50 to Sta. 418+50 – "RLF" Line) will cross the toe of a fan where colluvium has been deposited at the mouth of a swale between two ridges. (See Plate D-7.)

7.2.4 Bimrocks (Blocks-in-matrix)

The distribution and types of the various material types present at the site have been discussed in the previous sections. Two material types are predominant in the areas of planned major modifications: Franciscan Complex and landslide and debris flow deposits. A third material type of significance is within the sheared zone. The behavior of all these three material types is of primary significance to the design and construction of the project.

A common characteristic of all these three material types is that they are chaotic mixtures of strong blocks within a weaker matrix. They may, therefore, be designated as "bimrocks," a geologically neutral word coined by Medley (1994) as a short form for "block in matrix rocks" per Raymond (1984). This section on bimrocks is presented due to the predominant presence of bimrocks in the project area and since their mechanical properties are significantly different from those of conventional 'soil' or 'rock' units.

Major work on bimrocks has been published by Medley and others in recent years, which has greatly enhanced our understanding. Based on available literature, the following may be noted:

- Bimrocks are mixtures of rocks composed of geotechnically significant blocks within a bonded matrix of finer texture.
- There is a mechanical contrast between the blocks and the matrix between the blocks.
- The volume and size of the blocks influence the mass properties at the scales of engineering interest.
- Block sizes may range from millimeters to several kilometers.
- Bimrocks may have considerable spatial, lithological and textural variability.
- Bimrocks should not be approached as stratigraphically orderly ("layer-cake") rocks.
- Important engineering characteristics of bimrocks include:

- Block volumetric proportions (volume occupied by blocks/total volume)
- Block size distributions and overall block orientations
- Matrix strengths and matrix-to-block contact strengths
- Matrix and block discontinuity fabrics.

Block lithologies, block strengths, individual block shapes and matrix lithologies are of lesser importance to predicting overall behavior of cut slopes and retaining walls in cuts.

From associated literature, it appears that block volumetric proportion is probably the most significant parameter for design for this project. This literature indicates relationships between volumetric block proportion and strength or deformation characteristics of the material as a whole. These relationships enable a practicing engineer to avoid overly conservative designs using only the strength characteristics of the matrix. Also present in the literature are projects where extensive focused investigation enabled the determination of a spatial distribution of block volumetric proportions (BVP) and development of project-specific relationships between block volumetric proportions and strength characteristics (e.g. friction angle) of the bulk material.

Two terms that are very significant for our purposes emerge from literature: “block-rich” and ‘block-poor”. The fundamental meanings of the terms are somewhat self-explanatory. Available literature indicates that for BVP below 25 percent, the strength will be dominated by that of the matrix and BVP above 75 percent will be dominated by block strength. For intermediate values of BVP, the values may be interpolated. It may be noted that the overall strength of a bimrock is typically independent of the strength of the blocks themselves. Failure surfaces are always through the matrix or along the interfaces between blocks and matrices, and are, therefore, tortuous (going around blocks). The strength increases with tortuosity, which increases with increasing BVP and also with a range in block sizes and orientations.

Due to the size and character of this project, coupled with the potentially high variability of materials, it was not practical to have a meaningful site-specific investigation such as described above. We believe that additional investigation beyond that performed would not have substantially improved the quality of information. Therefore, a more simple, yet pragmatic approach was taken for this study, as described below.

For convenience, bimrocks at the site were classified as either "block-rich" or "block-poor." The classification was based on: (a) information from cut exposures or natural outcrops, wherever available; (b) information from boring logs and test pits; and (c) geologic and geomorphic interpretation of subsurface conditions at specific locations. In general, the Franciscan Complex was classified as "block-rich" and the debris flow and landslide deposits and shear zone material were classed as "block-poor." Based on the above information, our geologist established expected zones of block-rich and block-poor materials at several pertinent locations as discussed in appropriate subsequent sections. Design parameters were established for each zone.

An internal friction angle of 26 degrees was assigned to the block-poor material. The value appears reasonable based on the literature for the clay/shale matrix; it is also at the lower end of the range cited by Medley in a paper submitted for publication (in press). Finally, the steepest natural slopes within the project site are approximately 2H: 1V (e.g. 26 degrees).

An internal friction angle of 36-degrees was used for block-rich material. The 36-degree friction angle is well within the range cited by Medley for block-rich units. The friction angle is also in the lower bound of the relationship:

$$\tan(\varphi_{\text{weakest block}}) / \tan(\varphi_{\text{matrix}}) = 1.5 \text{ to } 2.0$$

A particular characteristic of bimrock materials is the extreme heterogeneity in terms of block volumetric proportions, block sizes and block hardness. All of these characteristics will have significant impacts during construction. Extreme heterogeneity in terms of block volumetric proportions may result in unexpected construction difficulties. Therefore, the prospective Contractor should be made aware of that variability. Large, hard blocks of intact rock may be encountered, which may not be excavatable by conventional excavators; jackhammers or blasting may be required to break up large hard rock blocks. Hard rocks may impose hard drilling for tiebacks and/or soldier piles. All these issues are covered in greater detail in Section 12.1 (Construction Advisories).

7.3 Water

7.3.1 Surface Water

Rte 101 is generally flanked by higher, steeper ground on the west and southwest. Surface runoff tends to flow eastward toward the Petaluma River. In addition, there are ten seasonal creeks or streams (Olompali Creek, Dear Creek and 8 unnamed creeks) located within the project limits, which reach the highway and are conveyed into cross culverts below Rte 101. Surface water drainage, therefore, flows toward the highway and flows into the drainage inlets located along the highway. Two additional drainage features are noted within the project limits and are considered significant to the project:

a) A drainage course running west to east on the slope west of Rte 101, intersecting the RLF line at Sta. 345+90.
b) A drainage course running west to east on the slope west of Rte 101, intersecting the highway at Sta. 409+05 (RLF Line).

7.3.1.1 Scour

The subject was considered and was determined to be not applicable for the roadway project.

7.3.1.2 Erosion

Colluvial sandy soils are present in many locations near the surface and exposed in the slopes. Erosion due to surface water flow is therefore a potential concern, particularly since vegetation on many of these slopes is usually limited to natural grasses.

7.3.1.3 Groundwater

Groundwater was encountered during drilling in only one boring, (Boring A-09-109, located on the northeastern side of Rte 101) at a depth of 30 feet below ground surface (Elevation -3.5 feet) within the sandstone rock. This is probably perched water. Groundwater was also measured 4 feet below ground surface (Elevation 7.0 feet) in CPT-11-S1 near the southern end of the project location. Additionally, presence of groundwater was inferred in the three other CPTs based on dynamic pore pressure profile; however, groundwater was not encountered in the adjacent soil borings. Also, various degrees of seepage were encountered in the test pits.

A piezometer was installed in Boring A-10-161 (Sta. 259+90 – "N2R" Line; Offset 395 feet, left; Elevation 92 feet). Groundwater was measured in the piezometer at a depth of 20.5 feet below ground surface (Elev. 70 feet (approx.)) on May 3, 2011. The measurement is essentially the same as it was first measured in December, 2010. The piezometer is located nearly 400 feet east of Rte 101. Therefore, the groundwater levels per the piezometer may not be particularly relevant for the adjacent project area.

Except for the flatter area in the southeast end, most of the project area is hilly. Localized trapped water and seepages may therefore occur, particularly in the rainy season. The presence of water is intermittent and not sustained to establish a groundwater table. This is borne out by our field investigations, where, groundwater was encountered in only one boring, even though over 40 borings were drilled with a hollow stem

auger. Rock was not encountered in only 10 of the borings, all drilled to 15 feet depth or less. It is therefore expected that a sustained groundwater table will not be established within the soils overlying the rock. The groundwater table will therefore not have significant implications in the potential engineering issues like stability and settlement. However, encountering groundwater in excavations, particularly those made in the flatter, lower elevation areas, such as in the southeast corner of the interchange near the northbound off-ramp and the new East Frontage Road cannot be ruled out.

It is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface and subsurface flow, ground surface run-off, and other factors that were not existent at the time of investigation.

7.4 Project Site Seismicity and Potential Seismic Hazards

7.4.1 Ground Motions

The project site is located in a seismically active part of northern California. Seismic activity may result in geological and seismic hazards including seismically induced fault displacement and rupture, ground shaking, liquefaction, lateral spreading, landslides, and structural hazards. Many faults exist in the San Francisco Bay Area and are capable of producing earthquakes. These faults may cause strong ground shaking at the site.

Caltrans has revised the 1996 Hazard Map and has produced a new map and an associated report (2009 Caltrans Deterministic PGA Map and ARS Online Report). The new map (2007 Caltrans Deterministic PGA Map) shows all the known faults and contours of peak ground accelerations (PGA) based on New Generation Attenuation (NGA) ground motion prediction equations. The report also includes an associated database (2007 Data Base) providing relevant information for all the faults in the map; and procedures for the development of

Acceleration Response Spectra (ARS) curves based on a user friendly on-line web tool. The Regional Fault Map, Plate 4A, presents the locations of the fault systems relative to the project site, based on the 2007 Caltrans Deterministic PGA Map.

The major faults in the vicinity, their distances from the project site, fault types and the maximum credible earthquake magnitudes associated with each fault are summarized in the table below. These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 2: SEISMIC SOURCES

Fault	Fault Type	Estimated Closest Distance to the Project Area (miles)	Mmax
Rodgers Creek Fault	RLSS	5.6	7.1
San Andreas Fault zone (North Coast section)	RLSS	14.5	7.9
RLSS – Right Lateral Strike Slip Fault			

A design ARS curve was developed, based on the 2009 Online report for the site, which is presented in Plate 4B. The Peak Ground Acceleration per the design ARS curve is 0. 63g.

The Burdell Mountain Fault Zone is not identified in the 2007 Caltrans Deterministic PGA Map, a portion of which is presented in Plate 4. However, two traces of the Burdell Mountain Fault are shown on the geologic map by Wagner et al (2010), a portion of which is presented in Plate 3A. Where they cross the central portion of the project area, the faults are concealed (represented by a dotted line) beneath landslide deposits and have no identifiable geomorphic expression at the ground surface (Ford, 2007). Per the Preliminary Geotechnical Report (PGR) by Caltrans August 2005, the fault zone “should be considered potentially active, unless later proven otherwise”.

7.4.2 Ground Rupture

The Burdell Mountain Fault Zone is mapped as crossing a portion of Southwest Frontage Road (Sta.247+20 to Sta. 258+80 ("FR1" Line)). The potential for ground rupture due to movement of this fault is undetermined. The project does not include any structure (retaining wall or bridge) within the fault zone. However, underground utilities including NMWD waterline will cross this zone.

7.4.3 Liquefaction

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004).

USGS Liquefaction Susceptibility maps published in 2006 indicate 'Moderate' liquefaction susceptibility for essentially the entire project (See Plate 5). A zone of 'Very High' liquefaction susceptibility is noted on the USGS map between Sta. 241+50 and 246+00 ("N2R" Line). However, groundwater was encountered in only one boring within the project limits (Boring A-10-109). The groundwater table was within sandstone material. There is no indication of the presence of loose or medium dense sands below the groundwater table in that boring. Additionally, groundwater was measured at a depth of approximately 4 feet (El. 7.0 feet) in CPT-11-S1, which is within the 'Very High' zone. However, the soil

conditions interpreted from the CPT results indicated predominantly fine grained soils: silts and clays. There is no indication of any significant layer of loose or medium dense sands below the groundwater table. Groundwater was also inferred in the other three CPTs from the pore pressure data. However, predominantly fine grained soils (silts and clays) were interpreted from the dynamic pore pressure profiles per the CPT results for these locations. The potential for liquefaction is therefore considered low for the proposed project location.

8 GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Cuts and Excavations

Based on the plans provided by the Designer, the significant proposed cuts and excavations in the project are discussed below. Cuts not supported by the retaining walls will have a gradient of 2H:1V or flatter. Groundwater was not encountered in any of the borings drilled in the vicinity of the proposed cuts. However, there is evidence that shallow seepage occurs in some places during times of heavy rainfall. Hillside seepage is a common occurrence and should be expected.

Slope stability analyses were performed on selected slopes for both under static and seismic loading (a pseudo static force of 0.2 g per Caltrans Guidelines for Structures Foundation Reports, December 2009, was used for stability under seismic loading). The analyses were performed using the SLOPE/W computer program. Details of the slope stability analyses and the results are discussed in some detail in Appendix C. It should be noted that per the SLOPE/W program, local stability is automatically analyzed along with global slope stability if the limits are specified appropriately and the soil properties are homogenous for the height of the slope. The safety factor that is presented is for the lowest value within the specified limits. This is further clarified in Appendix C in the discussions for slope stability analyses.

Locations of proposed significant cuts and excavations (greater than 10-ft high) are discussed below.

- Southwest Frontage Road between Sta. 256+50 and Sta. 261+75 ("FR1" Line): The cut will result in 2H:1V slopes on the western side of the Frontage Road. The maximum slope height is 32 feet at Sta. 259+00. The eastern side the Frontage Road slopes down at a 4H:1V slope or flatter and intersects the existing 2H:1V cut slope on the edge of Rte 101. The existing cut slope has a maximum height of approximately 35 feet at Sta. 259+00. The area was mapped as a large landslide. However, except for a few slumps, the existing slope was relatively stable over the years.

Five soil borings were drilled over the area to characterize the subsurface conditions at the cut location. Boring R-10-161 was drilled at a point approximately 180 feet upslope of the top of the proposed cut. It encountered 16 feet of clay containing rounded blocks of andesite, inferred as landslide deposits. Beneath that, Tertiary sand was encountered down to a depth of 26 feet, where Franciscan rocks (greenstone, basalt, breccia, and serpentinite) were found to 142-ft depth, the maximum depth explored. Boring R-10-162 drilled near the top of the proposed cut slope indicated clay containing rounded blocks of dark gray andesite (similar to those strewn on the ground surface) to a depth of 8 feet. The clay layer was inferred to be a landslide deposit. Medium dense to dense Tertiary Sandstone was encountered below the landslide deposit to a depth of 33 feet, where a 2-foot thick layer of sandy clay and gravel was encountered. Hard Franciscan greenstone was found below the sandy clay and gravel layer to 62-ft depth, the maximum depth explored. Borings A-10-163, 164, and 165 were drilled at the base of the existing cut slope along the highway shoulder. Each encountered Tertiary Sandstone underlain by a thin layer of silty clay with Franciscan rocks underlying it at various depths: at 18 feet in Boring A-10-163 on the south side; at 16 feet in Boring A-10-164 at the center; and at 3 feet in Boring A-10-166 on the north side.

As noted above, a 1- to 2-ft layer of sandy clay was encountered below the Tertiary sandstone, separating the sandstone from the Franciscan rock beneath the entire area of the proposed cut. The layer was 10 to 15 feet below the toe of the existing slope. Some randomly oriented slickensides were observed in the clay, reflective of creep, rather than a landslide. Consolidated Undrained (CU) triaxial tests were performed on two samples of this clay: one from Boring R-10-162 at the top of the proposed cut and the other from

A-10-164 below the toe of the existing slope. Test results indicate: (a) a total stress friction angle of 22 degrees and a cohesion of 450 psf; and (b) an effective stress friction angle of approximately 30 degrees (no cohesion). The results are in reasonable agreement with published literature for clays of similar plasticity characteristics.

Slope stability analyses were performed for the proposed cut slope section at Sta. 259+00. A 'wedge' method of analysis was performed to force the failure plane through the clay layer. The analyses yielded a factor of safety of 3.07 using total stress strength parameters and a factor of safety of 3.27 using effective stress strength parameters for the clay layer. Similar analyses were also performed for the existing slope, which yielded factors of safety of 2.66 and 2.87 using total and effective stress parameters, respectively.

The upper soil zones along the slopes tend to slump due to seepage of water. This is more prominent in the new cuts. Therefore, we recommend the top of the slope be rounded off. In addition, we recommend erosion protection measures be implemented on the slope. Typical Erosion protection measures are discussed in Section 8.1.1. Until the slopes have established ground cover/erosion protection measures, they are expected to erode and would require higher maintenance. For segments with slope heights greater than 8 feet, an interceptor drain as described in Section 8.1.2 should be constructed on top of the slope to prevent blowouts of the slopes due to seepage.

- Southwest Frontage Road between Sta. 269+50 and Sta. 273+00 ("FR1" Line): The cut will result in 2H:1V slopes on the western side of the Southwest Frontage Road. The maximum slope height is 12 feet at Sta. 272+00. The eastern side of the Southwest Frontage Road slopes down to Rte 101 at a 4H:1V slope or flatter. TP-157 excavated within the north-south limits of the cut indicates a 2-ft layer of topsoil (sandy silt), underlain by a layer of colluvium, consisting of mixed gravelly clay and sand to a depth of approximately 9 feet. Rounded pebbles of very weathered andesite and chert, ranging from ¼-inch to 3 inches, were noted within the colluvium layer. Soft, uncemented sand with minor silt (possibly Tertiary Sandstone) was encountered below the colluvium layer to 12-ft depth, the maximum depth explored. The slope will essentially be within the colluvium layer (which is classed as block-poor

bimrock) with the bottom portions within Tertiary sandstone for the higher slopes. Per our analyses presented in Appendix C, 2H:1V cut slopes up to a height of 20 feet in block-poor bimrocks should have a factor of safety of 1.58 under static conditions and 1.14 under seismic loading, both satisfying the requirements. The slope on the western side of the Southwest Frontage Road is therefore considered globally stable. The slope will potentially be subject to surface flows and erosion from upslope. We recommend the top of the slope be rounded off. In addition, we recommend erosion protection measures be implemented on the slope. Typical erosion protection measures are discussed in Section 8.1.1. Until the slopes have established ground cover/erosion protection measures, they are expected to slump and would require higher maintenance. For segments with slope heights greater than 8 feet, an interceptor drain as described in Section 8.1.2 should be constructed on top of the slope to prevent blowouts of the slopes due to seepage.

- Bike Path between Sta. 325+50 and Sta. 334+37 ("BK" Line) and Southbound On-Ramp between Sta. 326+30 and Sta. 334+96 ("RL4" Line): The cut will accommodate a 12-ft wide bike path on the west side and a 24-ft (min.) wide on-ramp to southbound Rte 101 on the east side between the Bike Path and the highway. Generally speaking, the cross-sections indicate 2H:1V cut slopes on both sides of the Bike Path; the slope between the on-ramp and Rte 101 is 2H:1V or flatter. The maximum slope height is approximately 19 feet (at Sta. 330+50) on the western (upslope) side of the Bike Path and 12 feet (at Sta. 330+50) on the eastern (downslope) side. Two test pits (TP-159 and TP-160) were excavated within this segment of the proposed cuts. The test pits indicate a 2-ft layer of topsoil (sandy silt), underlain by clayey gravel or sandy gravel to the maximum depths excavated (6 to 8 feet). The clayey and sandy gravels were identified as debris flow material, which concurs with the geologic mapping. As noted earlier, relatively stable 2H:1V man-made cut slopes are present at the site in the debris flow material. Per our analyses presented in Appendix C, 2H:1V cut slopes in block-poor bimrocks, e.g. debris flows should have a factor of safety of 1.5 up to a height of 20 feet. Cut slopes, 2H:1V or steeper are also present in the northwest corner of the bridge adjacent to the present cut. Based on this observation and the limited heights of the cut slopes (less than 20

feet), the slopes are considered globally stable. Relatively shallow slumps are present on the slope, which are attributed to seepage. The 2H:1V cut slope on the west side will potentially be subject to surface flows and erosion from upslope. We recommend the top of the slope be rounded off. In addition, we recommend erosion protection measures be implemented on the slope. Typical erosion protection measures are discussed in Section 8.1.1. Until the slopes have established ground cover/erosion protection measures, they are expected to slump and would require higher maintenance. For segments with slope heights greater than 8 feet, an interceptor drain as described in Section 8.1.2 should be constructed on top of the slope to prevent blowouts of the slopes due to seepage.

- Northwest Frontage Road between Sta. 408+50 and Sta. 412+50 ("RLF" Line): The cut will result in 2H:1V slopes on the western side of the Northwest Frontage Road. The maximum slope height is 15 feet at Sta. 410+00. Per the area geologic map by Wagner (2010) and our geomorphic interpretation (See plate D-5 in Appendix D), the cut will be in an alluvial fan. Available subsurface information from Boring A-09-145 located within the cut zone indicates very stiff to hard clay to 10-ft depth, the maximum depth explored. The slope should therefore be stable from a global standpoint. An incised channel exists near the southern end of the planned cut slope. Infiltration through this channel could lead to seepage that could potentially emerge on the face of the new cut slope, causing accelerated erosion and localized slumping. Drainage within the channel should, therefore, be intercepted upstream of the planned cut slope and diverted away from it as appropriate. Typical erosion protection measures are discussed in Section 8.1.1. Until the slopes have established ground cover/erosion protection measures, they are expected to slump and would require higher maintenance. For segments with slope heights greater than 8 feet, an interceptor drain as described in Section 8.1.2 should be constructed on top of the slope to prevent blowouts of the slopes due to seepage.

- Northwest Frontage Road between Sta. 413+50 and Sta. 418+50 ("RLF" Line): The cut will result in 2H:1V slopes on the western side of the Northwest Frontage Road. The maximum slope height is 30 feet at Sta. 416+00. Based on available subsurface

information (Boring A-09-146) the depth to rock (claystone) is 12 feet. Soils overlying the rock were predominantly very stiff clays. The proposed cut slope will be in very stiff to hard clays, possibly underlain by claystone. A global factor of safety of 3.8 was computed (see Appendix C). However, the area geologic map by Wagner (2010) and our geomorphic interpretation (See plate D-5 in Appendix D) indicate that the cut slope will cross the toe of a fan where colluvium has been deposited at the mouth of a swale between two ridges. Typical erosion protection measures are discussed in Section 8.1.1. Until the slopes have established ground cover/erosion protection measures, they are expected to slump and would require higher maintenance. For segments with slope heights greater than 8 feet, an interceptor drain as described in Section 8.1.2 should be constructed on top of the slope to prevent blowouts of the slopes due to seepage.

- Northbound on-ramp between Sta. 336+24 and Sta. 339+43 ("RL2" Line): This ramp will be located on the northeast quadrant of the interchange. On the eastern side of the ramp, excavation will result in a vertical cut face supported by a retaining wall (Retaining Wall No. 5) to a maximum height of 13.6 feet with a 2H:1V cut slope (with a maximum height of the slope at 16 feet) above the wall. On the western side, there will be a 2H:1V cut slope with a maximum slope height of approximately 20 feet. On the back side of the cut slope, native terrain slopes down. Slopes on the back side are 2H:1V or steeper at some locations. Boring Nos. A-09-112 and 113 drilled approximately 100 feet east of the cut slope indicate medium dense to dense silty sand with gravel to a depth of 10 to 15 feet, underlain by sandstone rock. A slope stability analysis was performed for a section at Sta. 337+40 ("RL2" Line). The analysis indicated a factor of safety of 1.61 under static loading and 1.13 under seismic loading.

8.1.1 Erosion Control & Mitigation Measures

As discussed in the previous sections of the report, the proposed project will have cut slopes within alluvium and colluvium soils. Also there are proposed cuts that will expose debris flow deposits and landslide deposits. Debris flow or landslide deposits will be exposed in all the cuts on the western side of Rte 101 except the cuts on the Northwest Frontage Road northwest of Sta. 408+50 ("RLF" Line).

These materials are subject to erosion and slumping until they have been stabilized by established ground cover.

As part of the erosion mitigation it is recommended to construct lined surface drainage ditches at the top of all cut slopes five feet or greater in height to intercept the surface run off before it reaches the top of the cut slopes. It is also recommended to use slope rounding wherever possible to reduce the sharp cut edge at the top of the slope.

For surface treatment, it is recommended that the slopes be covered with erosion control material such as jute netting that is impregnated with grass seed. Other netting materials may also be used if preferred and approved by Caltrans. In addition, other types of plantings can be used that are able to establish quickly and have deeper root systems.

8.1.2 Subsurface Drainage Mitigation

Toe Drains

Based on the existing terrain along the project corridor, hillside seepage may be encountered from the adjacent uphill slopes. Such moisture penetrations in pavement layers, when combined with heavy traffic load, could compromise the service life of the pavement. Therefore, toe drains are recommended where the cut slopes or walls toe into the roadway. This a permanent feature and it is installed between the toe of the slope and the pavement improvement including shoulder and any future widening. It is recommended that the toe drains (underdrains) be installed where the cuts/slopes exceed 8 feet in height. This underdrain system is considered to be an interceptor drain to collect seepage from the uphill slopes before it reaches the pavement subgrade. The design of the toe drains should conform to Caltrans standard plan (Sheet D102). The bottom of the trench is recommended to be minimum 3 feet below the pavement subgrade and 20 inches wide with an 8 inch diameter perforated PVC pipe. Class 3 Permeable Material should be used as drain rock, which should be wrapped in appropriate filter fabric. For segments of pavement adjacent to the toe drains, aggregate subbase (AS) for

the pavement section should be replaced by Class 3 Permeable Material wrapped in filter fabric from edge to edge of the pavement. The required pavement sections are presented in Tables 7B and 7C later in the report. Wherever applicable, pavement structural sections (beginning with the base layers) can be placed above the underdrain system.

Interceptor Drains

In areas where there is potential for seepage to 'blow-out' from the slope cuts, it is recommended to install subsurface interceptor drains. These should be installed at the top of the cut slope just downslope of the lined surface drainage ditch. The intent of these drains is to collect and divert the subsurface seepage before it reaches the slope face. These interceptor drains are typically 18 inches wide and 7' to 8' deep. The typical drain backfill consists of Standard Class 1 permeable material wrapped in appropriate filter fabric with an 8" diameter perforated PVC pipe at the bottom. The top 18-24" of the surface of the drain is sealed with native soil.

In addition, subsurface drainage mitigation is recommended at the following two locations:

a) Upslope of Retaining Wall No. 4 intersecting the wall at the approximate location 345+90 ("RLF" Line); and
b) At approximate location 409+50, near the southern end of the proposed cut between Sta. 408+50 and Sta. 412+50.

Based on soil gradation, a Class C filter fabric is recommended for the first location and a Class A filter fabric is recommended for the second location.

8.1.3 Rippability

Observation of the exposures in the existing rock cuts at the site suggests that excavation of the weathered rock formations should be possible using standard excavation methods. Large boulders and blocks of rock may be present within the

Mélange formations making them hard to excavate. Specialty equipment and significant effort could be required for excavating these rock formations.

8.1.4 Grading Factor

Source of the project fill may include the fill generated from the cuts (as long as the on-site native soil meets the project specifications) planned for the project. Fill may also be imported from outside borrow sources. The source of borrow is unknown at the time of report preparation. Based on previous experience, for preliminary estimate, a grading factor of 0.9 may be assumed for import materials.

8.2 Embankments

8.2.1 General

Embankment fill will be required at several locations. The approximate maximum fill thicknesses at the approach embankments and ramps and are summarized in Table 3 below for significant fills (10 feet or greater).

TABLE 3: SUMMARY OF MAXIMUM FILL THICKNESS

Fill Area No.	Proposed Construction	Approx. Max Fill Thickness (ft)	Relevant Boring(s)
1	East Frontage Road (Line "FR2")	19 ft @ Sta. 328+00	A-09-104, 105
2	Northbound Off-ramp (Line "RL1")	30 ft @ Sta. 333+00	A-09-109, 110, 111
3	Northbound On-ramp (Line "RL2")	12 ft @ Sta. 340+50	A-09-114
4	Southbound Off-Ramp (Line "RL3)	11 ft @ Sta. 337+00	A-09-125
5	Northwest Frontage Road (Line "RLF")	28 ft @ Sta. 353+00	A-09-133, 134
6	Southwest Frontage Road (Line "FR1")	15 ft @ Sta. 255+50	A-10-167
7	Southwest Frontage Road (Line "FR1")	10 ft @ Sta. 262+00	A-10-165

8.2.2 Subsurface Soil Conditions

No distinct layers of soft clay (e.g. Bay Mud) were encountered in any of the reference borings for the proposed fill areas noted above. Also, groundwater was not encountered in any of the above referenced borings. Additional subsurface

conditions below each fill area, where fill thickness exceeds 10 feet, are discussed below.

Fill Area No. 1

Fill Area No. 1, proposed for the East Frontage Road, extends from Sta. 316+50 to Sta. 329+00 ("FR2" Line). Near the southern end, boring data (Boring A-09-104) indicates approximately 7 feet of firm sandy lean clay underneath the proposed fill embankment, underlain by very stiff lean clay to a depth of 10 feet, the maximum depth drilled. Near the northern end, boring data (Boring A-09-105) indicates approximately 7 feet of very stiff sandy lean clay underneath the proposed fill embankment, underlain by sandstone (Franciscan Complex) to a depth of 20 feet, the maximum depth drilled.

Fill Area No. 2

Fill Area No. 2, proposed for the northbound off-ramp, extends from Sta. 329+50 to Sta. 335+00 ("RL1" Line). The boring data (Borings A-09-109, 110, 111) indicate that the subsurface soil conditions underneath the proposed fill embankment varies from loose to medium dense clayey and silty sands at the southern end to very stiff clays at the northern end. Sandstone (Franciscan Complex) was encountered at a depth of around 15 feet at both ends.

Fill Area No. 3

Fill Area No. 3, proposed for the northbound on-ramp, extends from Sta. 339+25 to Sta. 341+50 ("RL2" Line). The boring data (Boring A-09-114) indicate that the subsurface soil conditions underneath the proposed fill embankment consist of alternating layers of loose to medium dense silty and clayey sand and firm silty clay to a depth of 17 feet, underlain by sandstone (Franciscan Complex) to a depth of 25 feet, the maximum depth drilled.

Fill Area No. 4

Fill Area No. 4, proposed for the southbound off-ramp extends from Sta. 335+50 to Sta. 338+000 ("RL3" Line). The boring data (Boring A-09-125) indicates that

the proposed fill embankment will be underlain by sandstone (Franciscan Complex) to a depth of 20 feet, underlain by shale to 22-ft depth, the maximum depth drilled.

Fill Area No. 5

Fill Area No. 5, proposed for the Northwest Frontage Road north of Retaining Wall No. 4, extends from Sta. 347+00 to Sta. 359+50 ("RLF" Line). Per the boring data (Borings A-09-133, 134), the subsurface soil conditions underneath the proposed fill embankment consist of very stiff clays. Sandstone (Franciscan Complex) was encountered at depths ranging from 8 to 12 feet.

Fill Area No. 6

Fill Area No. 6, proposed for the Southwest Frontage Road extends from Sta. 251+00 to Sta. 257+00 ("FR1" Line). The boring data (Boring A-10-167) indicate that the subsurface soil conditions underneath the proposed fill embankment consist of a surficial layer of very stiff clay to a depth of approximately 4 feet, underlain by hard clay and very dense sand to a depth of 20 feet, the maximum depth drilled.

Fill Area No. 7

Fill Area No. 7, proposed for the Southwest Frontage Road extends from Sta. 261+00 to Sta. 264+50 ("FR1" Line). The boring data (Boring A-10-165) indicate that the subsurface soil conditions underneath the proposed fill embankment consist of a surficial layer of very stiff clay to a depth of approximately 4 feet, underlain by hard clay, very dense sand and very dense clayey gravel to a depth of 20 feet, the maximum depth drilled.

8.2.3 Embankment Settlements

Settlements generally occur due to self weight of the fill, in addition to compression settlements of the underlying clays (native soils). An evaluation was made of the range of settlements for all the seven significant fill areas noted above. The following were included in the settlement computations for each fill area:

- Maximum Height of Fill for the specific fill area
- Subsurface condition as indicated by the relevant boring(s) for the fill area
- Contact area of the loading (e.g. equivalent width of the loaded area)

Settlement of Fill due to Self Weight

Based on available field information, settlement of fill due to self-weight will be on the order of 0.5 to 0.75 percent of the height of fill. Some settlement will occur concurrently with the fill placement, depending on the characteristics of the fill and the rate of placement. It is expected that the settlement will be rapid and 90 percent of the settlement should occur by the end of fill placement.

Settlement of the Underlying Native Soil

Subsurface conditions considered for the analyses of settlement of the native soils included:

- Thickness of the soils overlying the rock
- Location and thicknesses of the clay layers (only clay layers were considered for compression)
- Shear strength of the clay layers

As indicated in the subsurface conditions for each fill area, there was no indication of groundwater in any of the relevant borings. It was inferred that groundwater is unlikely to rise above the rock into the overlying soils. Compression of the soil by expulsion of the water (e.g. consolidation settlements) was therefore deemed unrealistic. Compression of the clays and consequent settlements in the native soil would therefore be due to immediate (elastic) settlements.

Settlements were calculated based on elastic compression of the underlying layers due to the load from the fill. Modulus of Elasticity of the various clay layers were based on existing correlations. The existing correlations considered the shear strength of the soils and the soil plasticity characteristics. The calculations are presented in Appendix C. A table summarizing the settlements is presented below.

Fill Area No.	Relevant Boring	Maximum Fill Height (ft)	Compressible Layer Thickness (ft)	Fill Settlement (inches)[1]	Native Soil Settlement (inches)
1A	A-09-104	15	20	0.9 to 1.35	0.66
1B	A-09-105	19	8	1.15 to 1.7	0.25
2	A-09-110	30	15	1.8 to 2.7	0.52
3	A-09-114	12	5	0.7 to 1.1	0.16
4	A-09-125	11	0[2]	0.65 to 1.0	0
5	A-09-133 A-09-134	28	12	1.7 to 2.5	0.55
6	A-10-167	15	8	0.9 to 1.35	0.12
7	A-10-165	10	12	0.6 to 0.9	0.15

Notes:
1) 0.5 to 0.75 percent of Fill Height
2) Rock at ground surface in the relevant boring

The primary consideration from engineering and design standpoint is the settlement that would occur subsequent to construction of the pavement, underground utilities, foundations and other settlement critical improvements. It is desirable that settlement be essentially complete prior to inception of such construction. It is therefore suggested that a waiting period be established and a settlement monitoring program be instituted to verify that the settlement has occurred.

Waiting Period

For planning purposes, for proposed new embankments greater than 15 feet high, a waiting period of 60 days is proposed prior to construction of foundations, utilities and pavements. For embankments less than 15 feet high, the Caltrans standard practice of a 30-day waiting period should suffice. The proposed 60-day settlement monitoring and waiting period reflects the variabilities of the various factors contributing to the settlement.

The final waiting period should be established, based on a proposed monitoring program per Caltrans Test Method 112, which will be included in the Construction Plans for the project. The monitoring program is discussed below.

Monitoring Program

Two types of monitoring instruments are proposed: (a) conventional survey monuments to measure the total settlement from the top of the embankment; and (b) fluid settlement cells to measure the settlement of the underlying native soils due to fill placement. Proposed locations for instrumentation for settlement monitoring are presented in the table below. The locations are also presented on the plans in Plates EX-1 thru EX-15 in Appendix F.

No.	Approx. Station	Control Line	Offset	Fill Area No.
Survey Monument (Type A)				
H-1	320+00	"FR2"	16' Lt.	
H-2	322+00	"FR2"	16' Lt.	
H-3	324+00	"FR2"	16' Lt.	1
H-4	326+00	"FR2"	16' Lt.	
H-5	328+00	"FR2"	16' Lt.	
H-6	329+60	"RL1"	22' Rt.	
H-7	331+00	"RL1"	22' Rt.	
H-8	332+00	"RL1"	22' Rt.	2
H-9	333+00	"RL1"	22' Rt.	
H-10	334+00	"RL1"	22' Rt.	
H-11	334+60	"RL1"	22' Rt.	
H-12	347+50	"RLF"	20' Lt.	
H-13	350+15	"RLF"	20' Lt.	
H-14	351+50	"RLF"	20' Lt.	5
H-15	353+50	"RLF"	20' Lt.	
H-16	355+00	"RLF"	20' Lt.	
H-17	357+00	"RLF"	20' Lt.	
H-18	254+00	"FR1"	19' Lt.	
H-19	255+00	"FR1"	19' Lt.	6
H-20	256+00	"FR1"	19' Lt.	
H-21	262+00	"FR1"	19' Lt.	7

H-22	340+00	"RL2"	6' Lt.	3
H-23	340+75	"RL2"	6' Lt.	
H-24	337+10	"RL3"	22' Lt.	4
H-25	337+90	"RL3"	22' Lt.	
Settlement Platform				
SP-1	322+00	"FR2"	@ Centerline	1
SP-2	328+00	"FR2"	@ Centerline	
SP-3	331+00	"RL1"	@ Centerline	2
SP-4	333+00	"RL1"	@ Centerline	
SP-5	350+00	"RLF"	@ Centerline	5
SP-6	354+00	"RLF"	@ Centerline	

Survey Monuments should be installed after completion of fill placement. Proposed hub locations are presented in the table above. The monuments should be located on top of the embankments near the outer edge, so that monitoring may continue beyond end of construction, if desired. Details for installation of the monuments should be per the Special Provisions for the project. Readings should be taken every two weeks by qualified personnel designated by the Resident Engineer, continuing to the end of the designated settlement period. The readings should be furnished to the Resident Engineer who will evaluate the results to determine if the settlement is essentially complete or if the waiting period should be extended.

Fluid Based Settlement Cells should be installed at 6 specified locations shown in the table above. A settlement platform consisting of a standpipe mounted on a plywood platform will be installed at the bottom of the fill area prior to inception of fill placement. Plastic tubing from the standpipe will be connected to a transparent site tube mounted vertically in a protected box outside the limits of the embankment. Qualified personnel designated by the Resident Engineer will take readings at the transparent site tube once a week, until the fill reaches its full height and twice a week after that for post-construction monitoring. The readings should be furnished to the Resident Engineer who will evaluate the results to determine if the settlement is essentially complete or if the waiting period should be extended. Post construction monitoring should extend to the end of the waiting period, unless the Resident Engineer decides otherwise.

8.2.4 Evaluation of Embankment Stability

New embankment fill will be required at the locations as described in Section 8.2.1 above. The maximum height of embankment at locations where retaining walls are not present will be on the order of 30 feet along the northbound off-ramp near the overcrossing structure. The proposed gradient of the slopes is 2H:1V or flatter. The underlying soils are stiff to very stiff clays up to 15 feet thick overlying bedrock. Groundwater was not encountered at the embankment locations. Slope stability analysis performed for this slope using the SLOPE/W computer program indicated a factor of safety of 1.87, which is greater than the required factor of safety of 1.5 under static conditions. The factor of safety computed for seismic conditions for a pseudo-static force of 0.2g per Caltrans Guideliens for Structures Foundation Reports (December 2009) was 1.39, which is greater than the required factor of safety of 1.1. Slope stability analyses are presented in Appendix C.

8.2.5 Mitigation of Surface and Subsurface Drainage

It is understood that several of the existing low lying areas will be crossed by new roadway embankment. Surface and subsurface drainage path could be impacted by such construction. Appropriate subsurface drainage system such as fabric wrapped underdrain and/or surface ditch with catch basins should be provided to avoid ponding on the uphill side of the embankment.

8.3 Earth Retaining Systems

Due to right-of-way and other geometric constraints, the project will require construction of four retaining walls. Information of approximate wall locations, length and maximum wall heights provided by the designer are summarized in Table 4 below. The subsurface soil conditions and design considerations of each of the retaining walls are discussed after the table.

TABLE 4: SUMMARY OF PROPOSED RETAINING WALLS

Wall No.	Approximate Wall Location	Cut/ Fill	Max. Wall Height (ft)	Approx. Length (ft)	Proposed Wall Type	Relevant Borings and Test Pits
1	Not Used					
2	Sta. 306+39 to 309+07 (BK Line')	Cut	14.2	266	Type 1	A-10-158, 158A, 158B
3	Not Used					
4	Sta. 342+77 to 346+74 ('RLF Line')	Cut	31	429	See Note 1 below	A-09-130, 131, 132, TP-171
5	Sta. 336+39 to 339+12 ('RL2 Line')	Cut	16	273	See Note 2 below	A-09-112, 113, 114
6	Not Used					
7	Sta. 358+96 to 361+20 ('RLF Line')	Cut	9	223	Type 1	A-09-135, 136 TP-168, 169, 170

Notes:
1. Tieback wall between Sta. 343+24 and Sta. 346+10; Soldier-Pile Lagging Wall for the rest of the wall.
2. Tieback wall between Sta. 336+92 and Sta. 338+54; Soldier-Pile Lagging Wall for the rest of the wall.

Retaining Wall No. 2

The proposed cut wall will be located along the western edge of the proposed new bike path. Wall heights range from 4 to 14.2 feet with a 2H:1V slope behind it. The entire wall alignment will be located across the nose of a small ridge of Franciscan Complex (KJf) flanked on both sides by colluvial deposits (see Plate D-4 in Appendix D). There are several slumps noted in the existing cut slope adjacent to the highway. The slumps appear to be surficial. Near the bottom of the slope, the ground is essentially level and appears to be covered with debris from these surficial slides. Subsurface conditions exposed in the existing cut slope indicate weathered Franciscan Complex rock in the lower portions of the cut and residual sandy soils are exposed in the upper portion of the cut slope. Boring A-10-158A drilled approximately 35 feet east of the wall near the southern end of the wall alignment indicates rock at a depth of 9 feet. Borings A-10-158 and 158B were drilled approximately 15 feet east of the retaining wall alignment near the center and northern end of the wall, respectively, indicate rock at the ground surface. The soil overlying the rock on the southern end (based on Boring A-10-158A), consist of stiff lean clay at the surface, underlain by medium dense clayey sand at 5-ft depth. However, the

southern end of the wall is 35 feet to the west of the boring, on steeper terrain, where the rock depth is expected to be shallower. It is therefore expected that majority of the wall will be founded on rock, with a small portion in the southern end may be on medium dense sand or a thin layer of clay overlying the sand. An allowable bearing capacity of 3.5 ksf is recommended for the stiff clay overlying the sand.

A Caltrans Standard Type 1 wall on spread footing is considered feasible, since per Caltrans Standard Plans, the required toe pressure for a 14-ft high wall is 3.3 ksf, which is less than the recommended allowable bearing capacity.

An immediate (elastic) settlement on the order of 0.2 inch was computed for the southern end of the wall. This is based on a toe pressure of 3.3 ksf. and an 8-ft wide footing (per Standard Plans for a 14-ft high wall) underlain by 6 feet of stiff clay overlying rock. Settlement from the middle of the alignment to the northern end should be negligible, the wall being founded on rock in this segment. The maximum differential settlement is therefore conservatively estimated to be on the order of 0.2 inch.

Retaining Wall No. 4

The proposed cut wall will extend along the southwestern edge of the Northwest Frontage Road. It starts from the northwestern edge of the Redwood Landfill overcrossing, and extends towards the northwest. There is an existing cut slope that was excavated several years ago for the existing overcrossing ramp. The new alignment will expand the cut into the hillside. The new excavation will result in a vertical cut for the wall itself, with a 2H:1V cut slope above the top of the wall. The maximum height of the vertical cut will be 31 feet. Per our geomorphic map interpretation (see Plate D-5 in Appendix D), the surficial soils in the area consist of debris flow deposits. Local slumps are also noted in the overlying debris flow deposits along the upper portions of the existing cut slope, northeast of the proposed wall alignment (See Photo No. 3 in Appendix E).

Rock (Franciscan Complex) is indicated near the surface (within 3 feet) in Borings R-09-130, R-09-131, A-09-132, drilled on the southwest side of Rte 101, and along the southwestern edge of the proposed Northwest Frontage Road in the area of proposed

Retaining Wall No. 4. Rock was identified at 10 feet below ground surface in Boring A-09-129 within 80 feet of the southern end of the wall. The rock is identified as sandstone/siltstone in Borings 129, 130 and 131 and as claystone in Boring 132. Crushed sediments and mylonized sediments are noted in Boring 131 at depths ranging from 20 to 30 feet below ground surface. Test pit TP-171 was excavated approximately 20 feet south of the wall alignment, near the north end of the wall. It indicated debris flow material to a depth of 4.5 feet, underlain by sandstone of the Franciscan Complex. (See Plate D-5 in Appendix D).

A 25-ft wide shear zone was observed within the sandstone near Sta. 345+75 ("RLF" Line). The shear zone, as exposed, is essentially vertical. It is anticipated that the width of the shear zone may increase toward the southwest (i.e. where the wall will be built). At the cut face for the proposed wall, the shear zone could be up to 100 feet wide. Therefore, it is assumed that along the wall alignment, shear zone will be present north of Sta. 345+50 ("RLF" Line).

Based on the topography, the exposed material in the existing cut slope and the borings and test pits located along the wall alignment and the field observations (Borings 129, 130, 131 and 132 and TP-171), our Engineering Geologist has estimated the depth to rock along the wall on the order of 4 feet. Based on this information, e.g. the vertical cut in this section south of Sta. 345+50 is expected to be in rock (e.g. block-rich bimrock). North of Sta. 345+50, the wall will support shear zone material. Shear zone material is assumed as block-poor bimrock. These approximate stationings could vary in the field and adjustments in the wall design may be required. Therefore for contingency purposes the "shear zone" wall design has been extended 25 feet on either side of the estimated station.

Based on the above conditions, a Soldier Pile-Lagging wall is recommended for Wall No. 4. The wall should be designed for the following parameters:

<u>South of Sta. 345+50 (wall supporting block-rich bimrock):</u>

Effective Angle of Internal Friction (phi)	= 36 degrees
Wall Friction Angle (delta)	= 0 (per BDS)

Active Earth Pressure, Ka	= 0.41 (assuming 2:1 backslope)
Soil Unit Weight	= 135 pcf
Cohesion	= 100 psf
Passive Earth Pressure Coefficient (Kp)	= 9.0
Maximum Pile Arching Capability	= 2.0 (for permanent walls, per B.D.S.)

North of Sta. 345+50 (wall supporting shear zone material, e.g. block-poor bimrock):

Effective Angle of Internal Friction (phi)	= 26 degrees
Wall Friction Angle (delta)	= 0 (per BDS)
Active Earth Pressure, Ka	= 0.59 (assuming 2:1 backslope)
Soil Unit Weight	= 130 pcf
Cohesion	= 100 psf
Passive Earth Pressure Coefficient (Kp)	= 3.5
Maximum Pile Arching Capability	= 2.0 (for permanent walls, per B.D.S.)

Depending on the structural demands and to control top of the wall deflections, a tieback wall is proposed for a segment of the wall near the center of the wall alignment between Sta. 343+24 and 346+10 ("RLF" Line), where wall heights are greater than 16 to 18 feet. Design recommendations for the tieback wall (single row of tiebacks) are presented in Plate 6A for block-rich bimrock and in Plate 6B for block-poor bimrock. Associated backup calculations are presented in Appendix C.

A cast-in-place concrete facing should be installed on the outer (roadside) face of the lagging. Adequate drainage should be provided behind the wall to reduce build-up of hydrostatic pore pressures.

The 2H:1V backslope above the top of the wall will be within debris flow material, which will potentially be subject to periodic creep movements, resulting in some of the material moving down the slope. Therefore, we recommend the top of the cut slope be rounded off and a V-ditch be installed on top of the slope to reduce water flow from upslope. In addition, we recommend erosion protection measures be implemented on the cut slope. Typical erosion protection measures are discussed in Section 8.1.1. Currently the existing 2H:1V slope at the location has been performing reasonably well. However, until the

slopes have established ground cover erosion protection measures, they are expected to slump and would require higher maintenance.

A drainage channel is present upslope of the location of Retaining Wall No. 4, which intersects the wall alignment approximately at Sta. 345+90 (RLF Line). This drainage could cause seepage to emerge from the debris flow exposed in the cut slopes, resulting in further slumping. Appropriate surface and subsurface drainage mitigation measures (such as described in Section 8.1.2) should be implemented.

Particular care should be exercised during excavation into the potentially unstable Shear Zone. Large mass of this material could become unstable requiring additional caution and monitoring. Construction staging may also need to be reviewed to reduce such risks. The issue is discussed further in Section 12.1 (Construction Advisories).

Retaining Wall No. 5

The proposed cut wall will run along the northeastern edge of the northbound on-ramp. The excavation will result in vertical cuts up to 19 feet backed by 2H:1V slopes up to 16 feet high. Borings drilled north of Redwood Landfill Road along the proposed new northbound on-ramp (Borings A-09-001, R-09-112, R-09-113 and A-09-114) encountered rock (Franciscan Complex) at depths ranging from 3 to 18 feet below ground surface. The rock was identified as sandstone. The soils overlying the rock are generally medium dense to dense silty sand with gravel.

An existing cut slope is present in the general vicinity of the proposed wall, above the existing retaining wall along the northeastern edge of Rte 101. The exposed face of the cut slope indicates the presence of intact rock (e.g. block-rich bimrock) for the most part (see Photo No. 4 in Appendix E). A large rock outcrop is present within the retaining wall alignment. The outcrop, identified as Franciscan chert (fch), appears to be a hard block, though it appears to be excavatable. Difficult excavation should be expected requiring specialized equipment. The wall alignment is assumed to be in Chert rock. Borings along the alignment (Borings 113 and 114) seem to indicate this.

A Soldier Pile-Lagging wall is recommended. The wall should be designed for the following parameters:

Effective Angle of Internal Friction (phi)	= 36 degrees
Wall Friction Angle (delta)	= 0 (per BDS)
Active Earth Pressure, Ka	= 0.41 (2:1 backslope in rock)
Soil Unit Weight	= 135 pcf
Cohesion	= 100 psf
Passive Earth Pressure Coeff. (Kp)	= 9.0 (for soldier pile in rock)
Passive Arching Capability	= 2.0 (for permanent walls, per B.D.S.)

Depending on the structural demands and to control top of the wall deflections, a tieback wall is proposed for a segment of the wall. This zone is near the center of the wall alignment between Sta. 336+92 and Sta. 338+54, where wall heights are 16 feet or the wall is in the vicinity of the Verizon Wireless Cellular Tower. Design recommendations for the tieback wall (single row of tiebacks) are presented in Plate 6A. Associated backup calculations are presented in Appendix C.

The proposed cut will be very close to the existing Verizon Wireless Cellular Tower, which will impose additional (surcharge) loads on the wall. The surcharge load (as uniform pressure on the surface) should be multiplied by a factor of 0.3 and added to the active earth pressures as a uniform load over the height of the wall.

A cast-in-place concrete facing should be installed on the outer (roadside) face of the lagging. Adequate drainage should be provided behind the wall to reduce build-up of hydrostatic pressures.

Required excavation of the highly block-rich bimrock could pose problems for conventional equipment. The problem could be exacerbated if the blocks are larger than the equipment can handle. Special measures such as use of hoe-ram, jackhammer and in the extreme case, controlled blasting may be required. Drilling for soldier piles through the hard chert blocks could potentially pose additional difficulties. Core barrel drilling

may be required. Hard drilling for tiebacks through the block-rich bimrocks should be expected.

Retaining Wall No. 7

The proposed cut wall runs along the western edge of the Northwest Frontage Road. The maximum height of the wall will be 12 feet with approximately a 3H:V slope behind the wall. The wall will cut across the toe lobe of a landslide deposit (see Plate D-4 in Appendix D). Three test pits (TP-168, 169 and 170) were excavated in the vicinity of the retaining wall alignment. The test pit depths ranged from 8 to 11 feet. The test pits encountered landslide deposits that are classified as clayey sands with minor gravel to silty sand and gravel. Near the bottom of the pits, large rock blocks (up to 30 inches) in soil matrix were encountered. A thin layer of gray brown clay with slickensides (slide plane gouge) was encountered in TP-168 and TP-169, both to the south of the southern limit of the wall. The dip of the slide plane was into the slope. Slide plane gouge was not encountered in TP-170, which is within the north-south limits of the wall alignment, 50 feet to the west of the alignment. Nearest borings in the area (Borings A-09-135 and A-09-136) indicate medium dense to very dense silty and clayey sands, underlain by sandstone rock. The rock depths occur at 8-ft depth below ground surface in Boring A-10-136 and at 20-ft depth in Boring A-10-135. It is likely that the rock noted in the boring is actually a large boulder within the landslide deposit.

As indicated above, per geologic mapping, the wall will cut through the toe of a mapped landslide deposit. Per our geomorphic interpretation, the toe of the landslide deposits extends to the western edge of Route 101. From our cross-sectional interpretations, at the wall location the slide plane is probably 50 feet deep beneath the wall. This is about 15 feet beneath the highway.

Analyses were performed to investigate if the potential for slope instability in the landslide mass was exacerbated by the introduction of the cut for the retaining wall. Based on the terrain contours and other pertinent field observations, our engineering Geologist developed an initial (preslide) section and a zone for possible location for the slide plane. Analyses were first performed for this initial condition to recreate the slide

plane and the shear strength characteristics of the slide plane material. Subsequently, the recreated failure plane and the strength characteristics were used to analyze (a) the existing profile at the wall location; and (b) the profile after the introduction of the proposed cut and wall. The factor of safety was found to be essentially unchanged due to the introduction of the wall, indicating that the proposed cut has no measurable impact on the stability of the slope. All analyses were performed using the SLOPE/W computer program. A more detailed discussion of the procedure of the analyses and the results of the analyses are presented in Appendix C. Based on these discussions, there is no intent to mitigate any potential "deep seated" movements. Investigations to locate the slide inferred from the geomorphic interpretation was therefore deemed unnecessary and was not pursued.

The proposed wall is to support the required cut for the roadway. A Caltrans Standard Type 1 wall is proposed. Based on the information from the relevant soil borings (A-09-135 and 136), the soils at the foundation level are dense to very dense silty and clayey sand. An allowable bearing capacity of 1.3B (ksf) is recommended, where the width of the footing is B (in feet). Thus, for the footing width of 7.25 feet for a standard 12-ft high Type 1 wall, the allowable bearing capacity is 9.4 ksf. A Caltrans Standard Type 1 on spread footing is therefore considered reasonable at this location, since, per Caltrans Standard Plans, the required toe pressure for a 12-ft high wall of 2.8 ksf is less than the recommended allowable bearing capacity.

Since the wall will be underlain by dense silty and clayey sands, total settlements, and consequently, differential settlements should be negligible.

Appropriate erosion protection should be provided for the backslope behind the wall. Suitable erosion protection measures are recommended in Section 8.1.1.

8.4 Corrosion Investigation

During our investigation, twenty two corrosion tests were performed on samples collected from various locations within project limits. The corrosion investigation for this

project was performed in general accordance with the provisions of California Test Method 643. A summary of the corrosion test results is presented in Table 5.

TABLE 5: SUMMARY OF CORROSION TEST RESULTS

Sample No.	Station (ft.) "N2R" Line	Offset (ft.)	Depth (ft)	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
A-09-102	305+10	155 Rt.	2	2680	5.79	0.4	16.4
A-09-103	311+65	115 Rt.	0-5	5630	5.81	10.1	10.5
A-09-104	321+85	180 Rt.	4	1150	6.71	27.6	63.2
A-09-114	341+00	80 Rt.	4	7500	4.10	4.1	8.0
A-09-116	310+95	75 Lt.	0-5	2010	7.47	24.2	20.8
A-09-117	321+00	65 Lt.	4.5	2680	3.72	18.2	31.8
A-09-124	342+95	45 Lt.	0-5	2470	7.74	43.5	21.5
A-09-126	341+40	135 Lt.	9.5	1310	6.48	28.1	28.3
A-09-128	346+45	45 Lt.	0-5	5360	6.76	16.9	15.4
A-09-129	334+95	295 Lt.	4.5	5360	5.18	1.9	13.4
A-09-134	345+35	215 Lt.	4.5	2570	5.47	15.9	20.2
A-09-135	349+45	215 Lt.	9.5	2680	4.23	6.4	57.1
A-09-137	355+15	180 Lt.	4.5	1050	6.73	23.2	56.1
A-09-140	372+35	10 Lt.	0-5	3480	5.97	11.0	17.2
A-09-143	384+55	140 Lt.	9.5	1880	6.15	4.9	19.5
A-09-145	401+50	100 Lt.	0-5	4020	5.58	4.4	9.7
A-09-146	407+10	75 Lt.	4	290	7.80	813.7	245.1
A-09-147	228+50	65 Lt.	0-5	910	7.53	47.7	51.6
A-09-149	250+35	65 Lt.	4.5	540	6.78	109.7	137.2
A-09-151	270+50	0.	9.5	940	6.09	37.5	42.9
A-09-152	279+05	110 Lt.	0-5	3220	7.19	20.7	16.9
A-09-154	299+05	80 Lt.	0-5	1340	6.76	25.6	18.2

8.5 Culverts

For selection of pipe material for culvert and storm drain applications, it is our understanding that AltPipe computer program is used by Caltrans to assist Designers. AltPipe program is a web-based tool (*http://dap1.dot.ca.gov//design/altpipe/*), which updates and supersedes the previous CULVERT4 program. The computations performed by AltPipe are based on the procedures and California Test Methods described in Chapter 850 of the Caltrans Highway Design Manual (HDM). AltPipe incorporates current requirements from the HDM supplemented by Caltrans Design Information Bulletin No. 83 (D.I.B. No. 83, June 30, 2003) for abrasion potential for material selection. The AltPipe program is intended for final design by the civil or hydraulic designer. In addition to soil corrosivity data, the input requires data such as Abrasion Level, 2-5 year Flow Velocity, and height of cover, which should be determined while finalizing the drainage design.

Analyses were performed by the Designers using the AltPipe program and the soil corrosivity data presented in Table 5. Analyses were performed for 44 drainage units. Majority of pipes are 18-inches in diameter; three units have 24-inch pipes and one has a 36-inch pipe. Appropriate depths of soil cover and soil corrosion values from Table 5 were incorporated in the analyses, based on the location of the unit. All analyses used a 50-year design life; a 2-5 year flow velocity of 3 ft/sec.; and an abrasion level of 3. The results of the analyses performed by the Designers are presented in Appendix C.

Following are some general findings, based on the analyses. The designer should refer to their calculations in Appendix C for more specific information.

- Corrugated steel pipes are allowable for approximately half of the drainage units. Minimum thickness of pipes generally ranged from 0.052 inches to 0.079 inches (polymeric sheet (PS) or polymerized asphalt (PA) coating).
- Spiral rib steel pipes are allowable in only four drainage units: minimum thicknesses range from 0.064 to 0.109 inches.

- Aluminum pipes are allowable in only eight drainage units: a minimum thickness of 0.06 inches is indicated for all the eight units.
- Plastic pipes (PVC corrugated or PVC ribbed) are allowable for all drainage units.
- Plastic pipes (HDPE corrugated or HDPE ribbed) are allowable in all but one drainage unit.
- Reinforced concrete pipes are allowable in approximately two-thirds of the drainage units. Required thickness of steel cover ranges from 0.75-in to 1-in. Five sacks of cement and 11.1 percent water are indicated in the AltPipe output for all cases.

8.5.1 Concrete Box Culverts

Based on the plans provided by the designer, three new concrete box culverts are planned at the following locations:

- Access/Maintenance Road at Sta. 293+50 (“BK" Line)
- Bike Path at Sta. 305+10 (“BK" Line)
- East Frontage Road at Sta. 305+80 (“FR2” Line)

In addition, concrete box culvert extensions are proposed at the following three locations:

- Northwest Frontage Road at Sta. 365+70 (“RLF” Line)
- Northwest Frontage Road at Sta. 378+40 (“RLF” Line)
- Northwest Frontage Road at Sta. 393+30 (“RLF” Line)

<u>Foundation Design</u>

a) Recommended soil spring stiffness for the foundation slab is 125 kips/ft^3.
b) Recommended bearing capacity for the structure and wingwalls is 3 kip per square foot.

Static Lateral Earth Pressures and Friction Factor

For the proposed box structures, the design vertical and lateral earth pressure should conform to Section 6.21 of Caltrans Bridge Design Specifications (BDS). Per Caltrans BDS, the recommended unit weight of soil (vertical pressure) is 140 pcf and the lateral earth pressures are 35 pcf and 100 pcf for Reinforced Concrete Box.

The effect of live load surcharge is required on the structure walls and wingwalls. An additional height with equivalent earth pressure of not less than 2 feet of uniform soil weight at 125 pcf should be added to the ground profile to account for the additional earth pressure resulting from the surcharge. A friction factor of 0.35 under invert slab is recommended. Only dead loads should be used to estimate the frictional resistance at the bottom of invert slab.

Seismic Lateral Earth Pressures

The proposed box structure will experience increased lateral loads during earthquake shaking. The additional horizontal forces recommended to simulate earthquake loads are dependent upon the magnitude of ground surface accelerations and the retained height of the proposed box structure, together with the weight and type of material retained by the walls of the box structure. A value of 14.5 HxH (in lbs. per lineal foot of wall) is recommended as dynamic lateral force in addition to the static earth pressures recommended above (assumed peak ground acceleration of 0.63g). It is recommended that the dynamic lateral force be considered to act a distance 0.6 h (h = height of the wall of the box structure) above the base of the wall. For the seismic earth pressure load, the load distribution should be an inverted triangle shape with maximum at the top and zero at the bottom.

Foundation Subgrade Preparation

To facilitate construction and provide a uniform support, a one-foot thick aggregate base wrapped in subgrade enhancement geotextile is recommended below the reinforced concrete box culvert structures. The proposed concrete culvert should be supported on a pad, which should be constructed as follows:

a) Excavate approximately one foot of existing soil below the bottom of the concrete culvert. The excavation should extend 2 feet beyond the culvert footprint.
b) Place a layer of subgrade enhancement geotextile on the subgrade. The subgrade enhancement geotextile may be either woven or non-woven type fabric and should conform to Caltrans Standard Specification (Section 88-1.04, Class B1).
c) Place 1 foot of Caltrans Class 3 Aggregate Base over the subgrade enhancement geotextile. The Class 3 Aggregate Base should be compacted to 95-percent relative compaction per Caltrans Test 216.
d) The subgrade enhancement geotextile should then be wrapped on top of the compacted Class 3 Aggregate Base for a minimum overlap of two feet.

9 STRUCTURAL PAVEMENT SECTIONS

R-value tests were conducted on representative samples collected at subgrade level. The test results are summarized in Table 6A.

TABLE 6A: SUMMARY OF R-VALUE TEST RESULTS BY PARIKH (2010)

Boring No.	Boring Location	Station (ft.) "N2R" Line	Offset (ft.)	Description	Atterberg Limits	R-Value
A-09-103	NB-Shoulder	311+65	115 Rt.	Sandy Silt		19
A-09-115	NB-Shoulder	346+80	40 Rt.	Silty Sand with Gravel		63
A-09-116	SB-Shoulder	310+95	75 Lt.	Sandy Lean Clay with some Gravel	LL=34, PI=15	25
A-09-117	SB-Shoulder	321+00	65 Lt.	Lean Clay with some Gravel	LL=39, PI=21	14
A-09-118	SB-Median	325+65	5 Lt.	Sandy Lean Clay with some Gravel		8
A-09-119	SB-On-Ramp	326+80	45 Lt.	Sandy Silt		44
A-09-124	NB-Shoulder	342+95	45 Lt.	Sandy Silty with some Gravel		45
A-09-128	SB-Shoulder	346+45	45 Lt.	Sandy Lean Clay with some Gravel	LL=25, PI=9	24
A-09-140	Frontage Road	372+35	10 Lt.	Sandy Lean Clay with Gravel		23
A-09-142	Frontage Road	379+65	115 Lt.	Sandy Lean Clay		10
A-09-145	SB	401+50	100 Lt.	Sandy Lean Clay with some Gravel		13
A-09-147	SB-Shoulder	228+50	65 Lt.	Lean Clay with some Gravel		7
A-09-148	SB-Shoulder	238+70	60 Lt.	Lean Clay		6
A-09-152	SB	279+05	110 Lt.	Lean Clay with some Gravel	LL=26, PI=9	10
A-09-154	SB-Shoulder	299+05	80 Lt.	Lean Clay with traces of Gravel	LL=31, PI=14	12
Note: R-value tests were not performed on all samples collected from shallow (5-ft deep) borings.						

Additional R-values for subgrade soils within project limits were available from the Preliminary Materials Recommendation (Caltrans Memo dated August 15, 2005). The R-values are presented below in Table 6B.

TABLE 6B: SUMMARY OF ADDITIONAL R-VALUE TEST RESULTS
(From Caltrans Preliminary Materials Recommendation Memo)

Test No.	Boring Location	Station (ft.) "N2R" Line	Report of Tests on	R-Value
9639-64P	Median	228+96	Soil	3
D70672	SB-Shoulder	229+49	Basement Soil	11
D70671	SB-Shoulder	284+40	Basement Soil	10
9639-63P	NB-Shoulder and Hinge Point	301+29	Soil	54
D70670	SB-Shoulder	327+16	Basement Soil	22
9639-70P	NB-Shoulder	337+72	Soil	33
55861	SB-Shoulder	356+20	Basement Soil/Structural Section	21
D70669	SB-Shoulder	387+88	Basement Soil	25
55862	SB-Shoulder	406+89	Basement Soil/Structural Section	16

The R-value test results tabulated in Table 6A and 6B indicate that the R-values of the subsurface soils at the project site range from 3 to 63. The higher R-values are generally for

sandier soils. Atterberg Limit tests performed on the subgrade soils indicate the subgrade soils to have relatively low plasticity.

As-built Pavement Sections

As-built pavement sections for the Mainline were provided to us by the Designers. As-built pavement sections and the proposed new sections are presented in Appendix F.

New Pavement Sections

New shoulders will be placed along Rte 101 as follows (all stationing along "N2R" Line):

- Southbound between Sta. 273+50 and 288+00: 10-ft wide outside shoulder
- Northbound between Sta. 326+01 and 342+15: 10-ft wide outside shoulder
- Southbound between Sta. 328+05 and 343+80: 10-ft wide outside shoulder
- Southbound between Sta. 399+02 and 411+84: 10-ft wide outside shoulder
- Northbound between Sta. 403+82 and 415+59: 5-ft wide inside shoulder
- Southbound between Sta. 407+20 and 410+78: 5-ft wide inside shoulder

Recommended Traffic Index (TI) values were provided by Caltrans as follows: (a) TI = 12.5 for 20-yr design life; and (b) TI = 13.5 for 40-yr design life. The recommended pavement sections are presented in Table 7A.

New Pavement will be required for the ramps (travel way and shoulders). A recommended TI value of 10.0 was provided by Caltrans. The recommended pavement sections are presented in Table 7B.

New Pavement will be required for the Northwest Frontage Road and Southwest Frontage Road. A recommended TI value of 6.5 was provided by Caltrans. The recommended pavement sections are also presented in Table 7B.

New pavement will also be required for (a) East Frontage Road (south of Redwood Landfill Road); (b) East Frontage Road (between Redwood Landfill Road and Sanitary Landfill Road); and (c) Class 1 Bike lane. The required pavement sections have been provided to us by Caltrans. The required sections are presented in Table 7C.

Recommended Structural Pavement Sections

Recommended structural pavement sections were computed, conforming to the procedures in the Caltrans Highway Design Manual (HDM), September, 2009, for the locations where new pavement is required per project plans. A design R-value of 5 was used for designing the structural pavement sections south of Sta. 279+05 – "N2R" Line and a design R-value of 10 was used for designing the structural pavement sections north of Sta. 279+05 – "N2R" Line. For units which span across Sta. 279+05 – "N2R" Line, the pavements were designed using an R-value of 5. Lime treatment was considered for enhancement of the low R-value subgrade. However, lime treatment was not considered justifiable due to the limited extent of the new pavement required and also due to the limited width available for lime treatment operations. The recommended minimum R-value for Class 2 Aggregate Base (AB) is 78 and for Class 4 Aggregate Subbase (AS) and for Class 3 Permeable Material it is 50.

The recommended sections are presented in Tables 7A, 7B and 7C. Computations are presented in Appendix C. Pertinent additional information is presented below.

TABLE 7A: RECOMMENDED PAVEMENT SECTIONS - New Mainline Shoulder

Design Life	TI	Option-1	Option-2			Option-3			
		FDHMA*	HMA-A*	LCB	Total	HMA-A*	LCB	AS	Total
New shoulder from Sta. 273+50 to 288+00 - "N2R" Line (R-value = 5)									
20-year	12.5	1.70	0.95	1.05	2.00	0.65	0.60	1.60	2.85
**	13.5	1.80	1.00	1.20	2.20	0.70	0.65	1.70	3.10
All other segments of new shoulder (R-value = 10)									
20-year	12.5	1.65	0.90	1.05	1.95	0.65	0.60	1.40	2.65
**	13.5	1.80	1.00	1.10	2.10	0.65	0.70	1.55	2.90

TI: Traffic Index
FDHMA: Full Depth Hot Mix Asphalt (Type A)
HMA-A: Hot Mix Asphalt Concrete (Type A)
RHMA-G: Gap Graded Rubberized HMA
LCB: Lean Concrete Base
AS: Aggregate Subbase (Class 4, R-Value=50)
***RHMA-G**, up to 0.15 ft may be placed at the surface, replacing equivalent thickness of HMA-A
****The TI of 13.5** is provided for 40-yr design. However, per Caltrans, there is no 40-yr design for HMA section. Therefore, the pavement cannot be classified as a 40-yr design section. The pavement elements are based on the equivalent TI value.

TABLE 7B: RECOMMENDED PAVEMENT SECTIONS - Ramps And West Frontage Road

Location	R	TI	Option-1	Option-2			Option-3			
			FDHMA	HMA-A	AB	Total	HMA-A	AB	AS**	Total
Northbound Off-Ramp	15	10	1.20	0.50	1.65	2.15	0.50	0.85	0.90	2.25
All Other On- and Off-Ramps	10		1.30	0.50	1.80	2.30	0.50	0.85	1.05	2.40
Southwest Frontage Road*	5	6.5	0.85	0.30	1.25	1.55	0.30	0.55	0.75	1.60
Northwest Frontage Road	10		0.80	0.30	1.15	1.45	0.30	0.55	0.65	1.50

TI: Traffic Index
FDHMA: Full Depth Hot Mix Asphalt (Type A)
HMA-A: Hot Mix Asphalt Concrete (Type A)
AB: Aggregate Base (Class 2, R-Value = 78)
AS: Aggregate Subbase (Class 4, R-Value=50)
* Includes Access/Maintenance Road
** For pavements adjacent to toe drains, AS should be replaced by Class 3 Permeable Material wrapped in filter fabric from edge to edge of pavement

TABLE 7C: RECOMMENDED PAVEMENT SECTIONS - Provided By Caltrans

Location	Option-1	Option-2			Option-3			
	FDHMA	HMA-A	AB***	Total	HMA-A	AB	AS	Total
East Frontage Road (South of Redwood Landfill Road)	---	0.25	0.5	0.75	---	---	---	---
East Frontage Road (Redwood Landfill Road and Sanitary Landfill Road)*	1.35	0.55	1.90	2.45	---	---	---	---
Class 1 Bike lane	---	0.25	0.5	0.75	---	---	---	---
Maintenance Vehicle Pullouts		0.5	0.5	1.0				

* Option-2 will generally be used. In some instances, due to staging/traffic handling, Option-2 may not be feasible, and Option-1 (FDHMA) may be used.

** A 4-ft wide shoulder consisting of 0.5-ft thick AB compacted to 95 percent should be provided on either side the pavement for both segments of the East Frontage Road

*** For pavements adjacent to toe drains, AB to a maximum of 1 foot should be replaced by Class 3 Permeable Material wrapped in filter fabric from edge to edge of pavement

FDHMA: Full Depth Hot Mix Asphalt (Type A)
HMA-A: Hot Mix Asphalt Concrete (Type A)
AB: Aggregate Base (Class 2, R-Value = 78)
AS: Aggregate Subbase (Class 4, R-Value=50)

10 MATERIAL SOURCES

There are several commercial sources of asphalt, concrete, and aggregate products in the vicinity of the project area. Some of the available commercial suppliers in the vicinity of the project site are listed in the following table.

TABLE 8: SOURCES OF ASPHALT AND AGGREGATE MATERIAL

Source	Location	Approx. Haul Dist. (One way, miles)
Shamrock Materials, Inc.	7552 Redwood Blvd., Novato, California	3.5
Scott's Concrete & Pumping	523 McClay Rd, Novato, California	6.6
Affordable Asphalt	22 Columbine Lane, Novato, California	7.0

11 MATERIAL DISPOSAL

Project may require off-haul of some of the excavated material that cannot be used on site. Prior to excavating, materials should be tested for contamination in accordance with the recommendations of the environmental report. Asbestos, if encountered, will require special

handling and disposal. Disposal of ADL and other contaminated material (if any) is beyond the scope of this project.

12 CONSTRUCTION CONSIDERATIONS

12.1 Construction Advisories

These sections are written primarily for the engineer responsible for the preparation of plans and specifications so that the construction advisories can be incorporated into the appropriate plans and specifications. Since these sections identify potential construction issues related to the project, it may also be of use to the Agency's representatives involved in monitoring of construction activity. The field investigation performed by us primarily addresses design issues and was not planned specifically to identify construction issues.

The project site is located along the existing Rte 101 and the Marin County roads. Therefore, traffic control is required to maintain traffic flow along Rte 101 and the other local streets. Several underground utilities exist at the site. The contractor should verify the utility lines, be aware of the existing conditions and plan the construction activities accordingly.

A significant portion of the construction will involve excavation of 'bimrocks' (see Section 7.2.4 for discussion of bimrocks). The Contractor should be prepared to deal with the very high degree of heterogeneity, both spatial and lithological, in the bimrock formations. He should in particular be prepared for very large and/or very hard blocks, which may not be easily excavatable using conventional equipment. (Jackhammers or even controlled blasting may be required). Hardness of the rocks may also result in very hard drilling for the soldier piles, and core barrel drilling may be required, particularly at Retaining Wall No. 5 location. Very hard drilling may also be encountered for tiebacks. Contractor should also be prepared for the high probability of encountering potentially unstable formations such as block-poor bimrocks with weak matrix material, sheared zones and serpentines during excavation and take appropriate precautions. Trapped water sources in the rock formations may suddenly be exposed during excavation and adequate,

timely measures will be required. Serpentines are also often associated with naturally occurring asbestos (NOA), which is considered hazardous. Appropriate mitigation measures should be implemented if it is encountered.

The materials to be excavated may also consist of stiff to hard clay, medium dense to dense sand and weathered rock material. Localized subgrade pumping may be encountered during earthwork construction depending on the weather, moisture condition of the subsurface soils, and surface drainage conditions. Equipment mobility may also be difficult if the subgrade is wet. Under such circumstances, the subgrade soils may require reworking, moisture conditioning, aeration, or over-excavation and replacing with dry granular fill to facilitate earthwork construction. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. are located along the alignment. It might require special equipment and additional efforts to remove these buried objects.

Soft ground conditions near the ground surface are anticipated at the lower elevations in the areas of alluvial fans, where groundwater seepage and surface flows accumulate. This may lead to additional settlements and difficulties in equipment mobility if appropriate mitigation measures are not taken. Soft and/or saturated ground was encountered at several locations during the test pit excavations in January, 2011. We recommend that in areas designated for embankments for future roadway alignment, the soft and/or saturated material, if encountered, should be excavated to a minimum depth of 2 feet and removed and replaced with compacted fill to adjacent grade prior to construction of the embankment or the roadway. If the soft material persists after 2 feet of excavation, a layer of subgrade enhancement geotextile should be placed at the bottom of the excavation prior to placement of the compacted fill. This is primarily to facilitate mobility of equipment and to reduce future settlements from the saturated soils. Approximate footprints of potential areas of soft ground requiring overexcavation are identified in Plates EX-1 through EX-15 in Appendix F. The depths and extents of potential overexcavation are presented in Plates X-1 thru X-15 in Appendix F. These areas and depths may vary upon field conditions and shall be up to the Resident Engineers discretion.

Prospective contractors for the project must be directed to evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other areas, or on the basis of field investigation on the site performed by them, taking into account their proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and State regulatory agencies.

12.2 Construction Consideration that Influence Specifications

The above construction advisories should be used to supplement the specifications. The contractor should verify the conditions of the existing utility lines. These locations should not be used for stockpiling of borrow materials. Any utility conflicts with proposed construction should also be reviewed prior to construction.

12.3 Construction Monitoring and Instrumentation

Construction monitoring and instrumentation will be required for monitoring of the settlement of the designated fill areas. The monitoring program, which is incorporated in the Construction Plans and specifications for the project, should conform to Caltrans Test Method 112. Typical survey hubs are considered acceptable for this program. Proposed monitoring hub locations have been provided to the Designer. The rate and magnitude of settlement should be provided to the Resident Engineer for appropriate reviews and making decisions. The final waiting period should be established, based on the proposed monitoring program.

12.4 Hazardous Waste Considerations

The project environmental study report should be referred to for further details about any potential hazardous materials within the project site. The presence of serpentinite indicates the significant probability of the presence of naturally occurring asbestos (NOA) at the site.

12.5 Differing Site Conditions

The soil conditions described in this report are based on available boring, test pit and CPT data and exposed cuts and rock outcrops. It should be noted that these borings depict subsurface conditions only at the locations drilled. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface soil conditions could change between the explored locations. Due to the predominant presence of bimrocks at the project site, a high degree of variability in the subsurface than is generally encountered should be expected and planned for.

Early communication should be made between the Resident Engineer, the Contractor and the Geotechnical Engineer as soon as conditions that differ from those established in this report are recognized by any of the parties. Additional recommendations could thereby be provided if such conditions arise.

13 RECOMMENDATIONS AND SPECIFICATIONS

13.1 Summary of Recommendations

If the designer has questions or concerns with any of these recommendations, or, if conditions are found to be different during construction, the Geotechnical Engineer who prepared this report should be contacted. Additional fieldwork, analysis or changes in recommendations may be required. These services may be provided under a separate authorization, as necessary. A concise summary of the geotechnical recommendations is presented below:

- Design peak ground acceleration (PGA) = 0.63g, based on the 2009 Caltrans ARS Online Report.
- Subsurface conditions at the project site generally indicate relatively shallow depths to rock. The soils overlying the rock range from stiff to hard clays and medium dense to very dense sands. The rock is predominantly weathered sandstone or claystone (Franciscan Complex).
- Several major cuts are proposed along hillsides. Some of the cuts require new retaining walls. Recommendations for the retaining walls are presented in Section 8.4.

- Recommended pavement sections for widening of Rte 101, the new ramps, new frontage roads and bike lane are presented in Section 9.

13.2 Recommended Materials Specifications

13.2.1 Standard Specifications

Unless otherwise stated in the special provisions, all materials specifications should conform to Caltrans Standard Specifications, May 2006 edition, including but not limited to the following: Earthwork, Structure Backfill, Pervious Backfill Material, Subgrade Enhancement Geotextile, Thermoplastic Pipes, Hot-Mixed Asphalt, Aggregate Base and Aggregate Subbase, Cement Treated Base, Permeable Material, etc. Note that there are most-current specifications included in the "Amendments to the Standard Specifications dated May 2006" – last revised/issued February 11, 2010. The entire Section 39 (originally "Asphalt Concrete," now "Hot Mix Asphalt") and Section 90 ("Portland Cement Concrete") were replaced on this date.

13.2.2 Special Provisions

Note that there are most-current standard special provisions (February 11, 2010) available. The up-to-date SSPs for all pavement-related items should be used.

Imported Borrow: Imported material should be in accordance with the specifications set forth in Caltrans Section 19. In particular, for new embankment/roadway construction, the material placed within 4 feet of the finish pavement subgrade should meet the following requirements:

1. Free of organic or other deleterious materials.
2. An R-value of no less than 15.

Aggregate Base: Aggregate Base (Class 2) shall conform either to the grading specified in the table below for the special provisions or to either the 1½-inch maximum or the ¾–inch maximum grading for Class 2 aggregate based

specified in Section 26-1.02A, "Class 2 Aggregate Base" of Caltrans Standard Specifications. It shall also be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 2 aggregate base shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing ¾" Maximum)

Sieve Sizes	Operating Range	Contract Compliance
1":	100	100
¾"	90 – 100	87 – 100
No. 4	35 – 60	30 – 65
No. 30	10 – 30	5 – 35
No. 200	2 – 9	0 – 12

Gradation Requirement (Percent Passing 1 ½" Maximum)

Sieve Sizes	Operating Range	Contract Compliance
2"	100	100
1 ½"	90 – 100	87 – 100
1"	------	------
¾"	50 – 85	45 – 90
No. 4	24 – 45	20 – 50
No. 30	10 – 25	6 – 29
No. 200	2 – 9	0 – 12

Aggregate Base (Class 2) shall also conform to the quality requirements given on the following table:

Quality Requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	25 min	22 Min.
Resistance (R-value) (301)	-	78 Min.
Durability Index	-	35 Min.

Aggregate Subbase: Aggregate Subbase (Class 4) shall conform to the provisions in Section 25 of the Standard Specifications and to these Special Provisions.

Aggregate Subbase (Class 4) shall be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class

4 aggregate subbase shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	Operating Range	Contract Compliance
2 1/2 "	100	100
No. 4	30 - 65	25 – 70
No. 200	0 - 15	0 - 18

Aggregate Subbase (Class 4) shall also conform to the quality requirements given on the following table:

Quality Requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	21 Min.	18 Min.
Resistance (R-value) (301)	50	50 Min.

Permeable Material: Permeable Materials (Class 1 and Class 3) shall consist of hard, durable, clean sand, gravel or crushed stone and shall be free from organic material, clay balls or other deleterious material. The percentage composition by weight of Permeable Materials shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing) for Permeable Materials

Sieve Sizes	Class 1		Class 3
	Type A	Type B	
2"	---	100	---
1½"	---	95-100	100
1"	---	---	90-100
¾"	100	50-100	40-100
½"	95-100	---	---
3/8"	70-100	15-55	0-50
No. 4	0-55	0-25	0-15
No. 8	0-10	0-5	0-5
No. 200	0-3	0-3	---

Both Class 1 and Class 3 Permeable Materials shall have a Durability Index of no less than 40.

14 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed "Marin-Sonoma Narrows Contract B-1, Redwood Landfill Project" as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the Designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge.

Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E., C54619
Senior Engineer

Gary Parikh, P.E., G.E., 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-11
GEOTECHNICAL
STATE OF CALIFORNIA

Reviewed by:

Y. David Wang, Ph.D., P.E., 52911
Senior Project Engineer

James Baker, C.E.G., 1021 exp 10/2011
Engineering Geologist

REFERENCES

1. Blake, Jr., M.C.; Graymer, R.W.; and Jones, D.L.; 2000; Geologic Map and Map Database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California"; U. S. Geological Survey Miscellaneous Field Studies Map MF-2337 (1:75,000 scale)
2. California Department of Transportation, May 2006, Standard Plans.
3. California Department of Transportation, May 2006, Standard Specifications, Sections 1 through 95.
4. California Department of Transportation, Highway Design Manual, September 2006.
5. California Department of Transportation, Caltrans Deterministic PGA Map and ARS Online Report (2009)
6. Rice, S.J.; 1975; Geology for Planning, Novato Area, Marin County, California; California Division of Mines and Geology; Open-File Report 75-1 (Plate 1 - West: Geology Map, western part of the Novato Area; 1:12,000 scale)
7. United States Geological Survey (USGS), 2008, “The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2), by 2007 Working Group of Earthquake Probabilities, USGS Open File Report 2007-1437
8. Wagner, D..; Rice, S.R.; Bezore, S.; Randolph-Loar, C.E.; Allen, J.; and Witter, R.C.; 2002; Geologic Map of to Petaluma River 7.5' Quadrangle, Marin and Sonoma Counties, California: A Digital Database (1:24,000 scale)

AERIAL PHOTOGRAPHS

US Geological Survey Library; 7-3-1965; MRN 66-131, 132, and 133.

US Geological Survey Library; 5-3-1981; SCS – CHH – 1B – 155, 156, and 157.

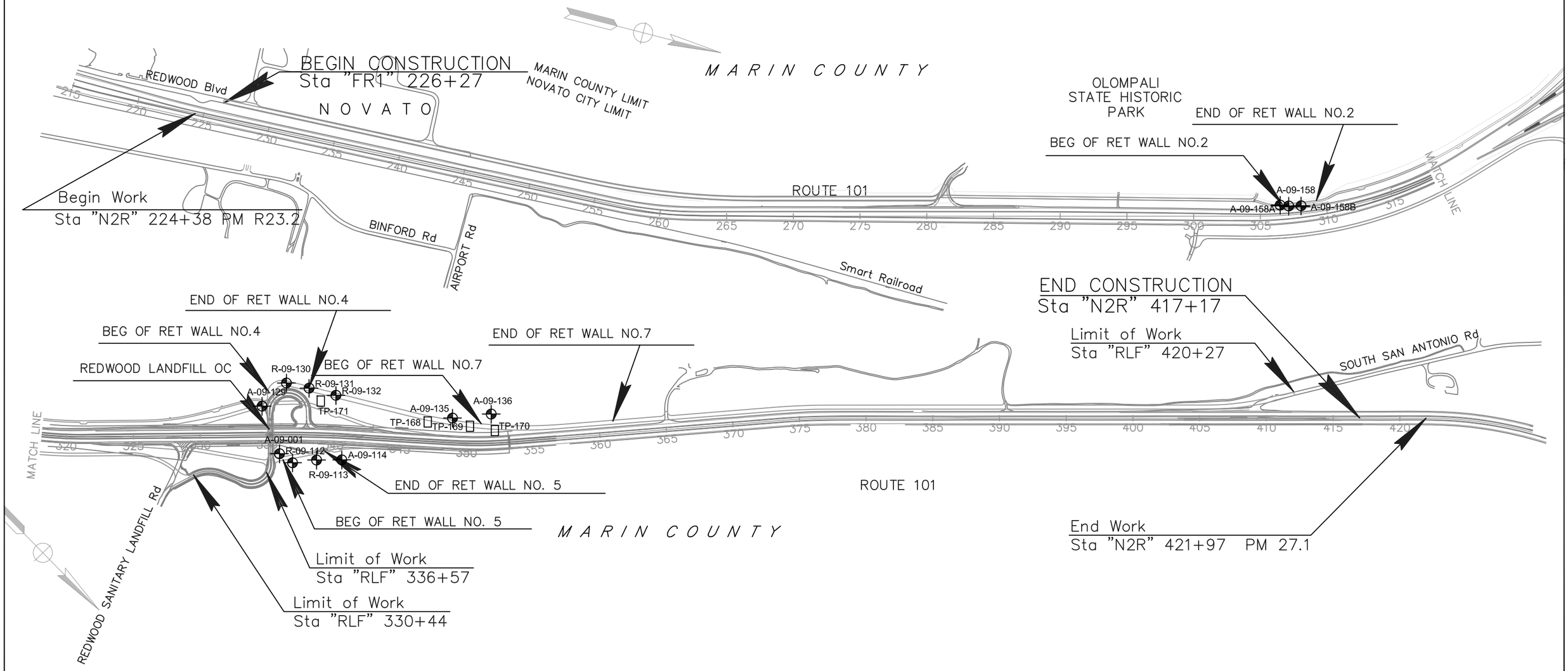
US Geological Survey Library; 9-25-1973; SFB – 2 – 52 thru 55 (color).

PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: 1



LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

TP-171 — Test Pit Location

NOT TO SCALE

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

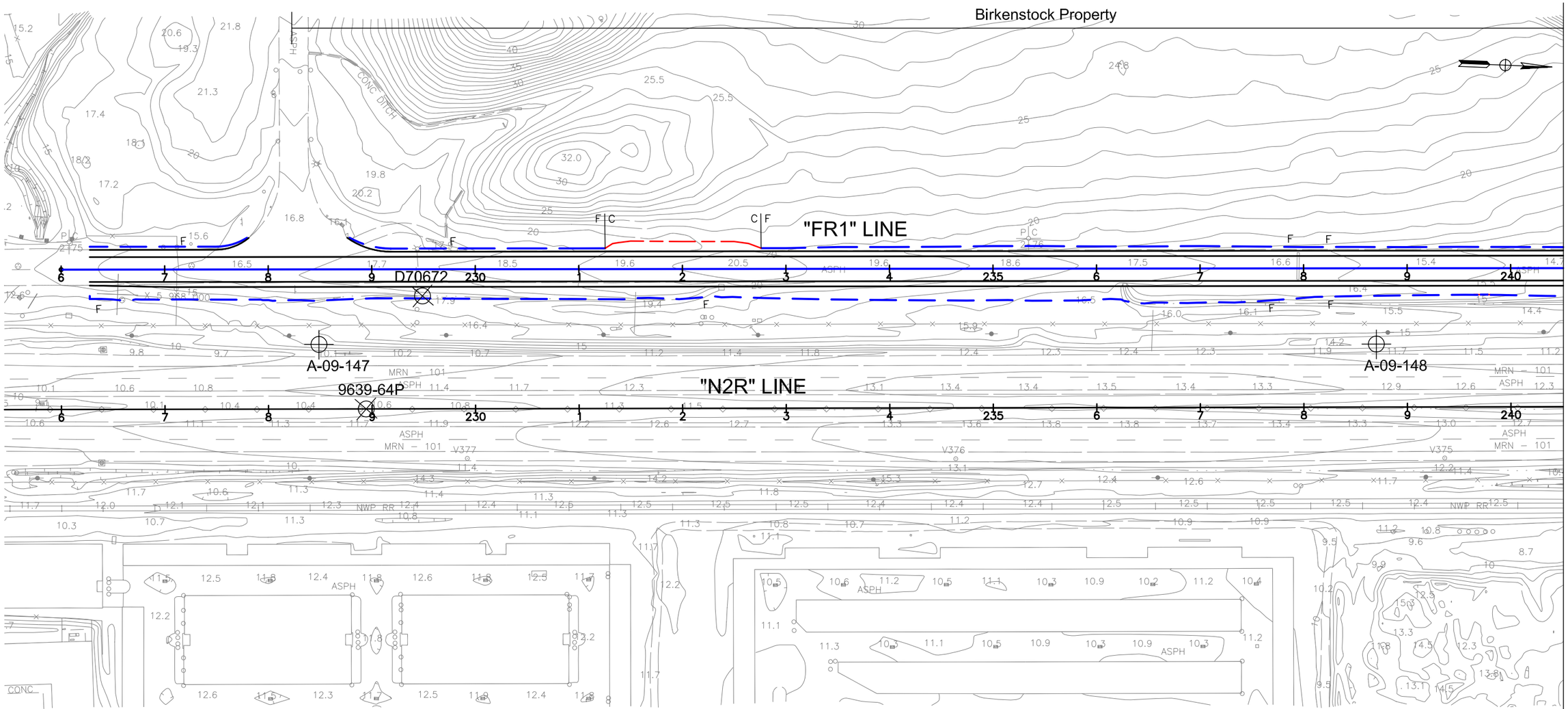
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2

S:\ACAD\208140.GDR\KEY MAP_GDMR-PLATE NO.2.dwg, TITLE SHEET 1, 10/17/2011 12:10:53 PM, Adobe PDF



X 5 968 500

Y 2 242 500

2 243 000

43 500

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

D70672
Approx. R-Value Boring Location (Caltrans Memo 2005)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

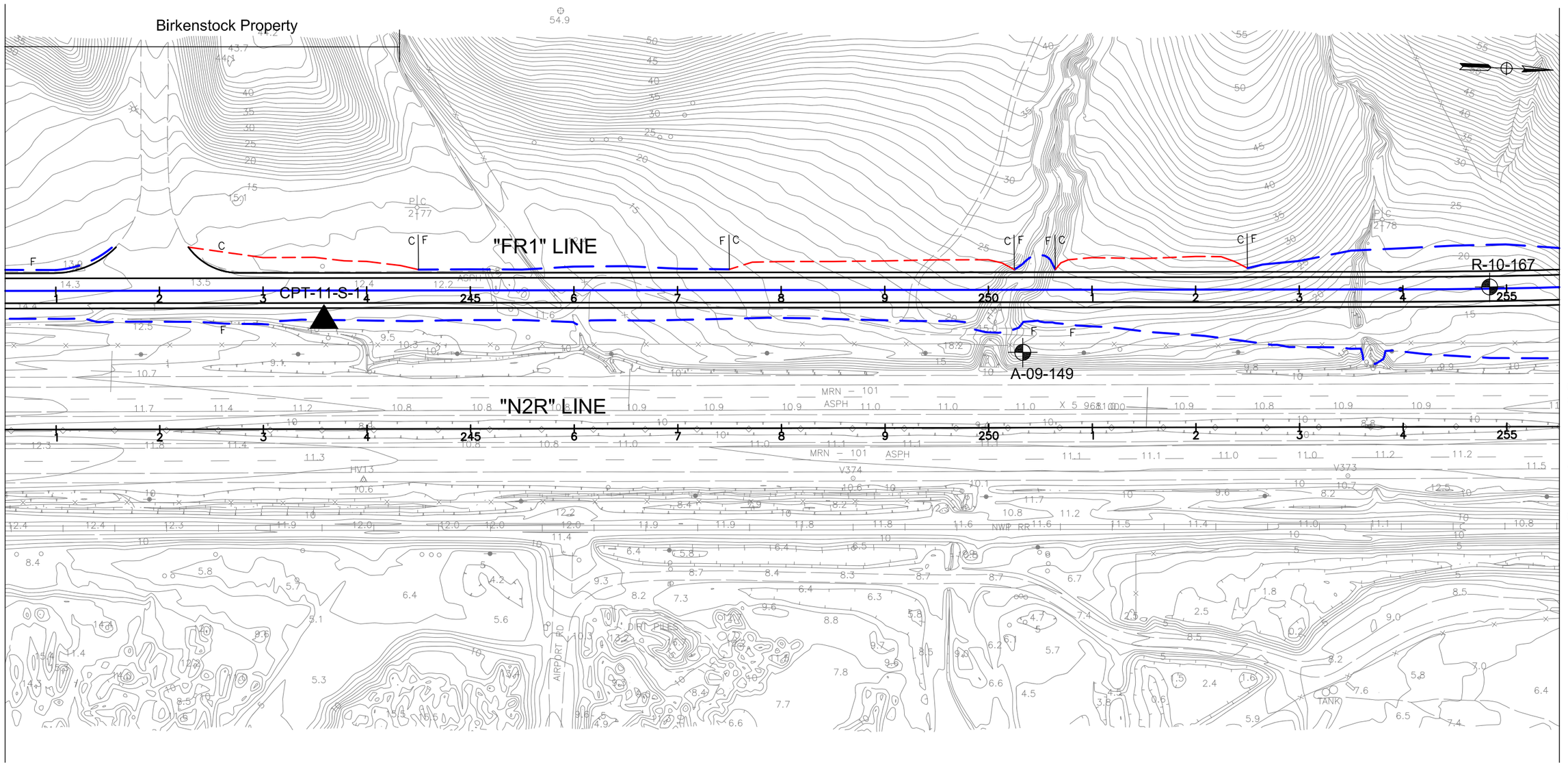
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2A

S:\ACAD\208140.GDR\Site Plan (GDMP).dwg, 2A, 8/17/2011 11:25:16 AM, Acrobat Distiller



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

CPT-11-S1
Approx. CPT Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

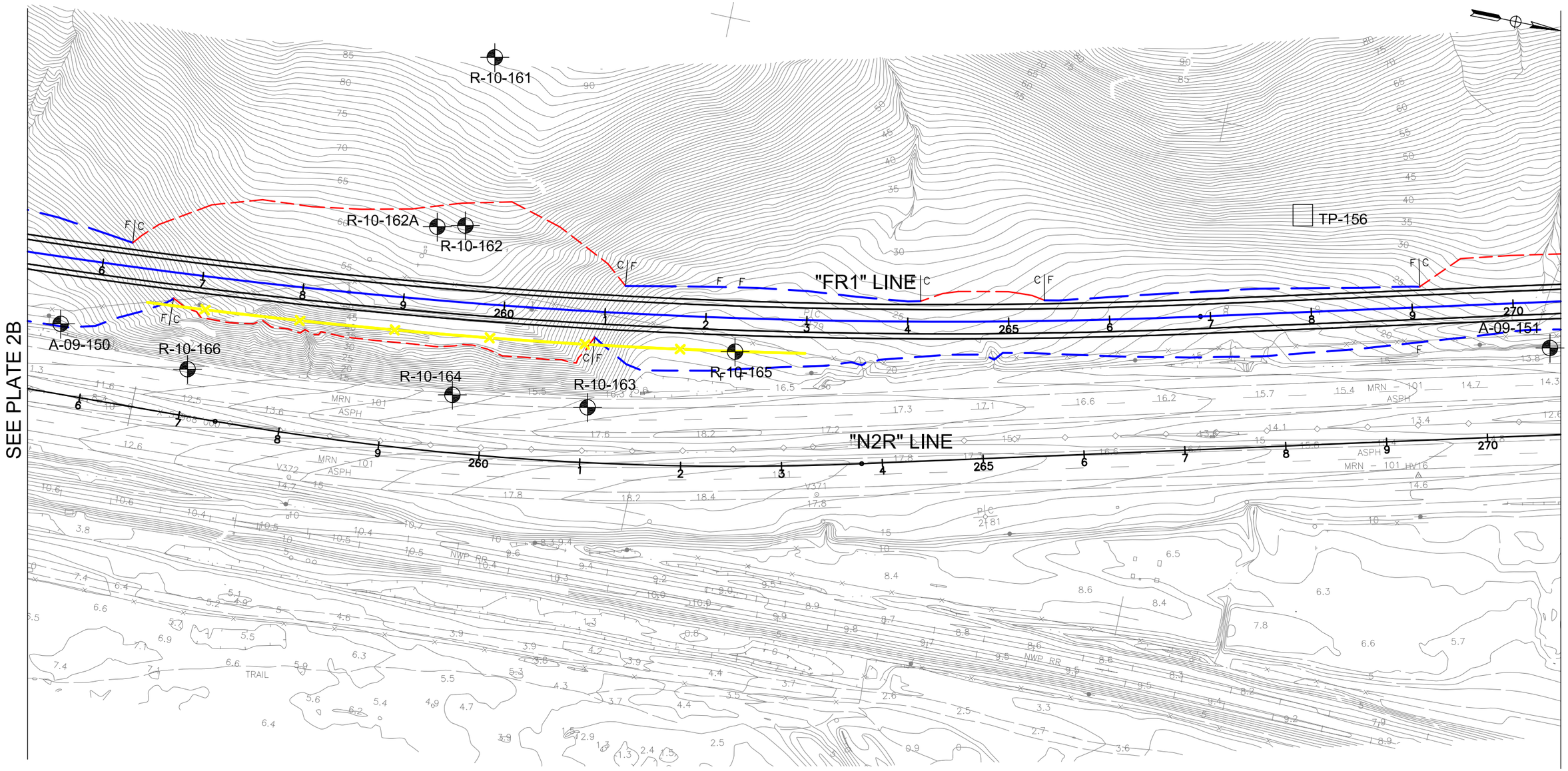
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2B

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2B, 8/17/2011 11:26:32 AM, Acrobat Distiller



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

Test Pit Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

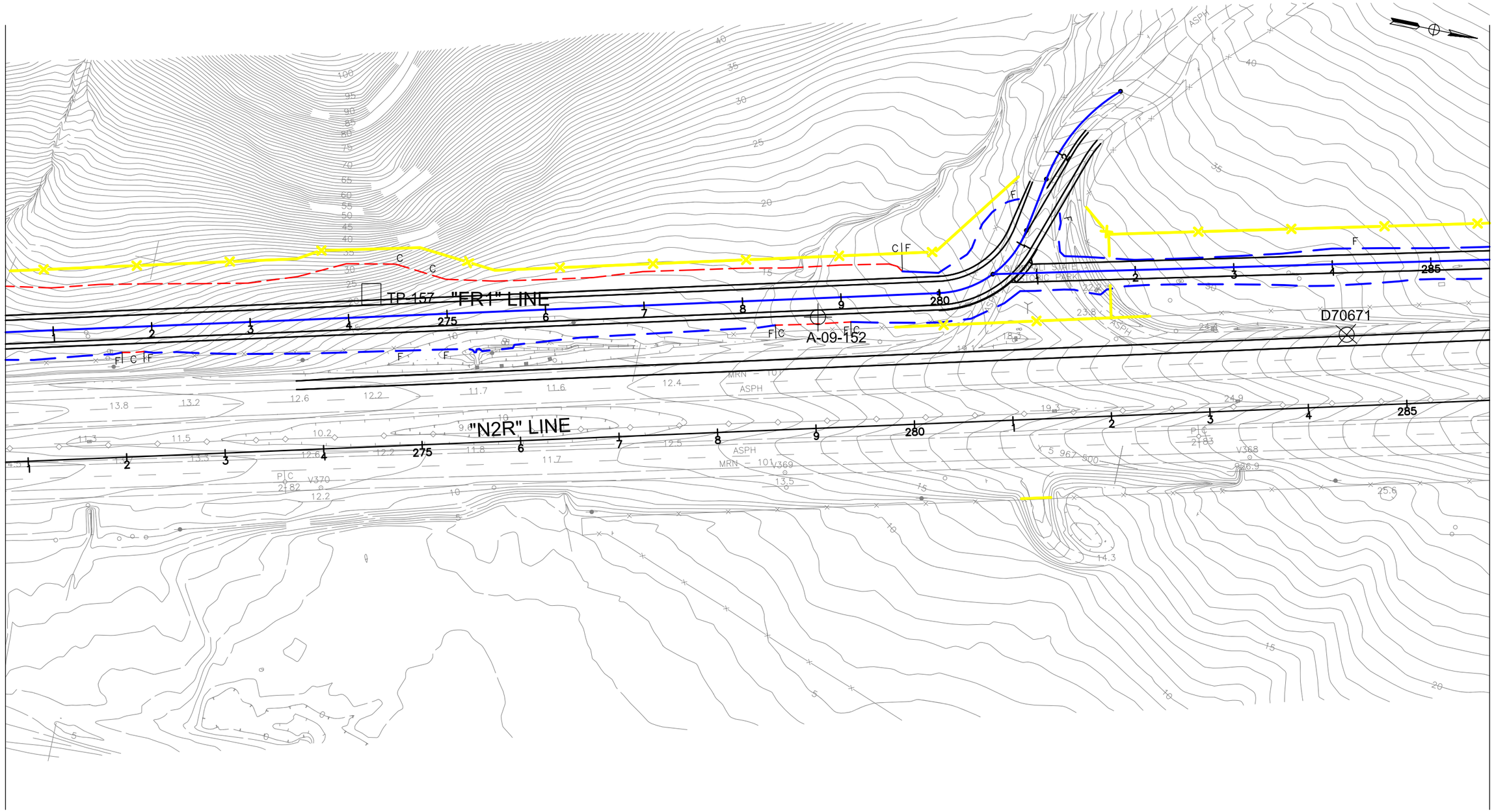
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2C

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2C, 8/17/2011 11:27:03 AM, Acrobat Distiller



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

Test Pit Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2D

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2D, 8/17/2011 11:27:29 AM, Acrobat Distiller

SEE PLATE 2D

SEE PLATE 2F

OLOMPALI CREEK

"BK" LINE

"N2R" LINE

"FR2" LINE

A-09-153

A-09-154

A-09-101

9639-63P

SHADOWS

PIPE

MRN – 101 ASPH

PTC 2184

HV20

V367

V366

X 5 967 500

X 5 968 000

X 5 968 500

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2E

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2E, 8/17/2011 11:28:02 AM, Acrobat Distiller

SEE PLATE 2E

SEE PLATE 2G

Beg. Retaining Wall No. 2

End Retaining Wall No. 2

"BK" LINE

"N2R" LINE

"FR2" LINE

A-09-155

A-11-158A

A-11-158

A-11-158B

A-09-116

A-09-102

A-09-103

SHADOWS

SITE PLAN

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2F

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2F, 8/17/2011 11:28:25 AM, Acrobat Distiller

SEE PLATE 2F

SEE PLATE 2H

"BK" LINE

"RL4" LINE

"N2R" LINE

"FR2" LINE

"RL1" LINE

TP-159

A-09-104

A-09-105

A-09-106

A-09-107

A-09-108

A-09-109

A-09-117

A-09-118

A-09-119

A-09-120

A-09-121

D70670

SHADOWS

TRAIL

CONC. DITCH

ASPH

MRN – 101

PIPE

W.L. 3.4

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

Test Pit Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2G

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2G, 8/17/2011 11:28:48 AM, Acrobat Distiller

SEE PLATE 2G

SEE PLATE 2I

R-09-130

End Retaining Wall No. 4

R-09-131

Beg. Retaining Wall No. 4

TP-160

"BK" LINE

"RL4" LINE

A-09-129

B-B

TP-B

TP-171

A-09-132

"RLF" LINE

A-09-133

TP-172

A-09-134

A-09-122

TP-J

TP-A

A-09-125

TP-C

TP-D

B-C

"RL3" LINE

A-09-126

A-09-127

A-09-123

B-A

"N2R" LINE

A-09-124

A-09-128

9639-70P

TP-I

TP-H

Beg. Retaining Wall No. 5

B-D

A-09-114

A-09-115

A-09-110

"RL1" LINE

A-09-111

A-09-061c

"RL2" LINE

End Retaining Wall No. 5

R-09-113

R-09-112

Verizon Area

"RL2" LINE 337+00

LEGEND

A-09-149
Approx. Boring Location (Parikh 2010)

B-B
Approx. Boring Location (Miller Pacific Engineering Group 2002)

A-09-147
Approx. R-Value Boring Location (Parikh 2010)

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

Test Pit Location (Parikh 2010)

Test Pit Location (Miller Pacific Engineering Group-2002)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2H

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2H, 8/17/2011 11:29:11 AM, Acrobat Distiller

SEE PLATE 2H

SEE PLATE 2J

A-09-135

A-09-136

A-09-137

A-09-138

A-09-139

TP-168

TP-169

TP-170

Beg. Retaining Wall No. 7

End Retaining Wall No. 7

CPT-11-S-2

CPT-11-S-2

"RLF" LINE

"N2R" LINE

55861

LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

Test Pit Location

9639-70P — Approx. R-Value Boring Location (Caltrans Memo 2005)

CPT-11-S2 — Approx. CPT Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2I

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2I, 8/17/2011 11:29:34 AM, Acrobat Distiller

SEE PLATE 2I

SEE PLATE 2K

A-09-140

CPT-11-S-3

A-09-141

"RLF" LINE

"N2R" LINE

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

Test Pit Location

CPT-11- S-3
Approx. CPT Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2J

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 21. 8/17/2011 11:29:55 AM, Acrobat Distiller

SEE PLATE 2J

SEE PLATE 2L

DEER CREEK

A-09-142

CPT-11-S-4

A-09-143

"RLF" LINE

"N2R" LINE

D70669

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

CPT-11-S-4
Approx. CPT Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

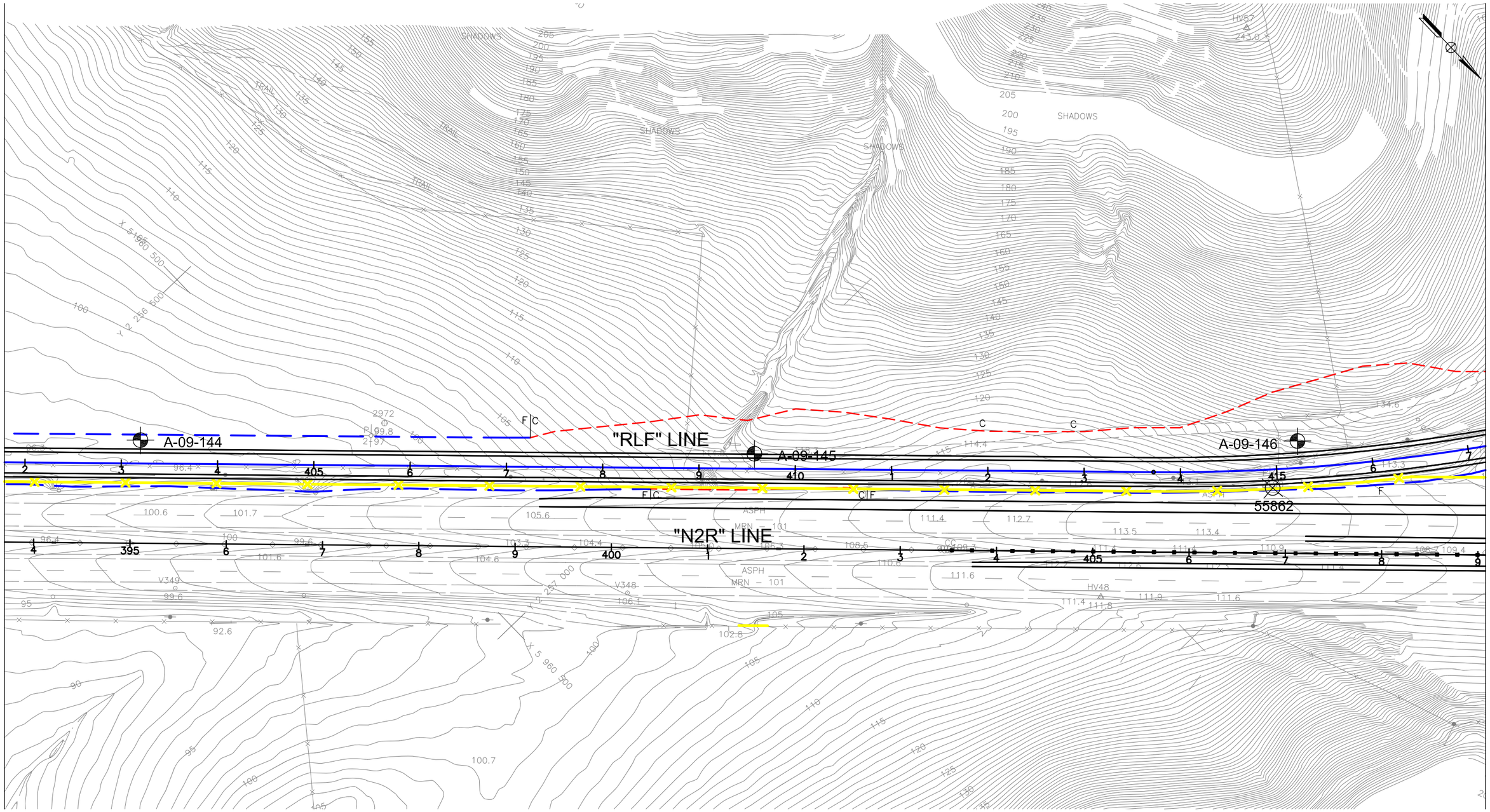
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2K

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2K, 8/17/2011 11:30:15 AM, Acrobat Distiller

SEE PLATE 2K



SEE PLATE 2M

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2L

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2L, 8/17/2011 11:30:37 AM, Acrobat Distiller

SEE PLATE 2L

"RLF" LINE

"N2R" LINE

SITE PLAN

LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

SCALE 1 inch = 100 feet

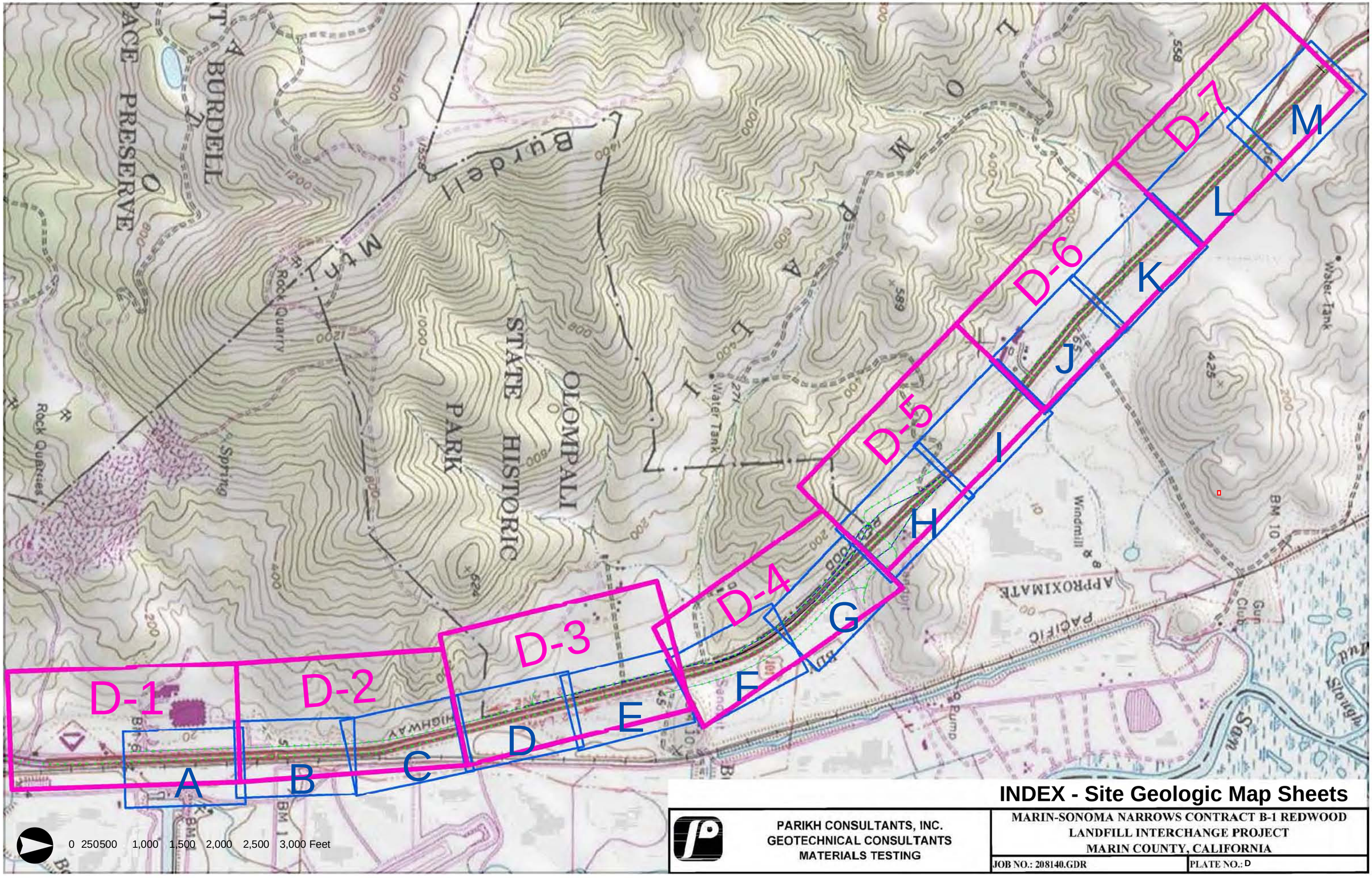
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.:208140.GDR | PLATE NO: 2M

S:\ACAD\208140.GDR\Site Plan (GDMR).dwg, 2N, 8/17/2011 11:30:57 AM, Acrobat Distiller

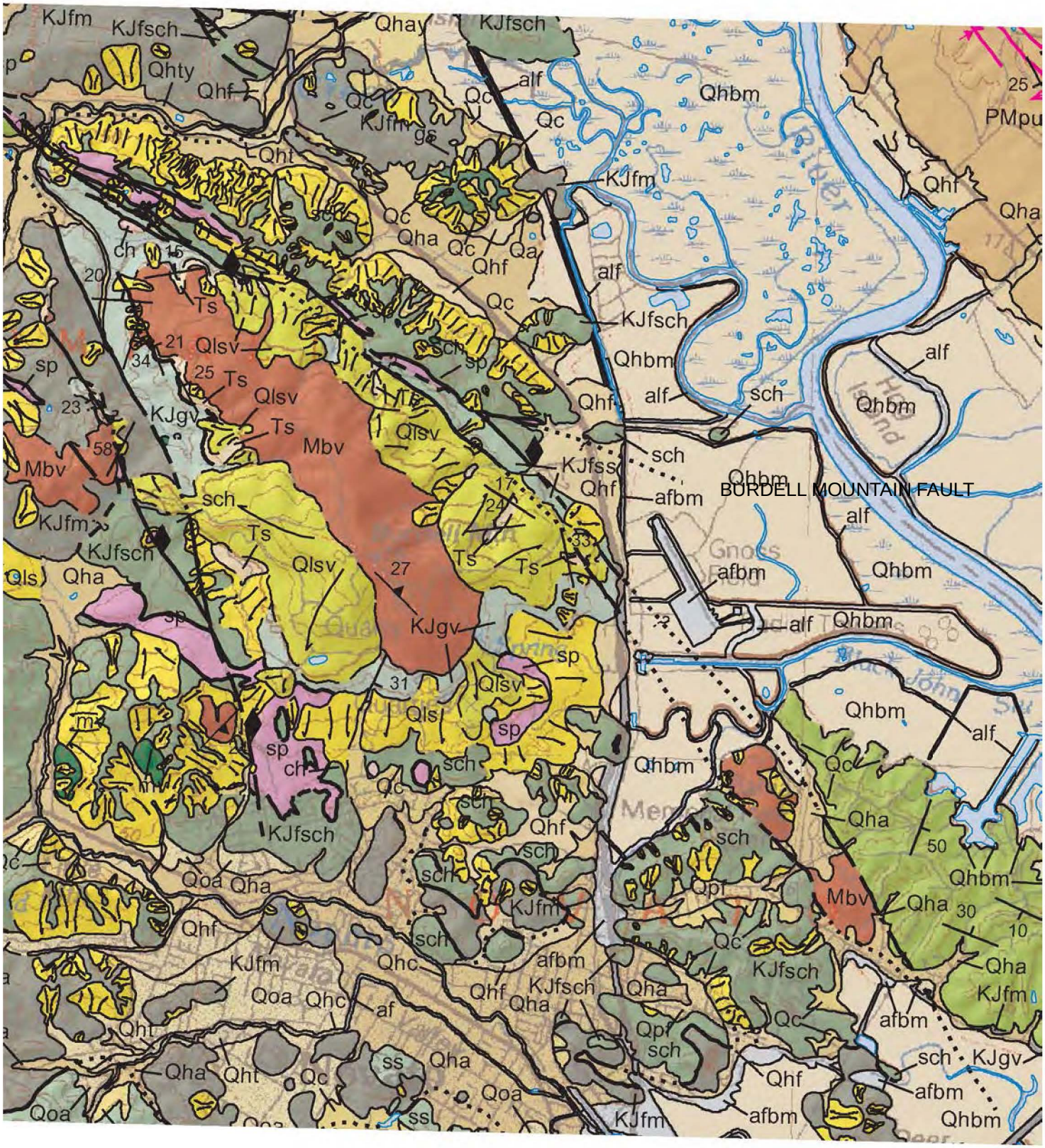


INDEX - Site Geologic Map Sheets

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D



SOURCE: Wagner, et al; 2010

See Plate 3B for Explanation

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.GDR	PLATE NO.: 3A

EXPLANATION

CENOZOIC — QUATERNARY — Holocene

- af — Artificial fill
- afbm — Artificial fill placed over bay mud
- adf — Artificial dam fill
- alf — Artificial levee fill
- ac — Artificial stream channel
- Qhay — Latest Holocene alluvial deposits
- Qhty — Latest Holocene stream terrace deposits
- Qhly — Latest Holocene alluvial fan levee deposits
- Qhfy — Latest Holocene alluvial fan deposits
- Qhc — Latest Holocene stream channel deposits
- Qhbm — Holocene estuarine deposits (bay mud)
- Qht — Holocene stream terrace deposits
- Qhl — Holocene alluvial fan levee deposits
- Qhb — Holocene basin deposits
- Qhed — Holocene estuarine deposits
- Qha — Holocene alluvium
- Qbmt — Bay mud and marine terrace deposits
- Qhbs — Holocene beach sand
- Qhf — Holocene alluvial fan deposits
- Qhds — Holocene dune sand

Pleistocene

- Qa — Alluvium (undivided)
- Qm — Bay mud
- Qds — Dune sand
- Qf — Alluvial fan deposits
- Qfc — Fan of Carriger Creek
- Qtv — Travertine
- Qpa — Pleistocene alluvium (undivided)
- Qt — Stream terrace deposits
- Qc — Colluvium
- Qpf — Pleistocene alluvial fan deposits
- Qls — Landslide deposit
- Qg — Fluvial gravel
- Qoc — Olema Creek Formation
- Qml — Millerton Formation
- Qtm — Marine terrace deposits
- Qof — Alluvial fan deposits (old)
- Qlsv — Landslide deposit (volcanic)
- Qoa — Alluvial deposits (old)
- Qot — Stream terrace deposits (old)
- Qop — Fan or terracel deposits (old)
- Qofv — Alluvial fan deposits (old, volcanic)
- Qols — Landslide deposit (old)
- Qobs — Beach sand (old)
- QPu — Gravel, sand, reworked tuff and clay
- QPge — Glen Ellen Formation

TERTIARY — Pliocene

- Pth — Tehama Formation
- Tgd — Sandstone, gravel and diatomite
- Tsu — Unnamed sediments
- Tss — Sandstone and volcanic gravel
- Ph — Huichica Formation
- Tdi — Diatomite
- Tvb — Unnamed basalt
- PMps — Purisima Formation

Petaluma Formation (PMp, PMpu, Mpm, Mpl, Mpbr)

- PMp - Undivided Petaluma Fm.
- PMpu - Upper Petaluma Fm.
- Mpm - Middle Petaluma Fm.
- Mpl - Lower Petaluma Fm.
- Mpbr - Silicic breccia

Miocene

- Mwg — Wilson Grove Formation
- Mco — Sand and gravel of Cotati
- Mor — Orinda Formation
- Msc — Santa Cruz Mudstone
- Msm — Santa Margarita Sandstone
- Mbr — Briones sandstone (undivided)
- Tms — Marine sandstone and mudstone
- Mr — Rodeo Shale
- Mh — Hambre Sandstone
- Mti — Tice Shale
- Ml — Laird Sandstone
- Ms — Sobrante Sandstone
- Msr — San Ramon Sandstone
- Mbv — Burdell Mountain volcanics
- Ts — Unnamed tuffaceous sediment
- Mpb — Putnam Peak Basalt

Tolay Volcanics (Mtvm, Mtvt, Mtvr)

- Mtvm - Mafic volcanics
- Mtvt - Tuff
- Mtvr - Rhyolite to dacite flows and tuff

San Pablo Group (Msp, Mnr, Mc)

- Msp - Undivided
- Mnr - Neroly Formation
- Mc - Cierbo Sandstone

Monterey Group (Mmy, Mmyd, Mmys)

- Mmy - Undivided
- Mmyd - Diatomite
- Mmys - Sandstone and Tuffaceous sandstone

Sonoma Volcanics

- Tsv - Sonoma Volcanics undivided
- Tsvm - Mafic flows and breccia
  - Psvasl - Andesite lava flows of Stags Leap
  - Psvbsl - Andesite flow breccia of Stags Leap
  - Psvatsl - Andesite ash flow tuff and tuff breccia of Stags Leap
  - Pgisl - Stags Leap Stock
  - Psvtt - Andesitic tuff and tuffaceous agglomerate of Tulucay Creek
  - Psvbt - Basalt of Tulucay Creek
  - Psvmb - Mafic flows of Bennett Mountain
  - Tsva - Andesite lava flows
  - Tsvg - Fluvial gravel, sand and silt
  - Psvb - Basalt flows
  - Psvbp - Basalt of Bouverie Preserve
  - PMsvb - Basalt
  - Msvbb - Basalt of Bismarck Knob
  - Tsvdt - Andesitic to dacitic ash flow tuff
  - Tsvh - Hyaloclastite
  - Tsvib - Basalt plugs and dikes
  - Tsvms - Mafic lava flows and intrusions of Sugarloaf Ridge
  - Msvam - Andesite of Mission Highlands
  - Msvas - Andesite of Shocken Hill
- Tsvt- Sonoma Volcanics, tuff and sediments
  - Ppt - Putah Tuff
  - Psvrt - Rhyolite ash flow tuff
  - Ptn - Tuff of Napa
  - Psvtr - Tuff of Rockville
  - Plt - Lawlor Tuff
  - Psvpf - Ash flow tuff and welded ash flow tuff
  - Msvtl - Tuff of Lovall Valley
  - Msvtp - Tuff of Mt. Pisgah
  - Tsvwt - Welded ash flow tuff
  - Tsvmt - Ash flow tuff of Milliken Dam
  - Tsvat - White pumiceous tuff of Atlas Peak
  - Tsvdt - Air fall tuff
  - Psvty - White pumiceous tuff
  - Tsvtb - Tuff breccia
  - Mpt - Pinole Tuff
  - Mrt - Roblar tuff
  - Mt - Tuff interbedded with the Wilson Grove Fm.
  - Tt - Tuff
  - Tsvft - Tuff and flows
- Tsvr- Sonoma Volcanics, rhyolite flows, tuff and intrusive rocks
  - Psvdg - Dacite of Mt. George
  - Psvdgp - Pumice breccia
  - Psvdgi - Gray porphyritic intrusions
  - Psvbn - Breccia of Napa
  - Tsvri - Intrusive rhyolite plugs and breccia
  - Psvrb - Rhyolite of Bennett Mountain
  - Psvrs - Soda rhyolite of Sugarloaf Ridge
  - Msvra - Rhyolite of Adobe Canyon
  - Msvfh - Dacitic lava flows of Huichica Creek
  - Msvrb - Rhyolite of Bismarck Knob
  - Msvr - Rhyodacite to dacite flows

Paleocene, Eocene

- Ees — Escobar Sandstone of Weaver
- Emk — Markley Sandstone
- Emkj — Markley Sandstone Jameson Shale Member
- Emr — Muir Sandstone of Weaver (1949)
- Ed — Domengine Sandstone
- Eeu — Unnamed mudstone, sandstone and siltstone
- Esh — Shale
- Ec — Capay Shale
- Epr — Point Reyes Conglomerate of Galloway (1977)
- Rlj — Las Juntas Shale of Weaver
- Ru — Unnamed sandstone, shale $us - Basal sandstone member
- Rvh — Vine Hill Sandstone of Weaver (1949)
- Rmz — Martinez Formation
- TKfs — Coastal Belt Franciscan

Nortonville Shale (Env, Envu, Envm, Envl)

- Env - Gray-weathering, brown shale
- Envu - Upper member
- Envm - Middle member
- Envl - Lower member

MESOZOIC — CRETACEOUS

- Kgd — Tonalite of Tomales Point
- Kgg — Porphyritic granodiorite of Point Reyes
- Kgr — Granodiorite and granite of Inverness Ridge

Franciscan Complex (KJfss, KJfsch, KJgs, KJfm)

- KJfss - Sandstone and shale
- KJfsch - Schist and semischist
- KJgs - Greenstone
- KJfm - Melange

Blocks within the Franciscan Melange (ss, ch, gs, mg, mv, sch, sp, sc)

- ss - Sandstone and shale
- ch - Chert and metachert
- gs - Greenstone and metagreenstone
- mg - Metagraywacke and graywacke
- mv - Metavolcanic rocks
- sch - Schist and semischist
- sp - Serpentinized ultramafic rocks
- sc - Silica carbonate rocks
- ◆ - Blueschist blocks

Great Valley Sequence

- Kgv — Cretaceous Great Valley Sequence (undivided)
- Ku — Upper Great Valley Sequence; Kus - Massive sandstone
- Kush — Unnamed sandstone and shale
- Kfo — Forbes Formation
- Kg — Guinda Formation
- Kf — Funks Formation
- Ks — Sites Formation
- Ky — Yolo Formation
- Kv — Venado Sandstone
- Kn — Novato Conglomerate
- Kl — Lower Great Valley Sequence
- KJgv — Great Valley Sequence (undivided)
- KJss — Ridge-forming sandstone
- KJgvm — Melange in the lower Great Valley Sequence
- KJssp — Detrital serpentine
- Greenstone blocks

Coast Range Ophiolite

- Jv — Volcanic rocks
- Jgb — Gabbro
- sp — Ultramafic rocks
- Jk — Knoxville Formation

JURASSIC / PALEOZOIC

- PzMz — Metamorphic rocks of uncertain age

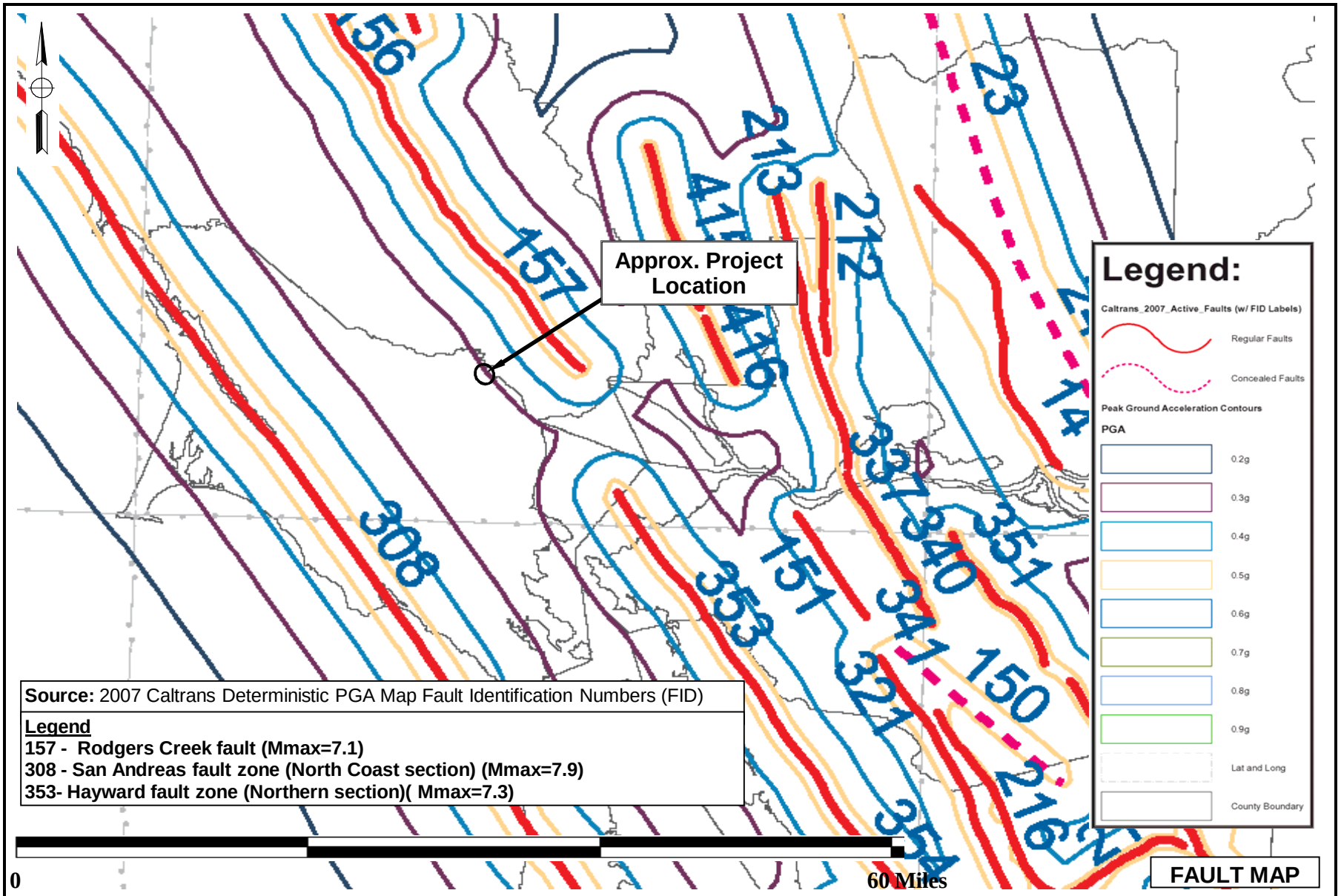
MAP SYMBOLS

- Contact between map units - Solid where accurately located, dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain.
- Fault - Solid where accurately located, dashed where approximately located; short dash where inferred, dotted where concealed, queried where uncertain. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.
- Thrust Fault- Solid where accurately located; dashed where approximately located; short dash where inferred; dotted where concealed, queried where uncertain. Barb located on upthrown block.
- Detachment fault - Solid where accurately located, dashed where approximately located; dotted where concealed, hachures on upper plate.
- Zone of intense shearing along the Tolay Fault Zone
- Anticline - Solid where accurately located, dashed where approximately located, dotted where concealed.
- Overturned Anticline - Solid where accurately located, dashed where approximately located.
- Syncline - Solid where accurately located, dashed where approximately located; dotted where concealed.
- Overturned Syncline - Solid where accurately located, dashed where approximately located; dotted where concealed.
- Strike and dip of sedimentary beds:
  - Inclined bedding
  - Inclined bedding - Top direction of beds known from local features.
  - Vertical bedding
  - Horizontal bedding
  - Overturned bedding
  - Inclined bedding - Showing approximate strike and direction of dip.
- Strike and dip of foliation
- Strike and dip of volcanic flow unit
- Landslide - arrow indicates principal direction of movement, queried where existence is questionable (some geologic features are drawn within questionable landslides); hachured where headscarp is mappable.

SOURCE: Wagner, et al; 2010

EXPLANATION FOR AREA GEOLOGIC MAP

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.GDR	PLATE NO.: 3B



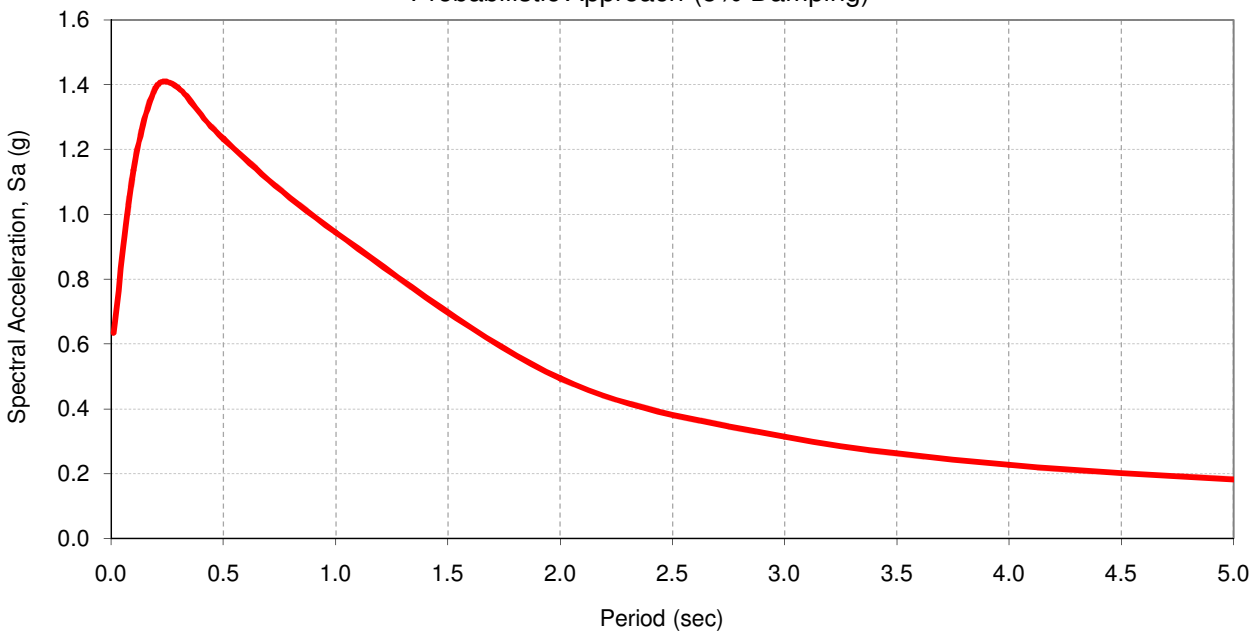
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | **PLATE NO.: 4A**

RECOMMENDED ARS CURVE

Probabilistic Approach (5% Damping)



Site Information

Latitude:	38.1631
Longitude	-122.5752
V_{S30} (m/s) =	400
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	5.9

Governing Curve:

Caltrans ARS Online Probablistic Curve

Recommended Response Spectrum

Period (sec)	Caltrans Online Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.634	1.000	1.000	0.634
0.1	1.135	1.000	1.000	1.135
0.2	1.391	1.000	1.000	1.391
0.3	1.39	1.000	1.000	1.390
0.5	1.233	1.000	1.000	1.233
1.0	0.787	1.200	1.000	0.944
2.0	0.411	1.200	1.000	0.493
3.0	0.262	1.200	1.000	0.314
4.0	0.188	1.200	1.000	0.226
5.0	0.151	1.200	1.000	0.181

Source:

1. Caltrans ARS Online tool (V.1.0.4, http://dap3.dot.ca.gov/shake_stable/)
2. USGS Deaggregation 2008 beta (http://eqint.cr.usgs.gov/deaggint/2008/index.php)
3. Caltrans Geotechnical Services Design Manual (Version 1.0)

Note:

Refer to "Probablistic Response Spectum Spreadsheet" (attached) for development of the recommended ARS curve.

Legend

Liquefaction Susceptibility (2006)

- Very High
- High
- Moderate
- Low
- Very Low
- Water
- not mapped

SOURCE: Witter, et al; 2006

0 250500 1,000 1,500 2,000 2,500 3,000 Feet

Liquefaction Susceptibility Map

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA
	JOB NO.: 208140.GDR — PLATE NO.: 5

PARIKH
Practicing in the Geosciences

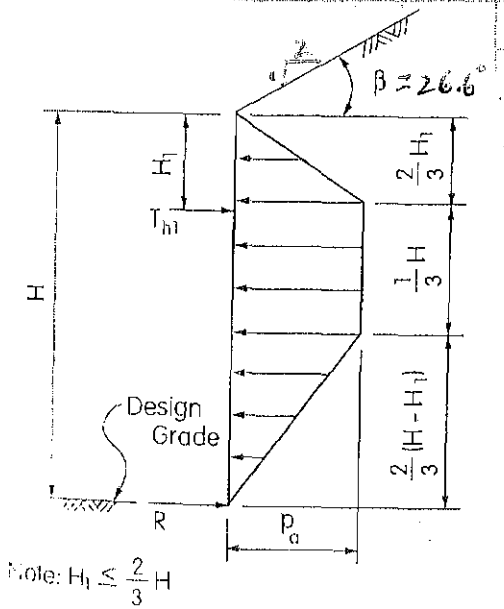
JOB 208140.10
SHEET NO
CALCULATED BY R. Sircar DATE 2/10
CHECKED BY [illegible] DATE 2/10
SCALE

MSW - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4 & 5

(Tieback in Block-Rich Bimrock)

Lateral Earth Pressures



Note: $H_1 \leq \frac{2}{3}H$

a) Wall with a single level of anchors

$P_a = 54H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum)

Ultimate Bond Strength = 80 psi (Allowable = 40 psi (FS = 2))

Coefficient of Passive Pressure (K_p) = 9.0

Unit Weight = 135 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 × eff. width of soldier pile)

Allowable Unit Skin Friction (for Soldier Piles) = 2.0 ksf

PARIKH
Practicing in the Geosciences

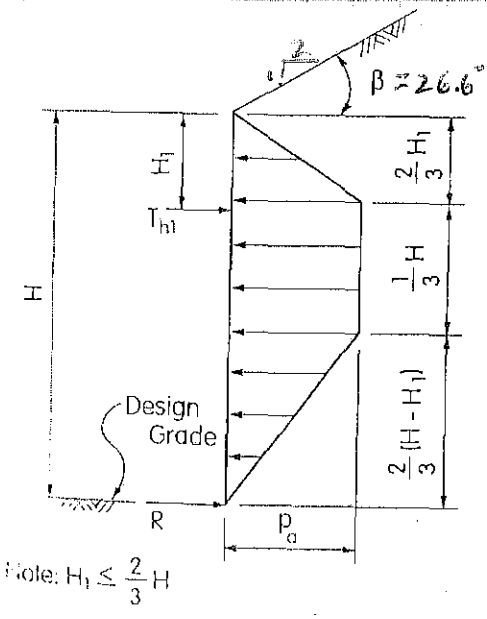
JOB 208140.10
SHEET NO ____ OF ____
CALCULATED BY P. Sircar DATE 2/11
CHECKED BY YRW DATE ____
SCALE ____

MSW - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4

(Tieback in Debris Flow (Block-Poor Bimrock)

Lateral Earth Pressures



Note: $H_1 \leq \frac{2}{3} H$

a) Wall with a single level of anchors

$P_a = 80\ H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum)

Ultimate Bond Strength = 40 psi (Allowable 20 psi (FS=2))

Coefficient of Passive Pressure (K_p) = 3.5

Unit Weight = 130 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 x eff. width of soldier pile)

Allowable Unit Skin Friction (for Soldier Piles) = 1.0 Ksf

APPENDIX A

APPENDIX A

INDEX

Plates A-1 thru A-3 - Legends and Notes for Log of Test Borings (LOTB) Sheets

Boring/Test Pit CPT Nos.

Western Side of Rte 101

Plate A-4	CPT-11-S1, A-09-149, R-10-167 and A-09-150
Plate A-5	A-10-166, A-10-164, A-10-163 and R-10-165
Plate A-6	R-10-162A, R-10-162 and R-10-161
Plate A-7	A-09-151
Plate A-8	A-11-158A, A-11-158 and A-11-158B (Retaining Wall No. 2)
Plate A-9	A-09-120, A-09-122
Plate A-10	A-09-129, R-09-130, R-09-131 and R-09-132 (Retaining Wall No. 4)
Plate A-11	A-09-125, A-09-126 and A-09-133
Plate A-12	A-09-127, A-09-134, A-09-135 and A-09-136 (Retaining Wall No. 7)
Plate A-13	A-09-137, A-09-138, A-09-139 and A-09-143
Plate A-14	A-09-144, A-09-145 and A-09-146
Plate A-15	CPT-11-S2, CPT-11-S3 and CPT-11-S4

Eastern Side of Rte 101

Plate A-16	A-09-101 and A-09-102
Plate A-17	A-09-117 and A-09-104
Plate A-18	A-09-105, A-09-108 and A-09-106

Plate A-19	A-09-109, A09-110 and A-09-111
Plate A-20	A-09-001, R-09-112, R-09-113 and A-09-114 (Retaining Wall No. 5)
Plate A-21	As-Built LOTB for Redwood Landfill Overcrossing (from Miller Pacific, Inc.)
Plate A-22	As-Built LOTB for Redwood Landfill Retaining Wall (from Miller Pacific, Inc.)
Plate A-23	Table of Shallow Borings for Pavement Design

Test Pit Logs

Plate A-24	TP – 156
Plate A-25	TP - 157
Plate A-26	TP - 159
Plate A-27	TP - 160
Plate A-28	TP - 168
Plate A-29	TP - 169
Plate A-30	TP - 170
Plate A-31	TP - 171
Plate A-32	TP - 172

CPT Logs

Plate A-33	CPT-11-S1
Plate A-34	CPT-11-S2
Plate A-35	CPT-11-S3
Plate A-36	CPT-11-S4

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

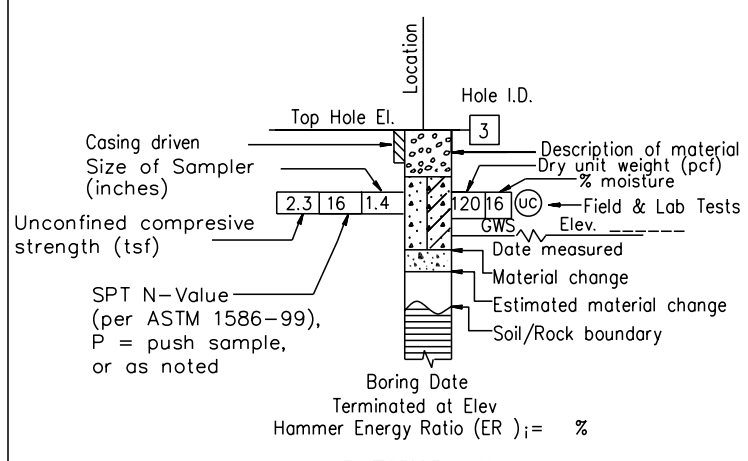
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring (hollow or solid stem bucket)
Size	R RW RC P	Rotary drilled boring (conventional) Rotary drilled with self-casing wire-line Rotary core with continuously-sampled, self-casing wire-line Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
	D	Dynamic Cone Penetration Boring
	CPT	Cone Penetration Test (ASTM D 5778)
	O	Other (note on LOTB)

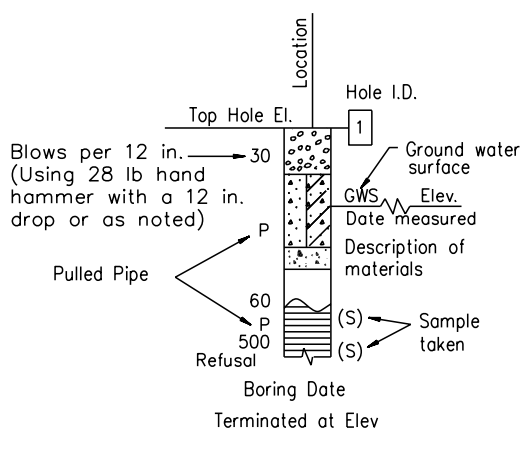
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

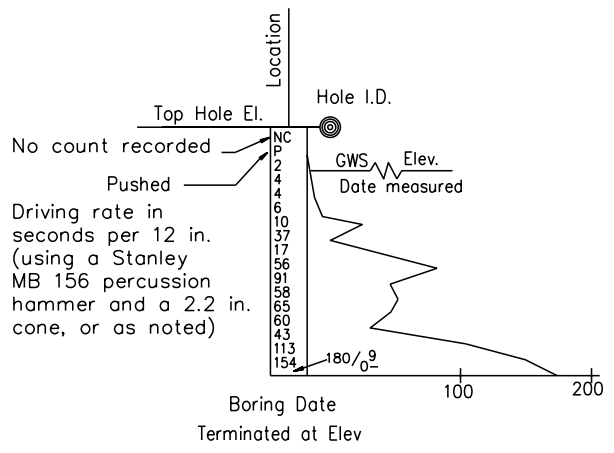
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 – 0.25	0.25 – 0.5	0.12 – 0.25	0.12 – 0.25
Medium Stiff	0.25 – 0.5	0.5 – 1	0.25 – 0.5	0.25 – 0.5
Stiff	0.5 – 1	1 – 2	0.5 – 1	0.5 – 1
Very Stiff	1 – 2	2 – 4	1 – 2	1 – 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



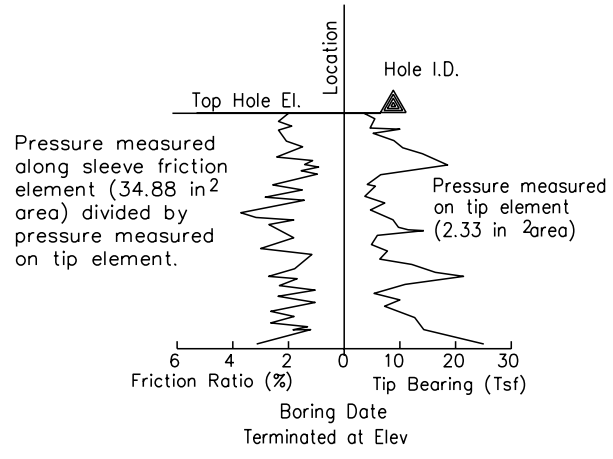
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY– FEBRUARY 2009		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-1

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 8/19/11

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT — SIGN OFF DATE

DRAWN BY: O. GOUTHIER — CHECKED BY: P. SIRCAR

S. DUDDU — FIELD INVESTIGATION BY:

DATE: JANUARY– FEBRUARY 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR — PROJECT ENGINEER

BRIDGE NO. — POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-2

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 8/19/11

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

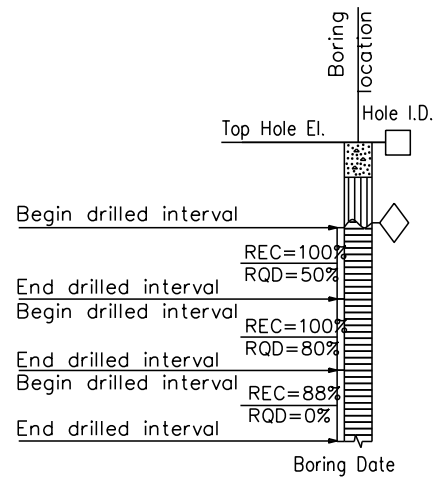
TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

PERCENT CORE RECOVERY (REC) + ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4"}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 – 30,000
Strong	7,000 – 14,500
Medium Strong	3,500 – 7,000
Weak	700 – 3,500
Very Weak	150 – 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3–5/8" to 1 ft
Thinly bedded	1–1/4" to 3–5/8"
Very thinly bedded	3/8" to 1–1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features: Chemical Weathering–Discoloration and/or oxidation: Body of Rock	Diagnostic features: Chemical Weathering–Discoloration and/or oxidation: Fracture Surfaces	Diagnostic features: Mechanical Weathering–Grain boundary conditions (disaggregation) primarily for granitics and some coarse–grained sediments	Diagnostic features: Texture and Solutioning: Texture	Diagnostic features: Texture and Solutioning: Solutioning	General Characteristics
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe–Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe–Mg minerals are altered to clay to some extent; or chemical alteration produces in–situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe–Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY: O. GOUTHIER

CHECKED BY: P. SIRCAR

S. DUDDU
FIELD INVESTIGATION BY:

DATE: JANUARY– FEBRUARY 2009

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO.

POST MILES

MARIN– SONOMA NARROWS CONTRACT B–1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04–2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-3

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

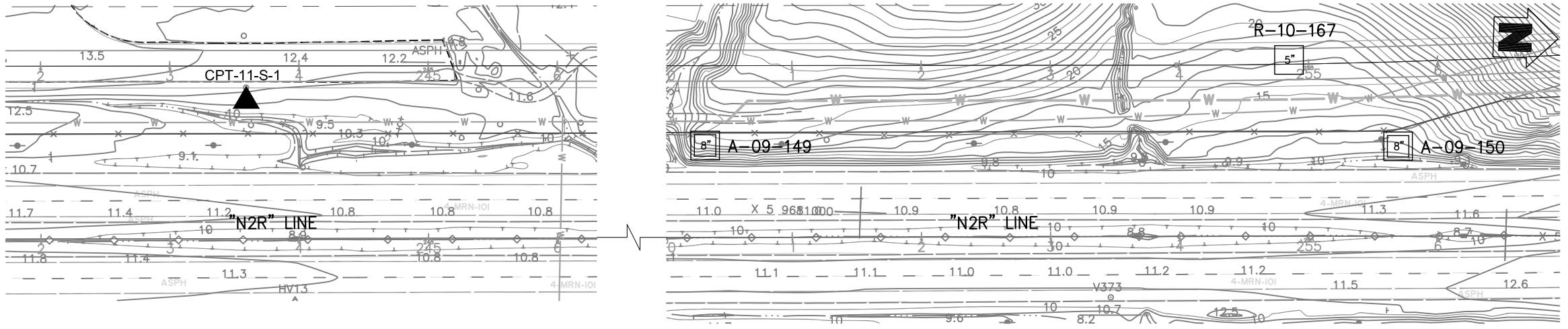
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

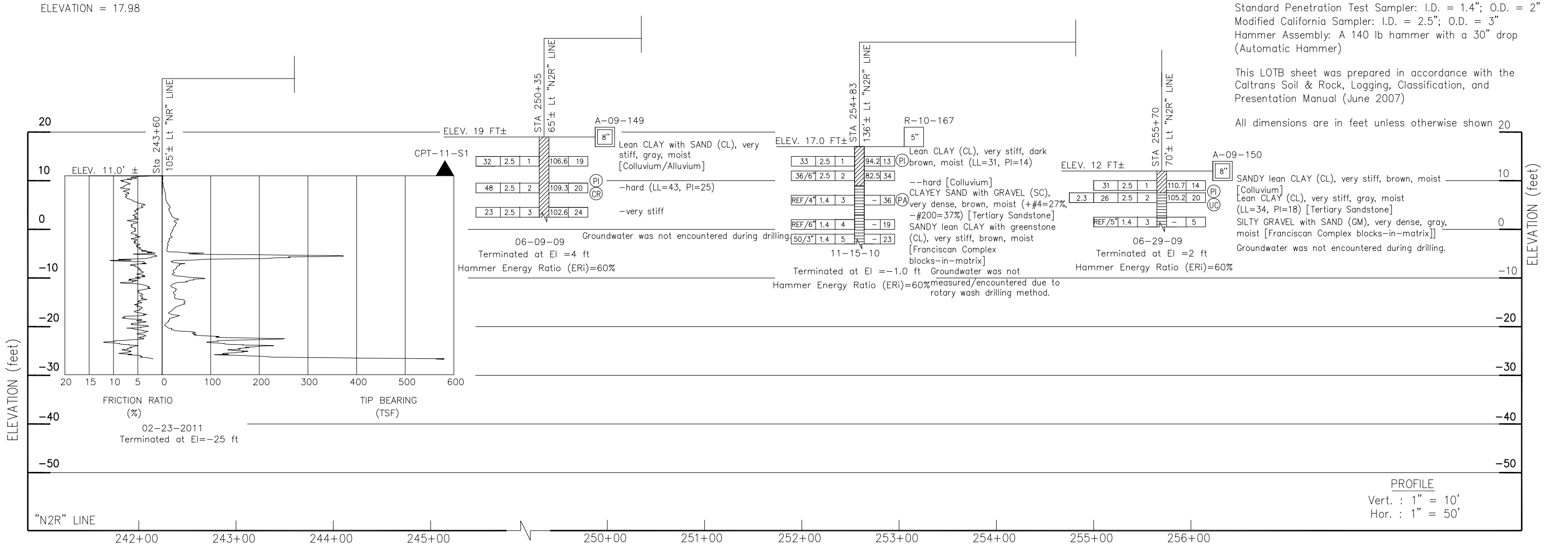
TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY– FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO.
POST MILES

MARIN– SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
				4	21

Plate A-4

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 8/19/11

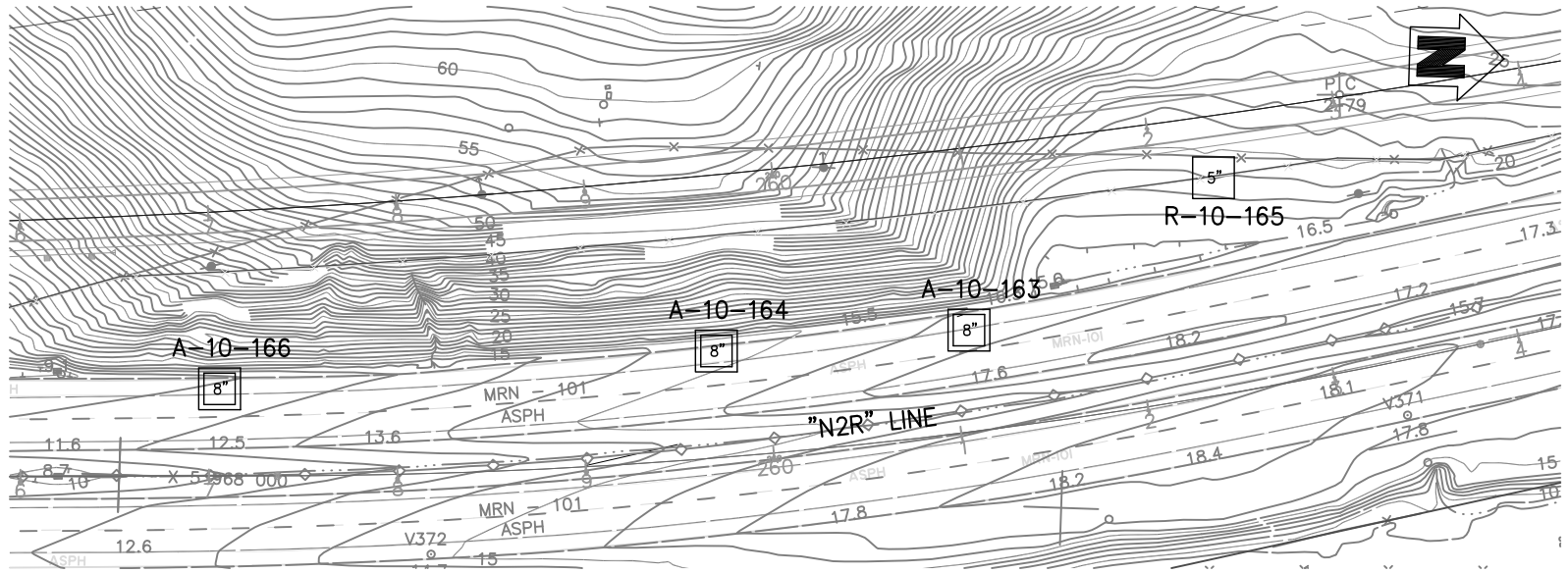
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



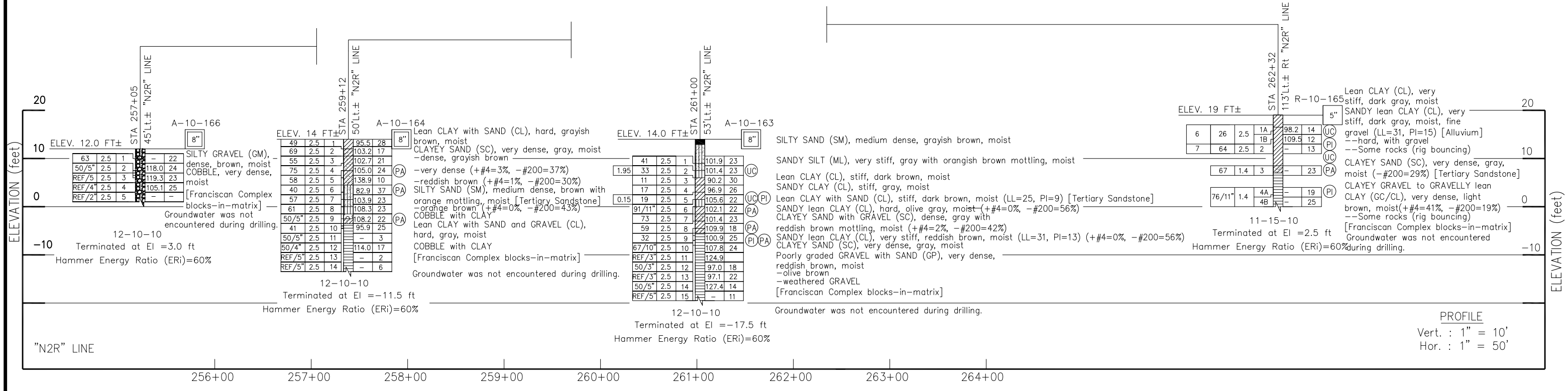
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-5

(SEE MAP TO RIGHT)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

ELEVATION (feet)

STA 259+63 228'± Lt "N2R" LINE

R-10-162A
ELEV. 65.0 FT±

5"					Lean CLAY (CL), hard, reddish brown, with Sandstone fragments [Landslide Debris], wet
65/4"	2.5	1	79.8	24	PA
90/8"	2.5	2	83.3	24	PA
93/11"	2.5	3A, 3B	96.6 / 100.1	16 / 18	PA — Silty SAND with GRAVEL (SM), very dense, reddish brown, moist [Landslide Debris] (+#4=10%, -#200=23%) (+#4=1%, -#200=36%)
83/11"	2.5	4	101.9	15	
55	2.5	5	95.5	16	DS — SANDSTONE, moderately to intensely weathered, light buff, moist [Tertiary Sandstone]
70/9"	2.5	6	93.5	15	

Groundwater was not measured/encountered due to rotary wash drilling method.

11-16-10
Terminated at El =43.0 ft
Hammer Energy Ratio (ERi)=60%

STA 259+63 225'± Lt "N2R" LINE

R-10-162
ELEV. 65 FT±

5"				CLAYEY SAND (SC)/SANDY lean CLAY (CL), brown, moist- No recovery [Landslide Debris]
–	30			SILTY SAND with fine GRAVEL
–	2			
–	14			SANDSTONE, light yellowish brown, highly fragmentalized along slightly oxidized fractures [Tertiary Sandstone]
–	16			
90.9	22	DS		
–	25			
88.7	32	UU		CLAY and GRAVEL dark gray green GREENSTONE (altered basalt) [Franciscan Complex blocks-in-matrix]

Groundwater was not measured/encountered due to rotary wash drilling method.

11-11&12-10
Terminated at El = 3 ft
Hammer Energy Ratio (ERi)=60%
Inclinometer casing (2.25" dia.) installed with trimmed grout backfill.

STA 259+90 395'± Lt "N2R" LINE

R-10-161
ELEV. ~92 FT±

5"				SANDY lean CLAY (CL), stiff, brown, moist
–	11			SILTY SAND, brown [Landslide Debris]
–	17	UU		Lean CLAY (CL), stiff, brown, moist [OLD TOPSOIL] --some Sandstone pieces
–	25			
–	22			CLAYEY SAND to SANDY lean CLAY [Tertiary Sandstone]
–	11			SILTY SAND with GRAVEL, light gray SANDSTONE, gray to green, weathered [Franciscan Complex blocks-in-matrix]

SANDSTONE, reddish, weathered

GREENSTONE (altered basalt) [Franciscan Complex blocks-in-matrix]

-reddish brown

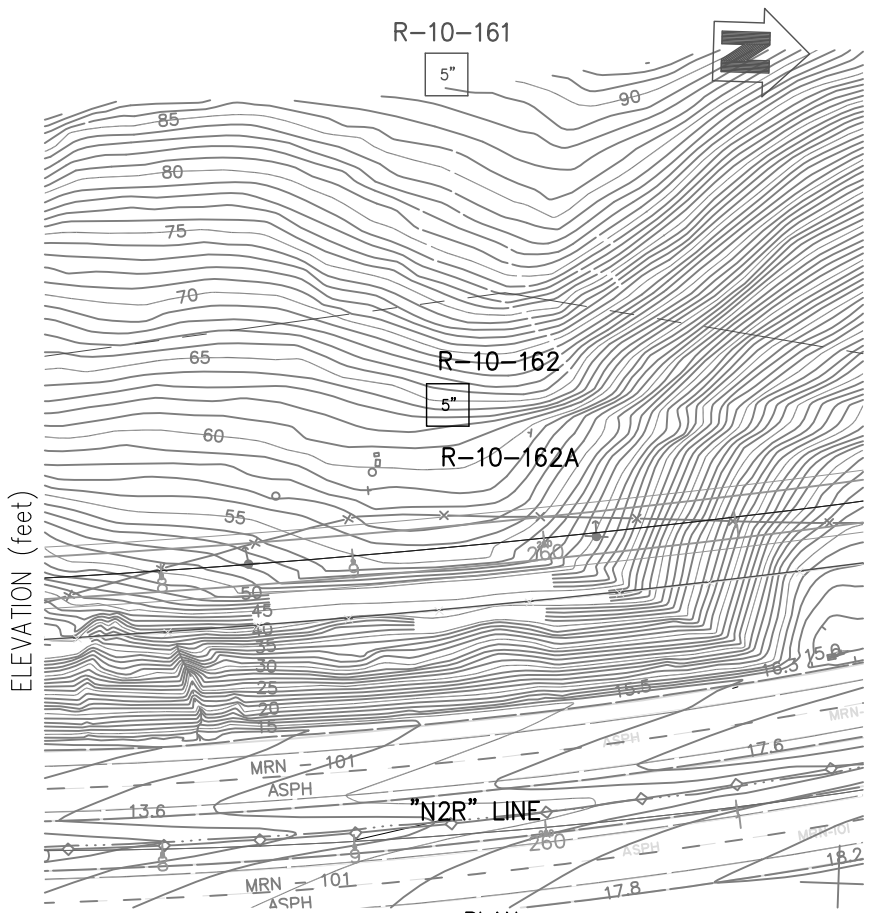
Groundwater was not measured/encountered due to rotary wash drilling method.

11-9,10&11-10
Terminated at El = -50 ft
Hammer Energy Ratio (ERi)=60%
Piezometer pipe (1" dia. slotted PVC) installed with SAND backfill.

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

"N2R" LINE
259+00 260+00 261+00



PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Boring R-10-162 and R-10-162A are drilled ± 5 ft away from each other.

TIME PLOTTED => $TIME
DATE PLOTTED => $DATE
USERNAME => $USER

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU		P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	PROJECT ENGINEER	POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

Plate A-6

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF

FILE => $REQUEST

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

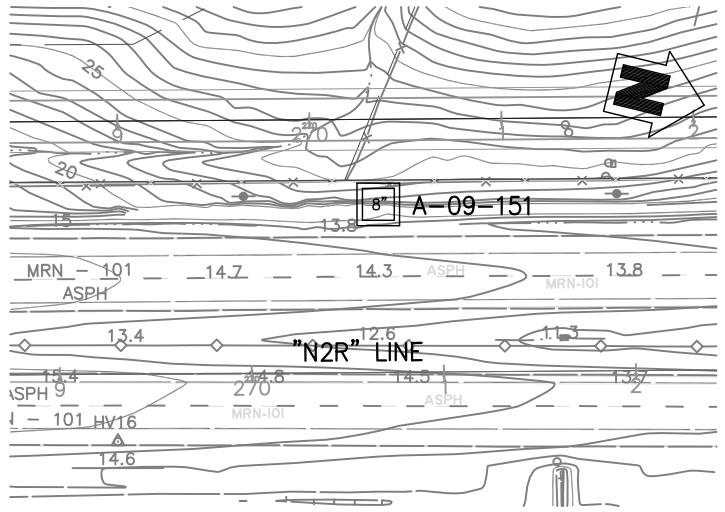
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



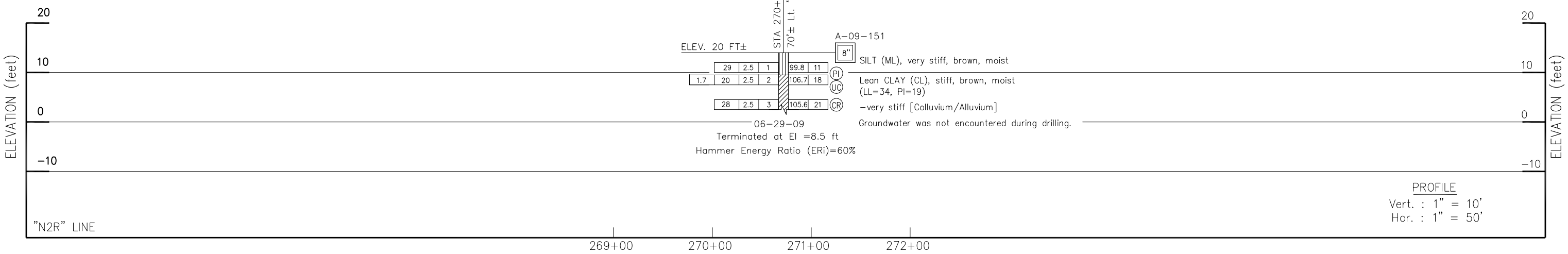
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU FIELD INVESTIGATION BY:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	DATE: JANUARY- FEBRUARY 2009				POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 040000007331 CONTRACT NO.: 04-2640741

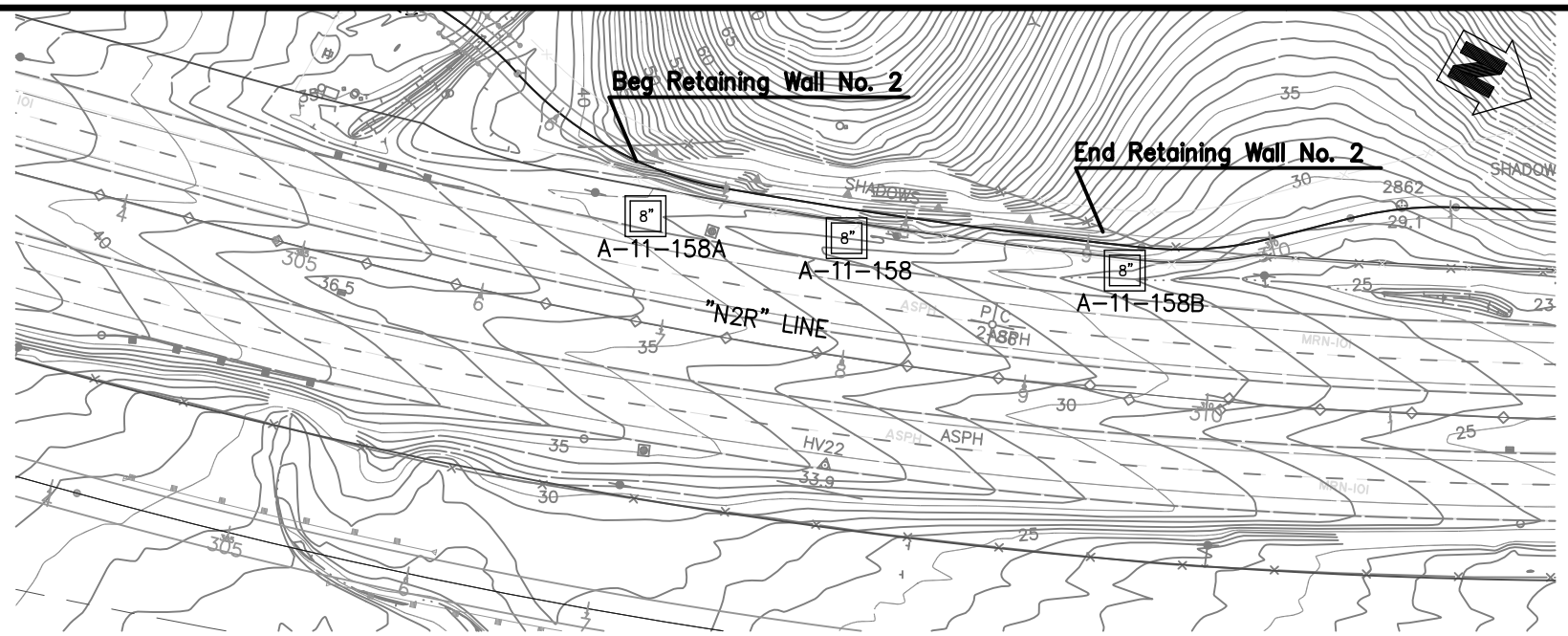
DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-7



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

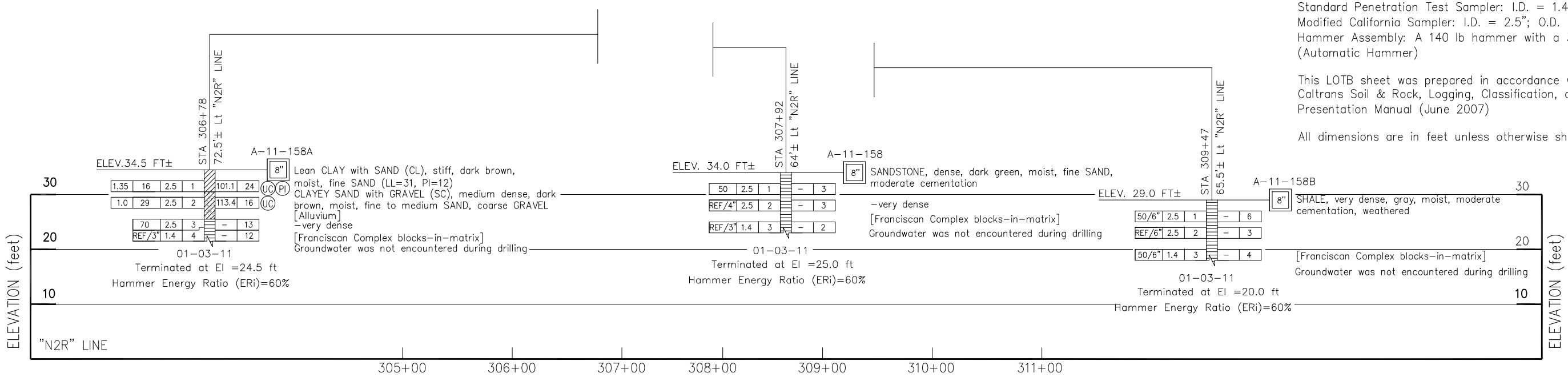
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009			PROJECT ENGINEER	POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-8

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

PLANS APPROVAL DATE

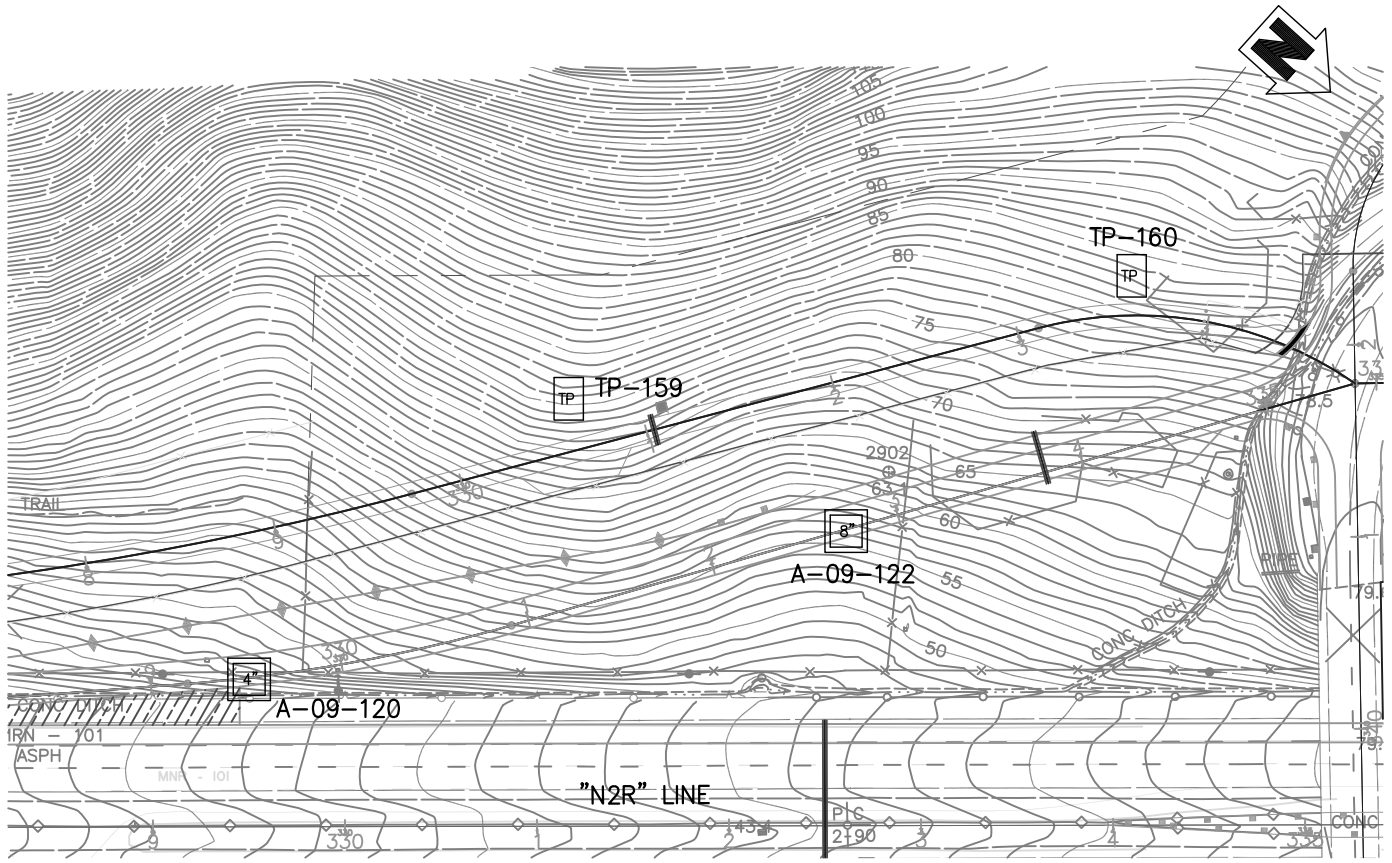
REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98



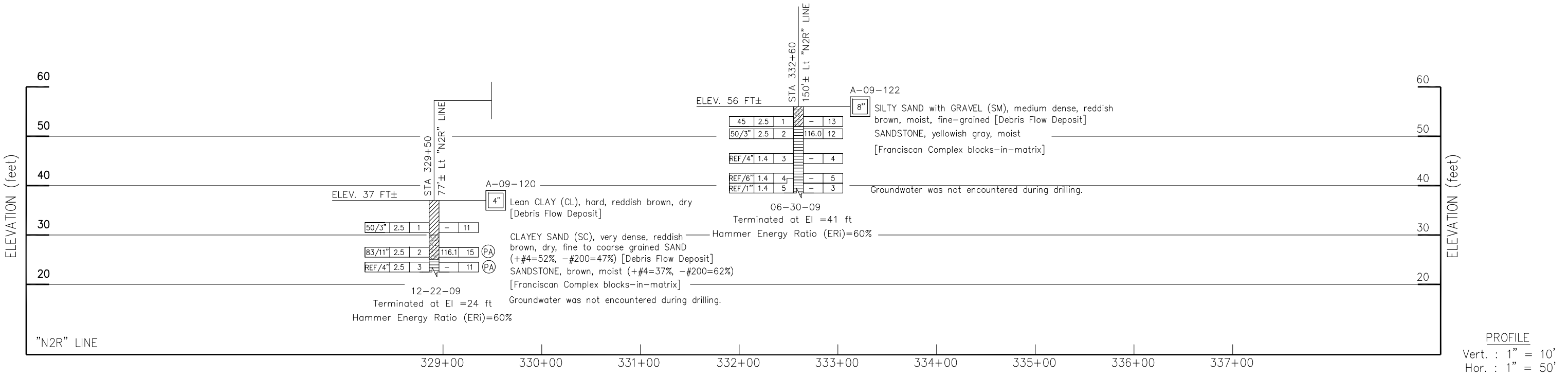
PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pits TP–159 & TP–160 at the end of Appendix A.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-9

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

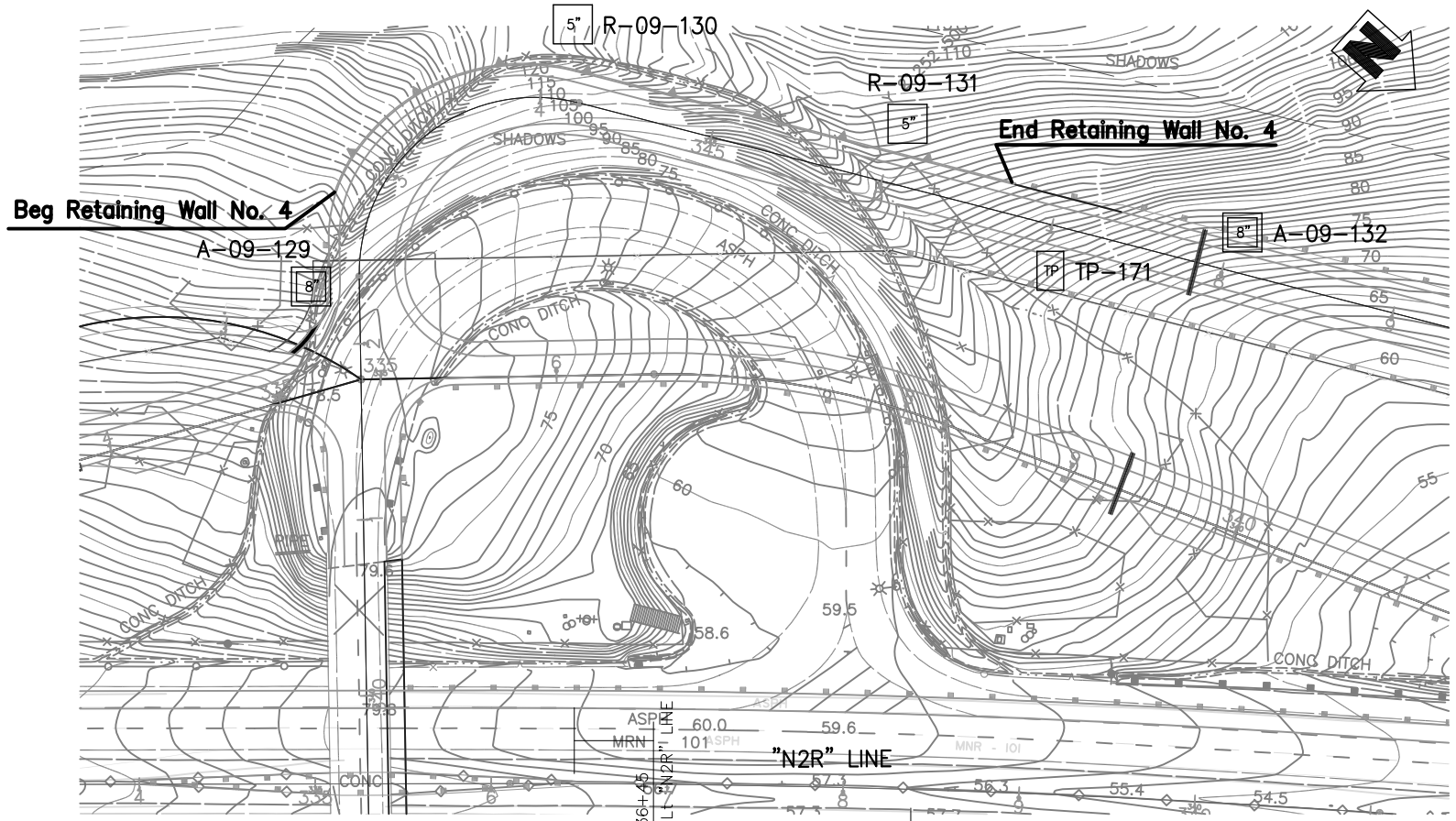
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

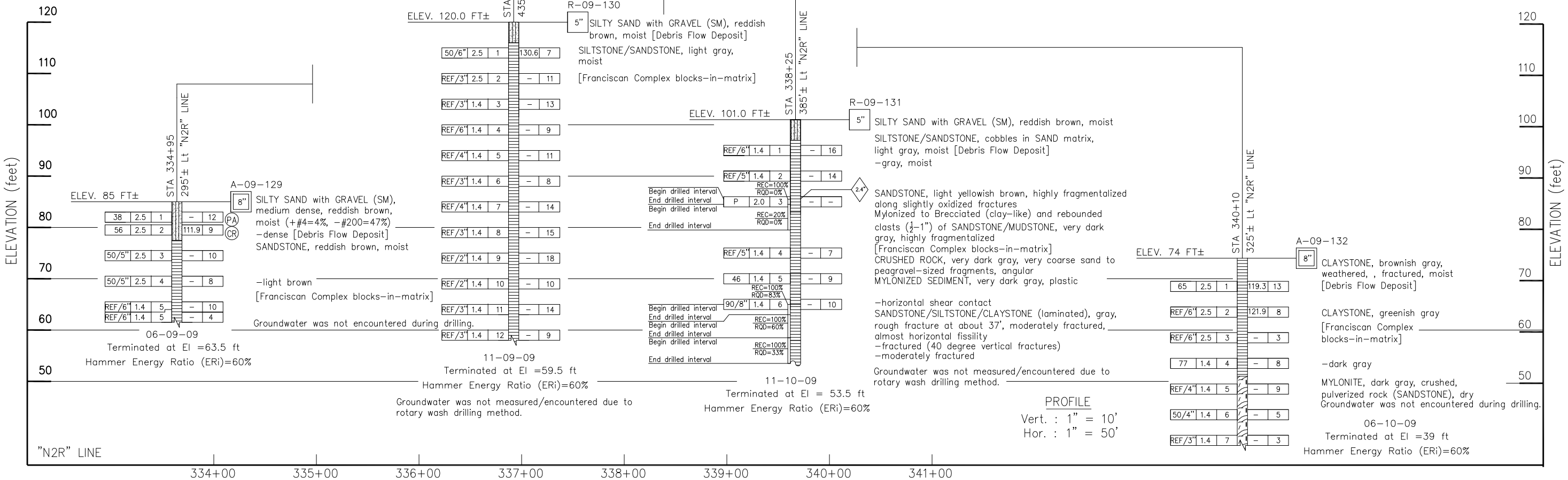
BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pit TP–171 at the end of Appendix A.



TIME PLOTTED => $TIME
USERNAME => $USER DATE PLOTTED => $DATE

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY– FEBRUARY 2009		PROJECT ENGINEER	POST MILES

MARIN– SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF

FILE => $REQUEST

Plate A-10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

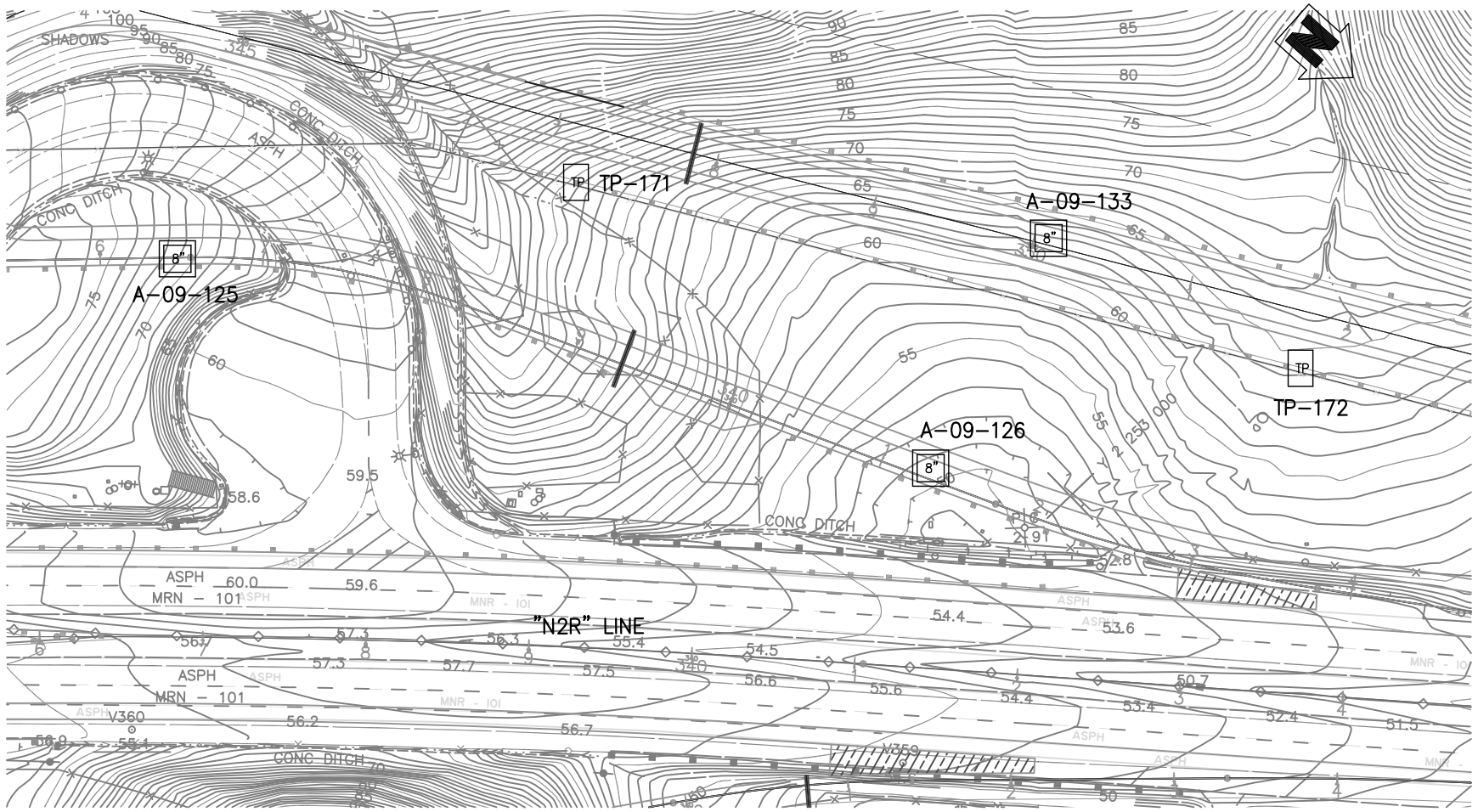
PLANS APPROVAL DATE

PROFESSIONAL ENGINEER — REGISTERED — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

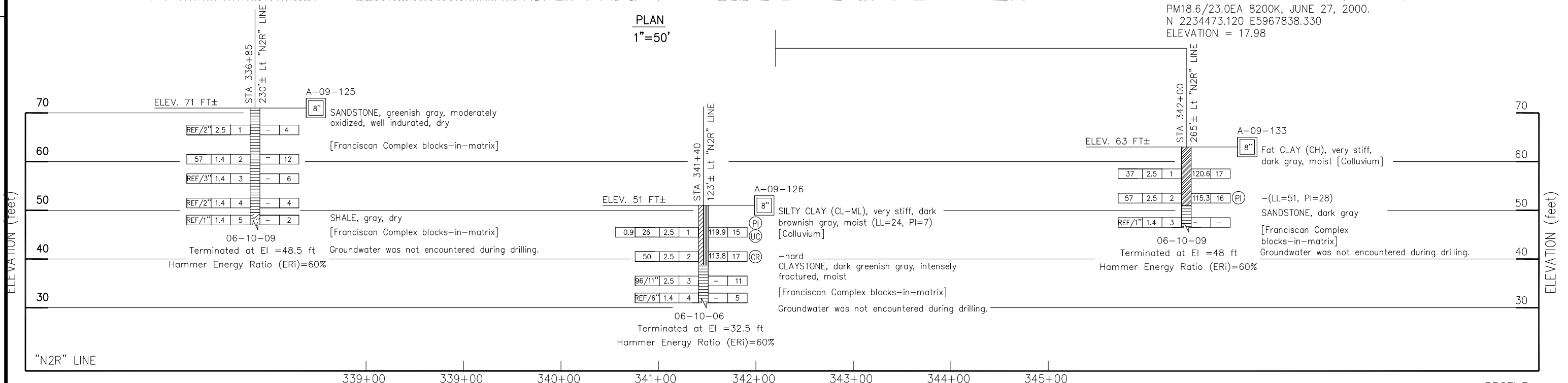
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pits TP-171 & TP-172 at the end of Appendix A.

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: O. GOUTHIER
CHECKED BY: P. SIRCAR

S. DUDDU
FIELD INVESTIGATION BY:
DATE: JANUARY- FEBRUARY 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO.
POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF

FILE => $REQUEST

TIME PLOTTED => $TIME
DATE PLOTTED => $DATE
USERNAME => $USER

Plate A-11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

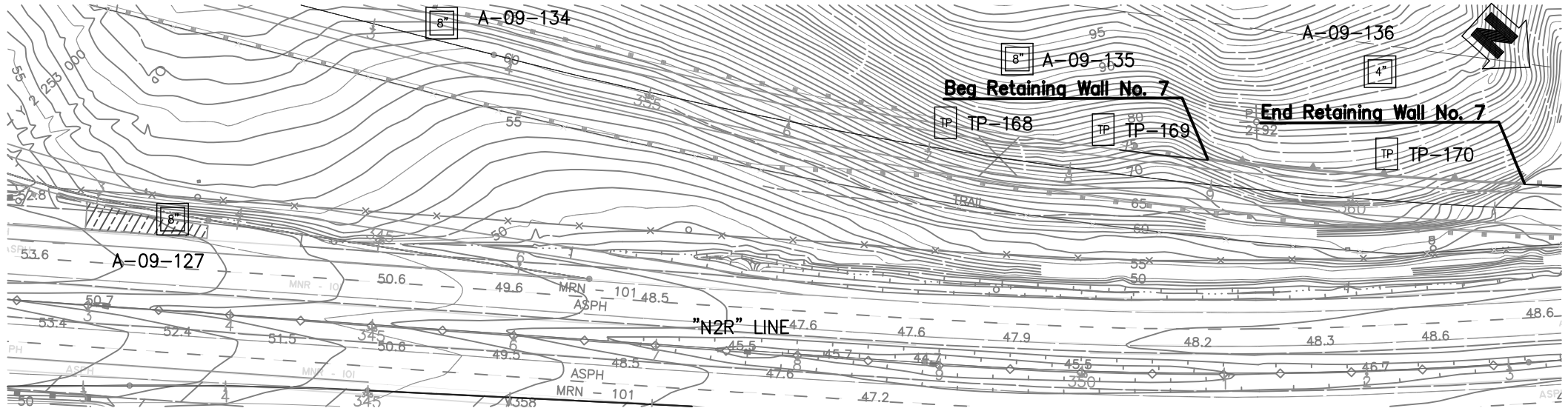
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

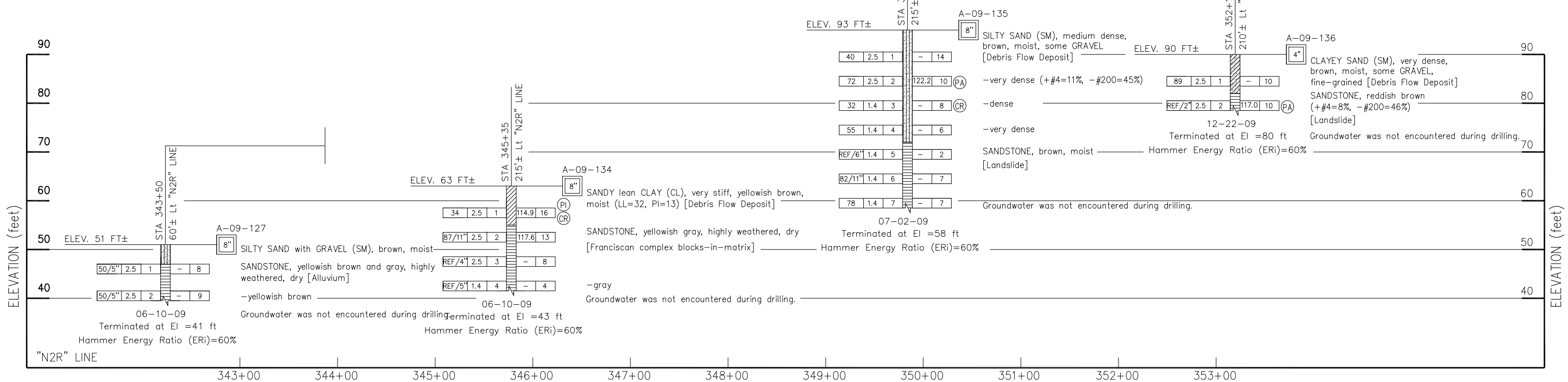
BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pits TP–168 & TP–169 at the end of Appendix A.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY– FEBRUARY 2009			PROJECT ENGINEER	POST MILES

MARIN– SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04–2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-12

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 8/19/11

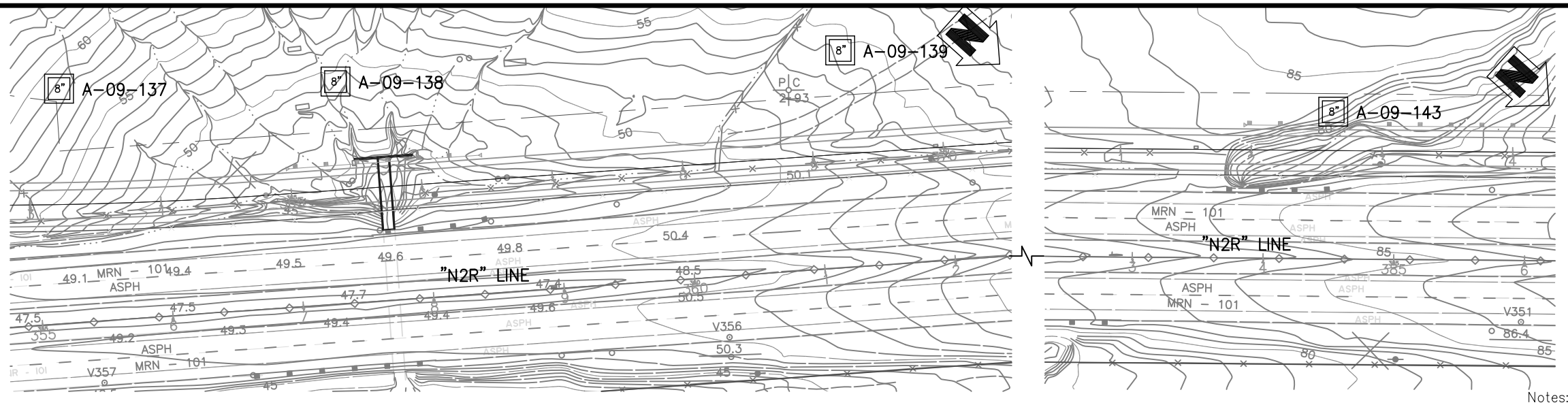
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



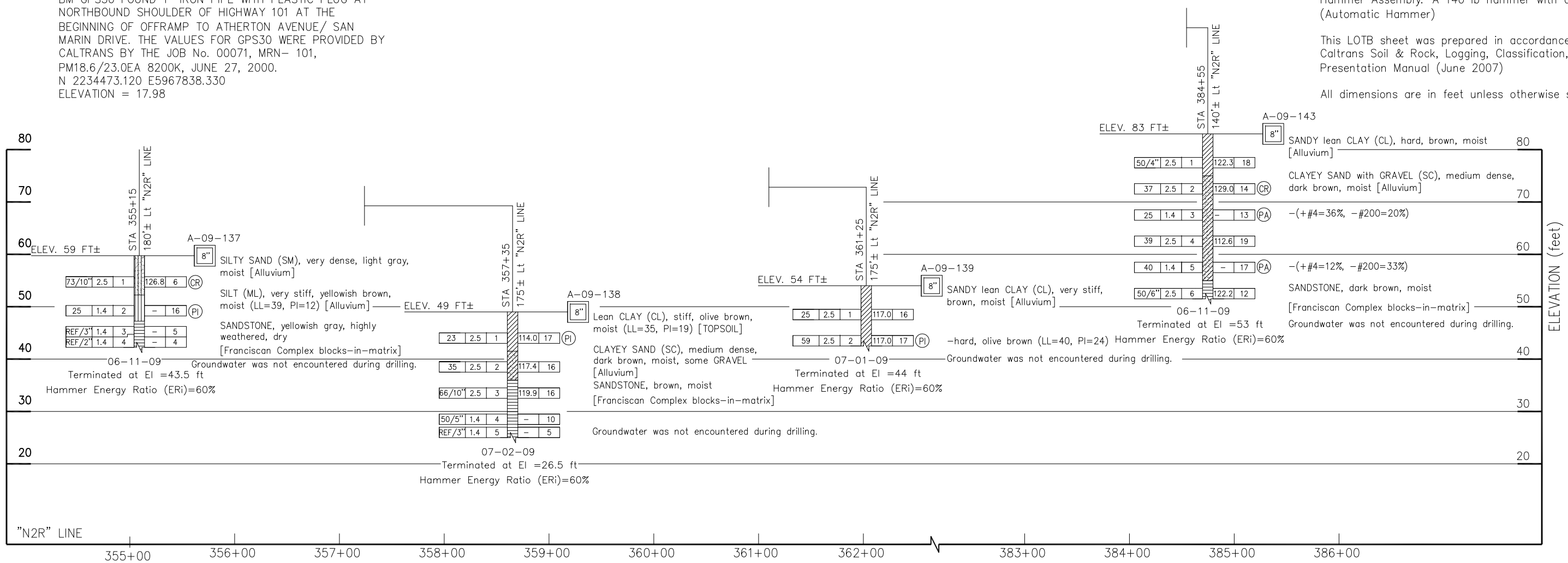
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN- 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY	O. GOUTHIER	S. DUDDU FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	BRIDGE NO. / POST MILES
	CHECKED BY	P. SIRCAR				

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

TIME PLOTTED => $TIME
USERNAME => $USER DATE PLOTTED => $DATE

Plate A-13

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

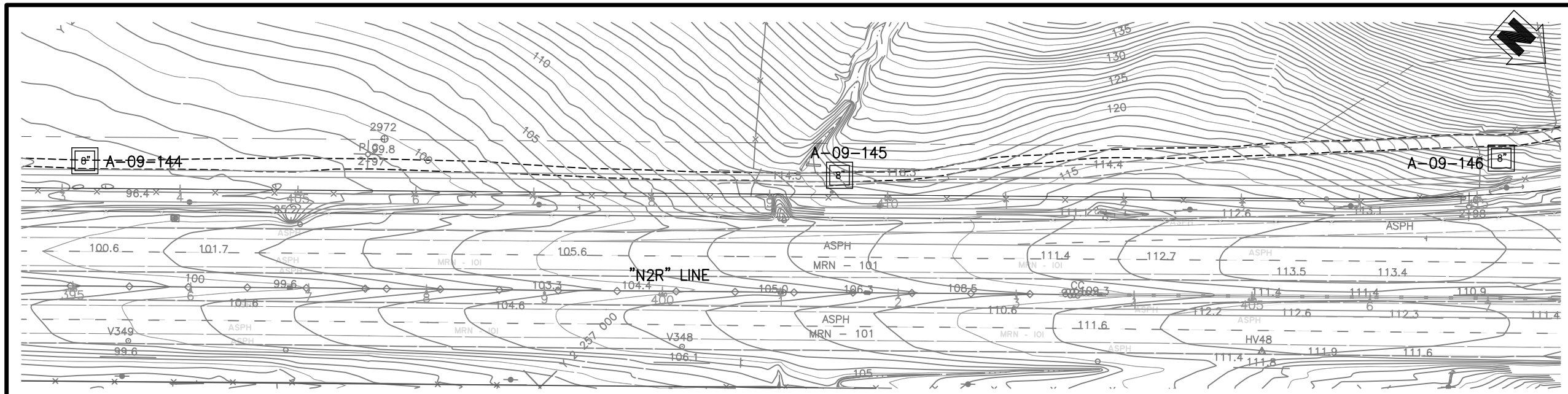
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



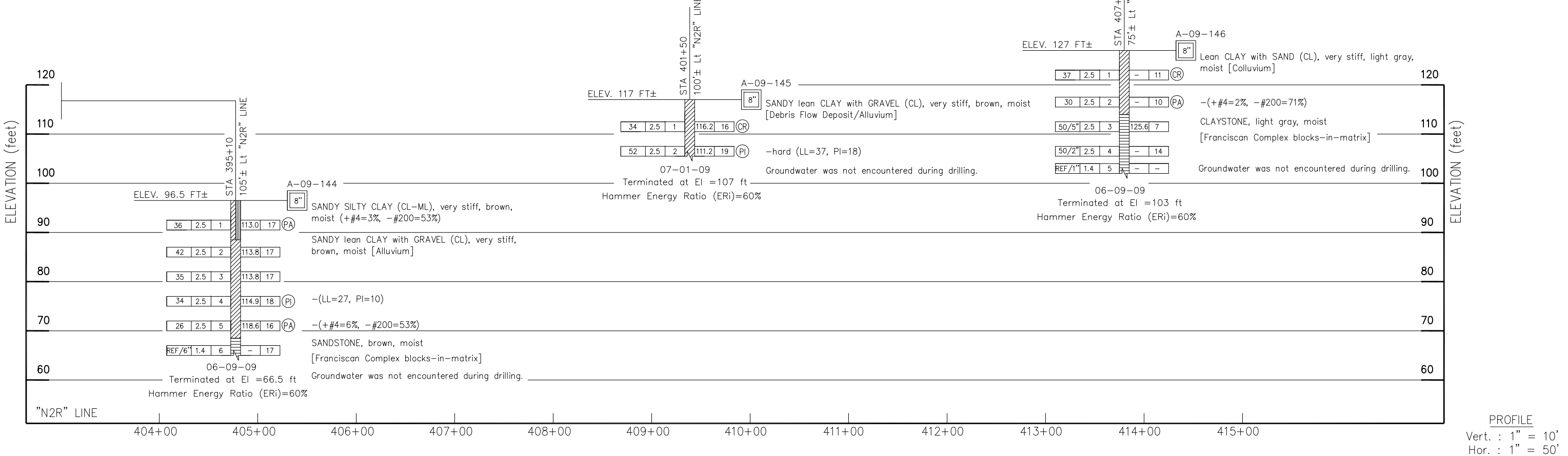
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

TIME PLOTTED => $TIME
DATE PLOTTED => $DATE
USERNAME => $USER

Plate A-14

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

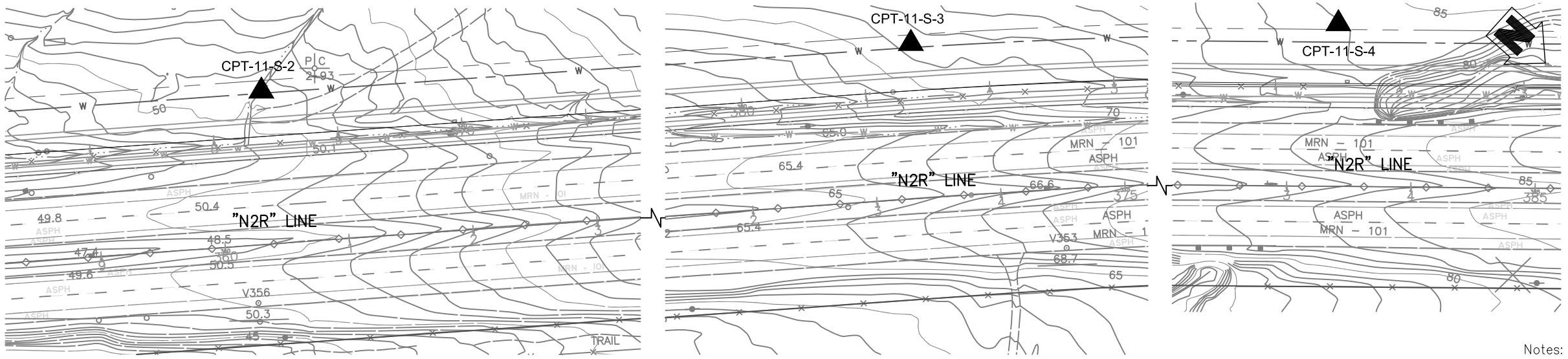
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



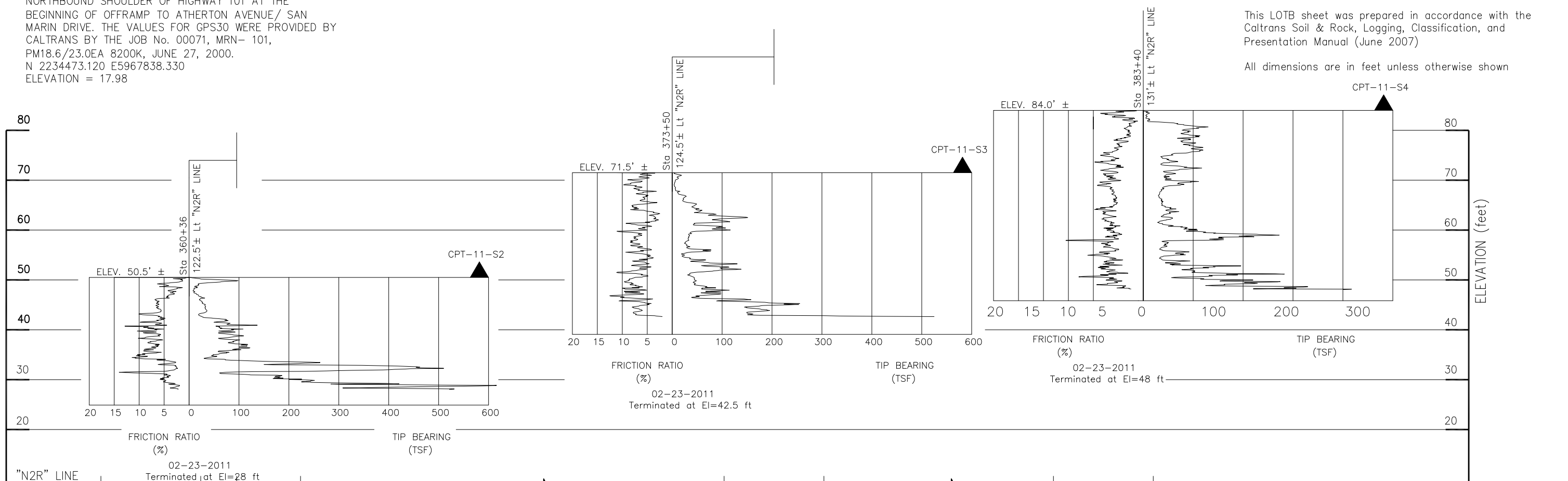
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU FIELD INVESTIGATION BY:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	DATE: JANUARY- FEBRUARY 2009				POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 040000073331 CONTRACT NO.: 04-2640741

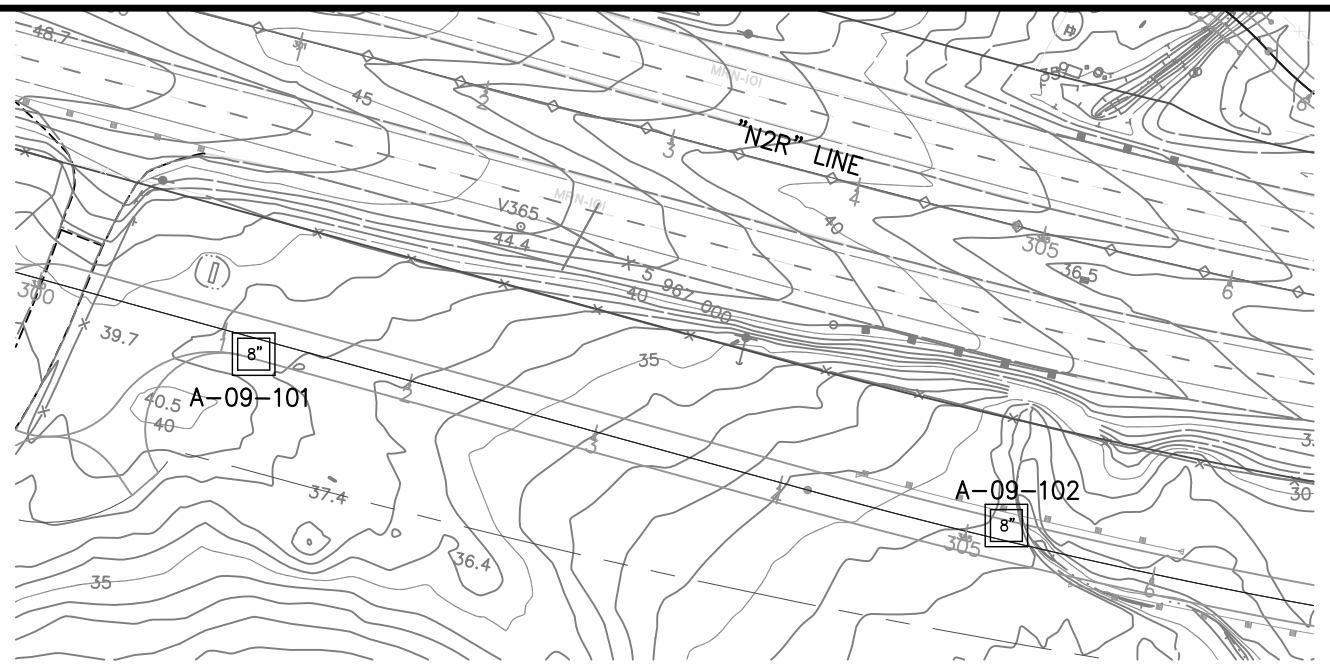
DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

Plate A15

USERNAME => $USER (CPT) DATE PLOTTED => $DATE 10/7/2011 11:27:01 AM PLOTTED => $TIME



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 8/19/11

PLANS APPROVAL DATE

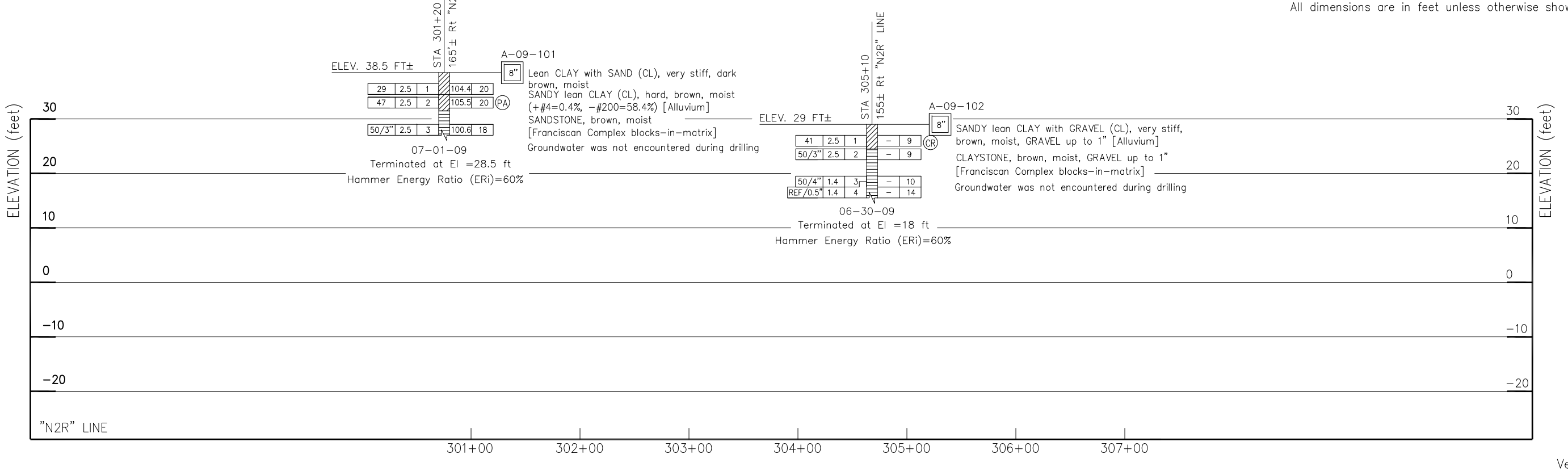
REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009			PROJECT ENGINEER	POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

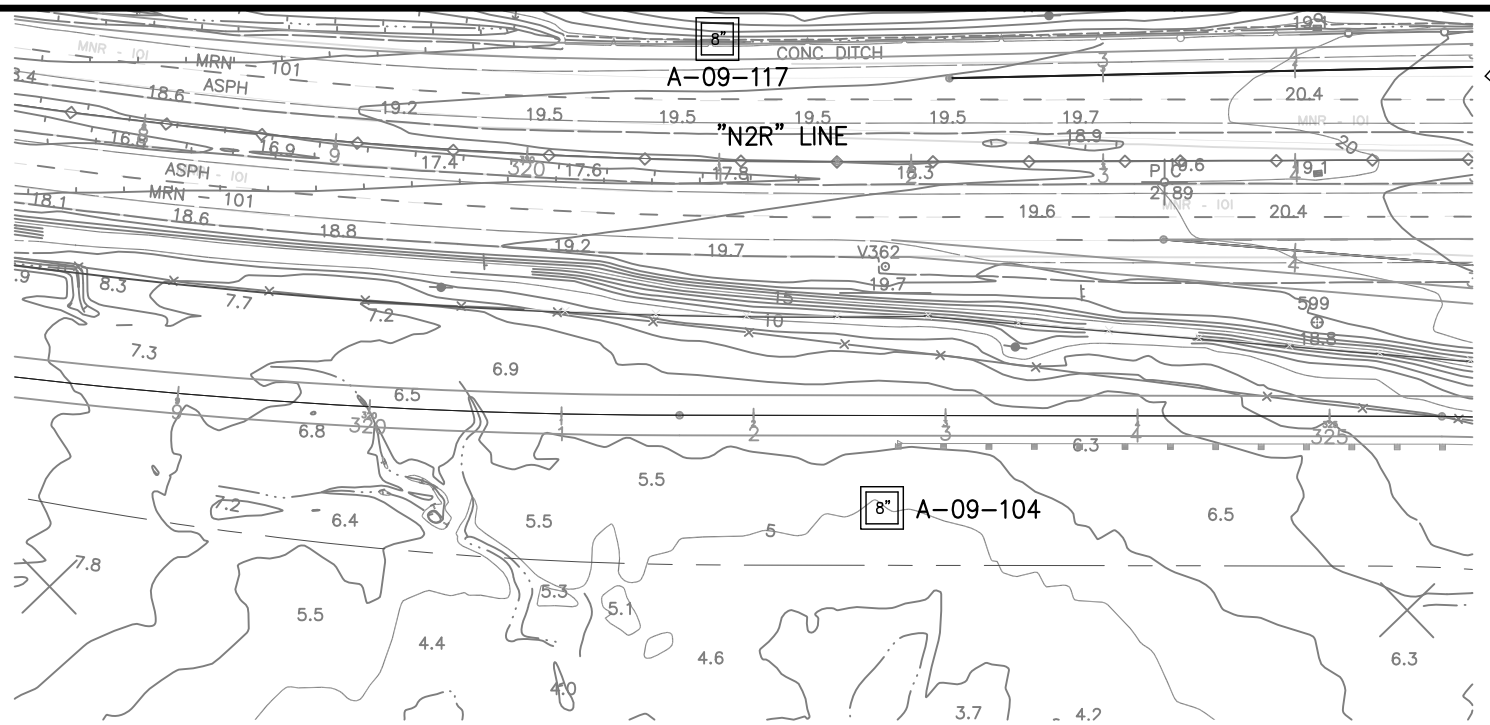
DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-16



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

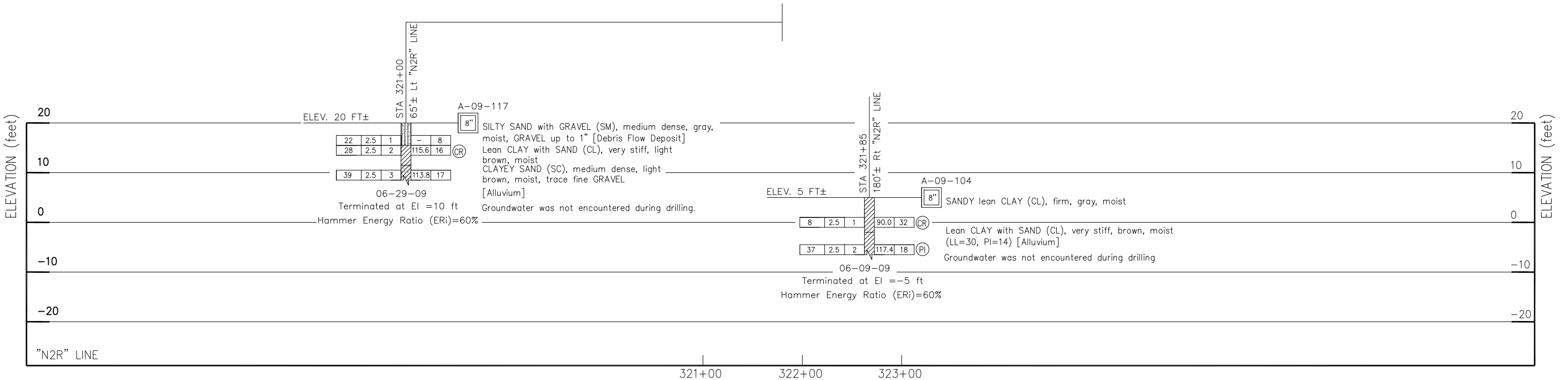
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-17

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

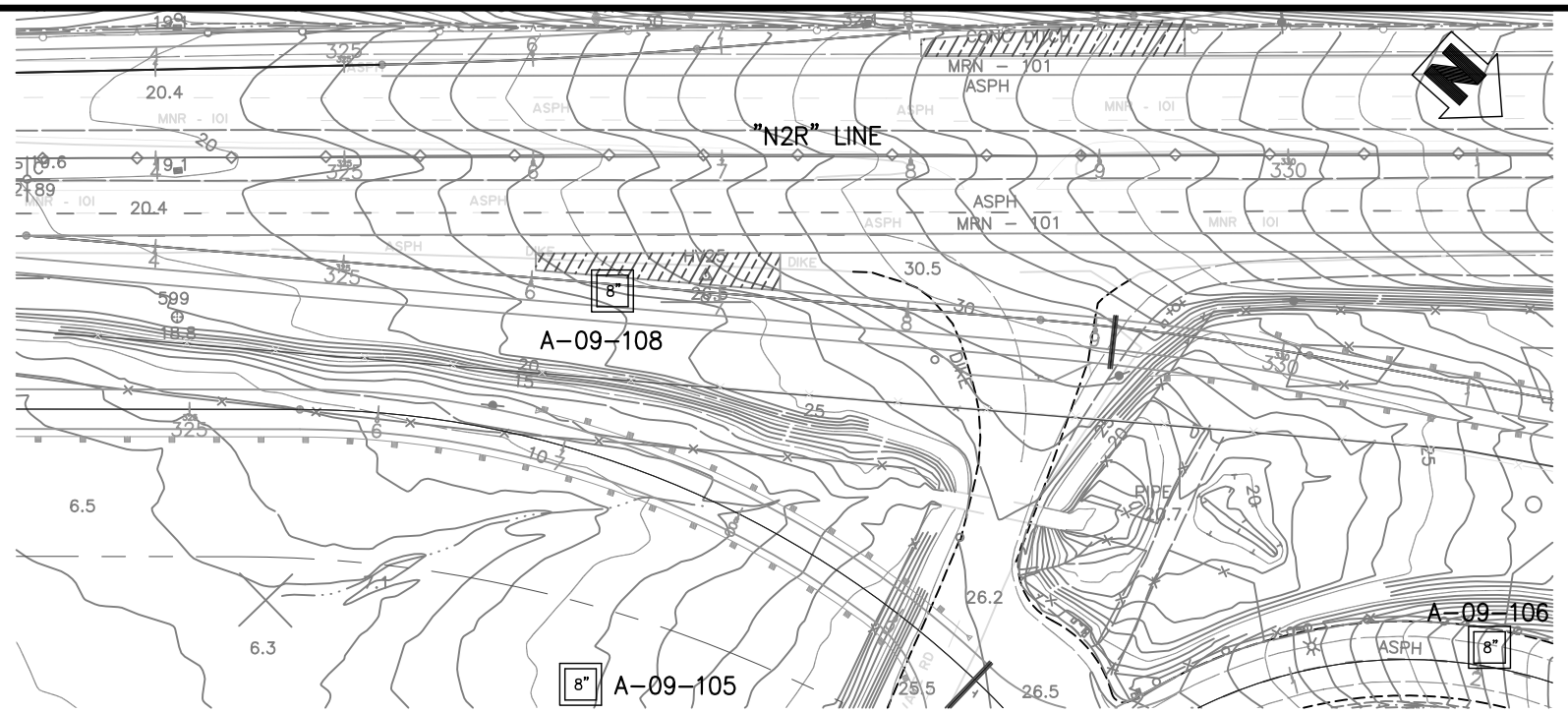
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



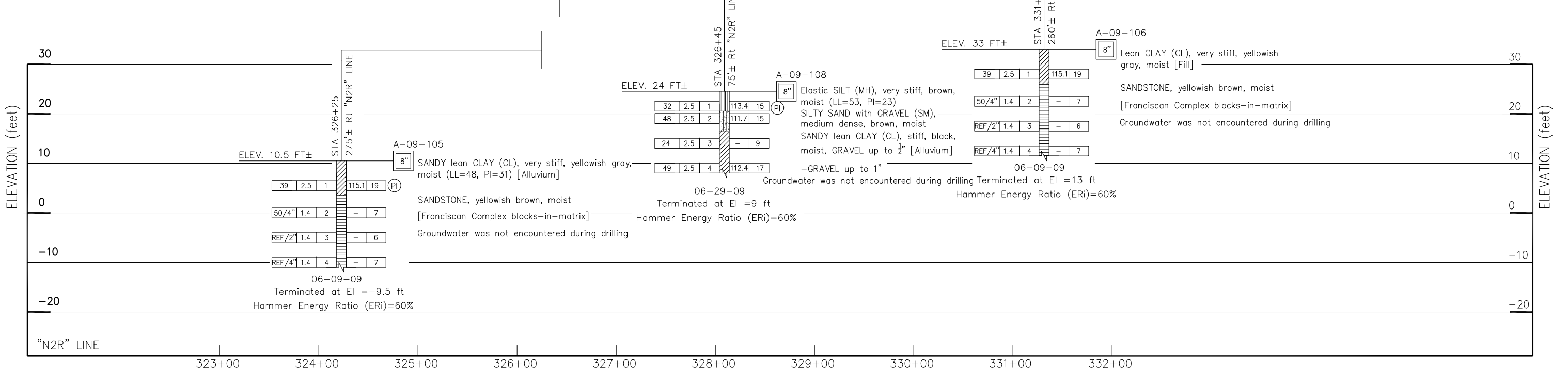
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009			PROJECT ENGINEER	POST MILES

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

TIME PLOTTED => $TIME
USERNAME => $USER DATE PLOTTED => $DATE

Plate A-18

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

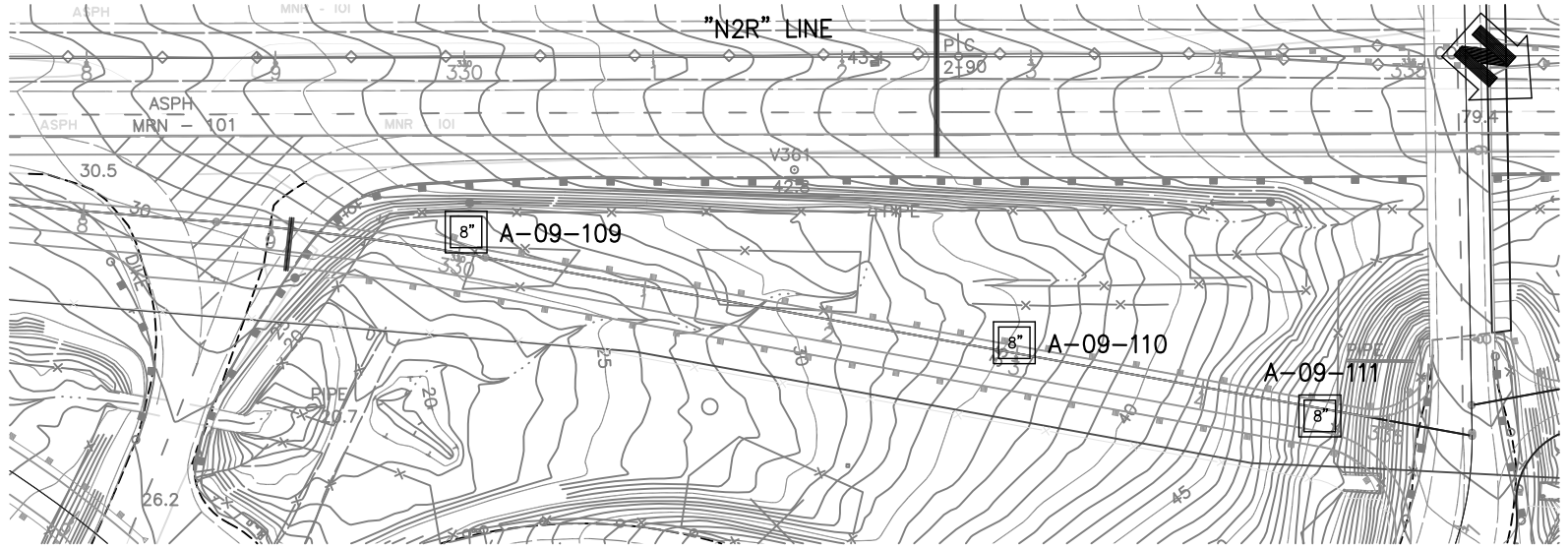
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARD STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



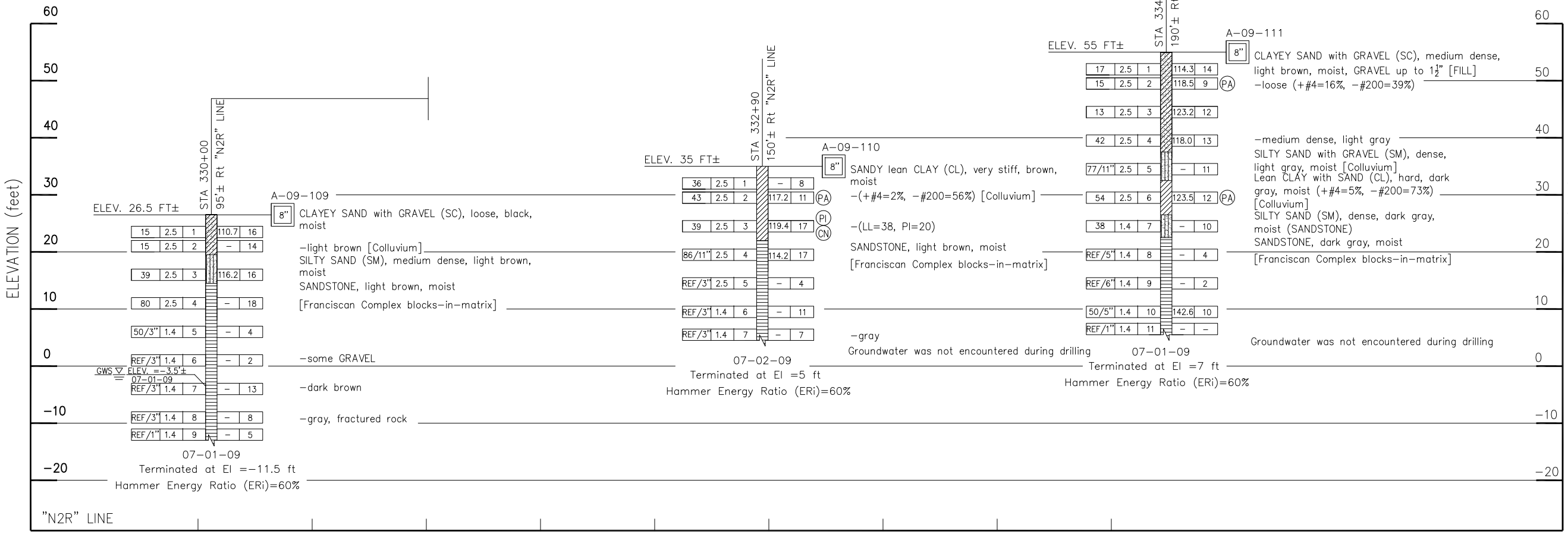
PLAN
1"=50'

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY– FEBRUARY 2009			PROJECT ENGINEER	POST MILES

MARIN– SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT

LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

TIME PLOTTED => $TIME
USERNAME => $USER DATE PLOTTED => $DATE

Plate A-19

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — 8/19/11 DATE

PLANS APPROVAL DATE

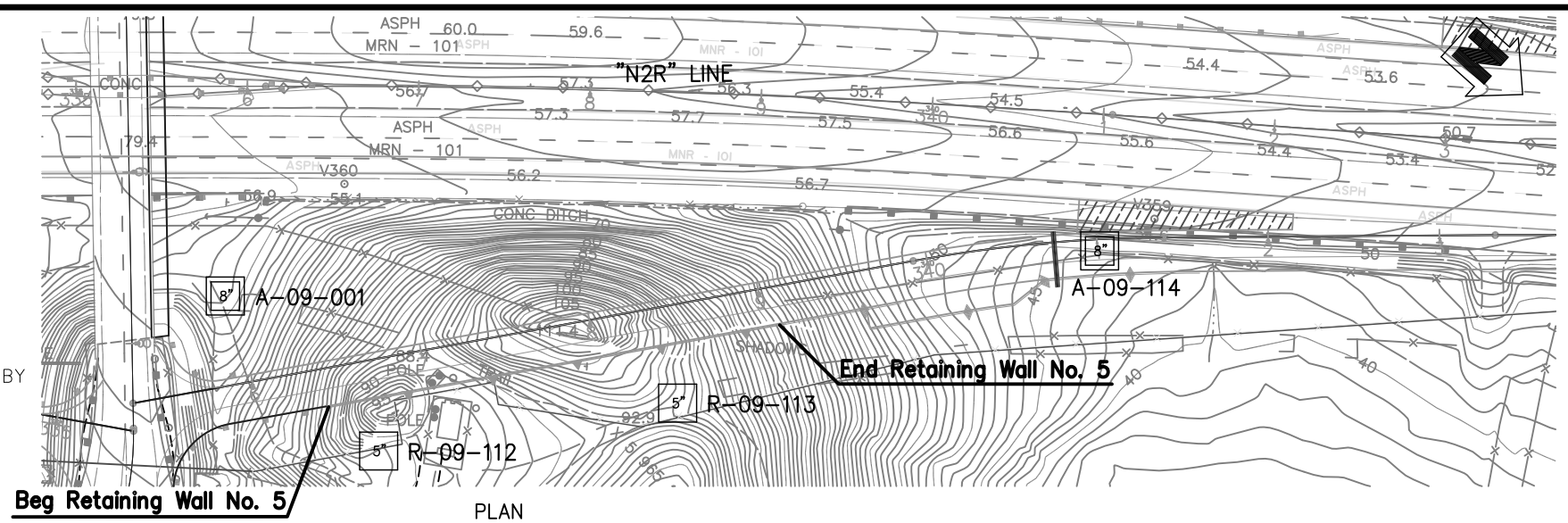
REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

TAM
750 LINDARO STREET, SUITE 200
SAN RAFAEL, CA 94901

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BENCHMARK:
BM GPS30 FOUND 1" IRON PIPE WITH PLASTIC PLUG AT NORTHBOUND SHOULDER OF HIGHWAY 101 AT THE BEGINNING OF OFFRAMP TO ATHERTON AVENUE/ SAN MARIN DRIVE. THE VALUES FOR GPS30 WERE PROVIDED BY CALTRANS BY THE JOB No. 00071, MRN– 101, PM18.6/23.0EA 8200K, JUNE 27, 2000.
N 2234473.120 E5967838.330
ELEVATION = 17.98

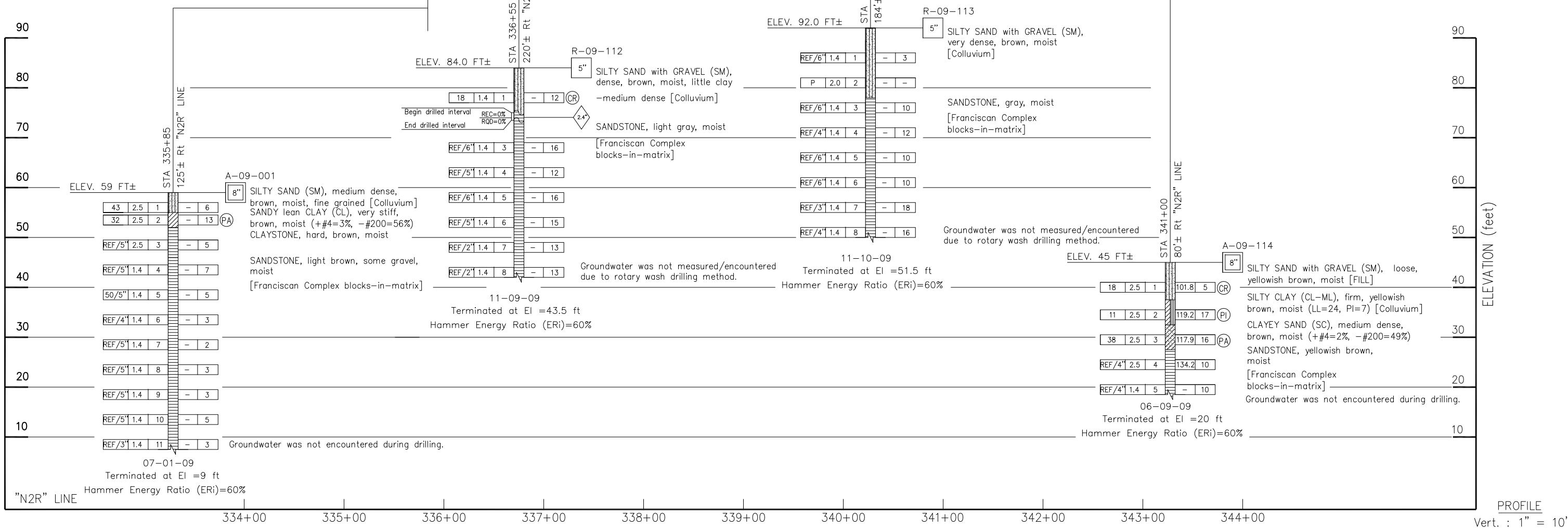


PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	S. DUDDU	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO.	MARIN- SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JANUARY- FEBRUARY 2009		PROJECT ENGINEER	POST MILES	LOG OF TEST BORINGS

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0716
PROJECT NUMBER & PHASE: 04000007331 CONTRACT NO.: 04-2640741

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Plate A-20

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	MRN	101	40.5/41.2		

4/4/05
GEOTECHNICAL PROFESSIONAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MICHAEL MORISOLI — No. 2541 Exp. 12/31/04 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

MILLER PACIFIC ENGINEERING GROUP
165 N. REDWOOD DR., SUITE 120
SAN RAFAEL, CALIFORNIA 94903

WASTE MANAGEMENT
8950 REDWOOD HIGHWAY
P.O. BOX 793
NOVATO, CALIFORNIA 94945

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 GEOTECHNICAL — STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
04	Mrn	101	25.5		

REGISTERED CIVIL ENGINEER — DATE

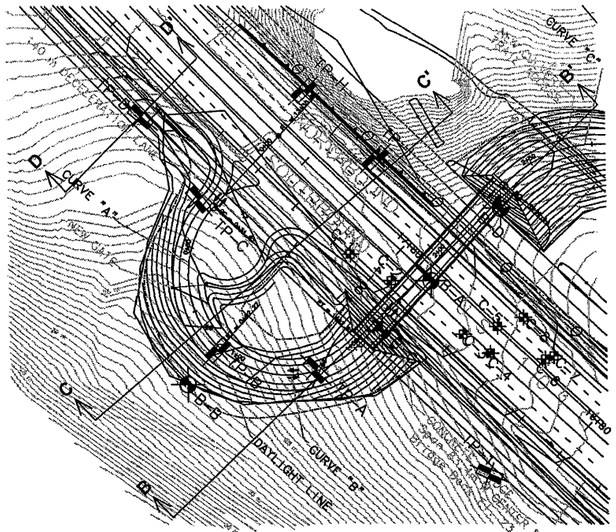
REDWOOD LANDFILL OVERCROSSING (WIDEN)

LOG OF TEST BORINGS

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 03240
EA: 264071

BRIDGE No.	
27-0115	
Sheet	of
22	22



PLAN
SCALE
0 10 20 30 40 50 METERS

BENCHMARK:
Vertical Datum is NAVD 88 (meters). Benchmark is MRN-28, Elevation 8.725m As published by CALTRANS 03/07/01. Basis of bearing for this control schedule is N12 11'07"W between Monuments MRN-28 & GPS Point 207.

REFERENCE: DKS Associates Redwood Landfill Access Bridge, Alternate 2, 11/01

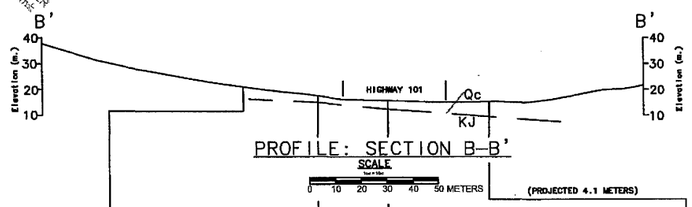
CSW Stuber-Stroeh Engineering Group, Inc. Construction Control Hard Copy, 12/14/04

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "N2" LINE
TB-A	335+30	211 ft Left
B-C	335+15	85 ft Left
B-A	335+15	0 ft CL
B-D	335+15	140 ft Right

Notes:
1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

NOTES:
1. 61 mm samples were taken using a Modified California split barrel sampler with an inside diameter (I.D.) of 61 mm and an outside daimeter (O.D.) of 76 mm.
2. A CME automatic hammer was used to advance the sampler using a 63.5 Kg hammer with a 762 mm drop.



PROFILE: SECTION B-B'
SCALE
0 10 20 30 40 50 METERS

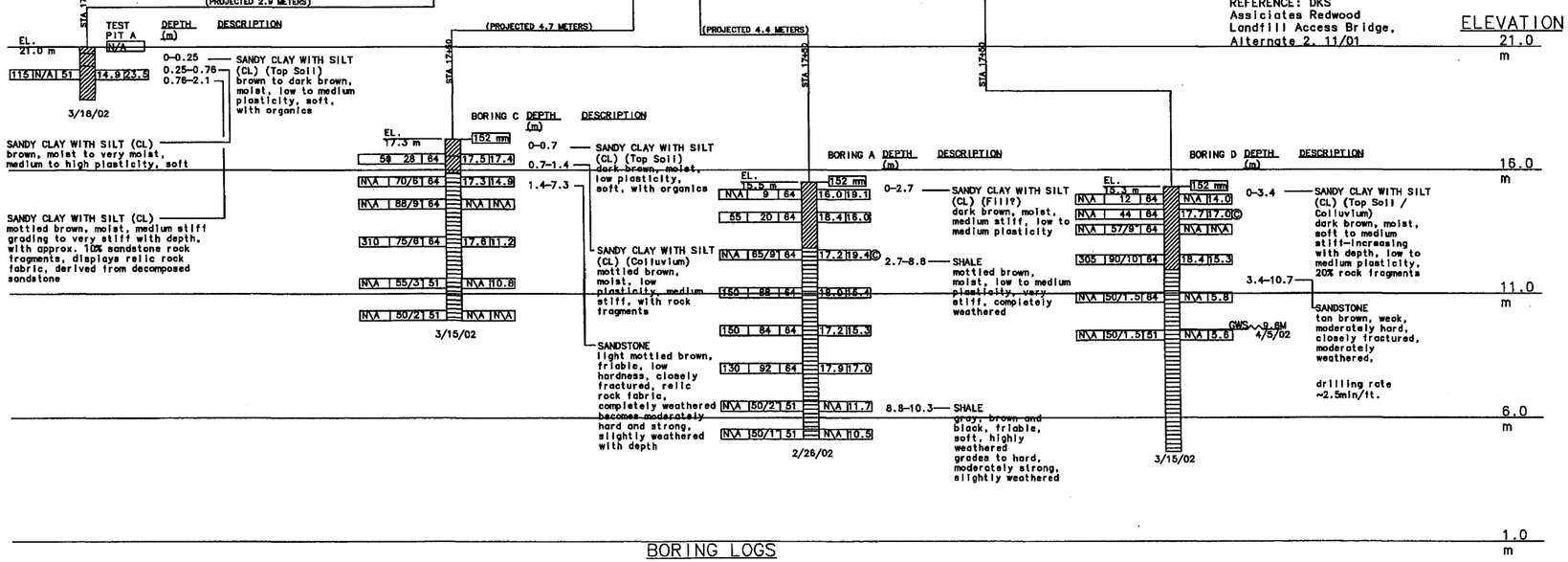
GEOLOGIC LEGEND: Qc = COLLUVIUM
KJ = FRANCISCAN COMPLEX, PREDOMINENTLY SANDSTONE

PLAN

BENCHMARK:
Elevations are based on 1929 N.G.V.D. using NGS BM N474 (Elev. 8.842M) and HPGN Station CA 04 KE (Elev. 5.459M)

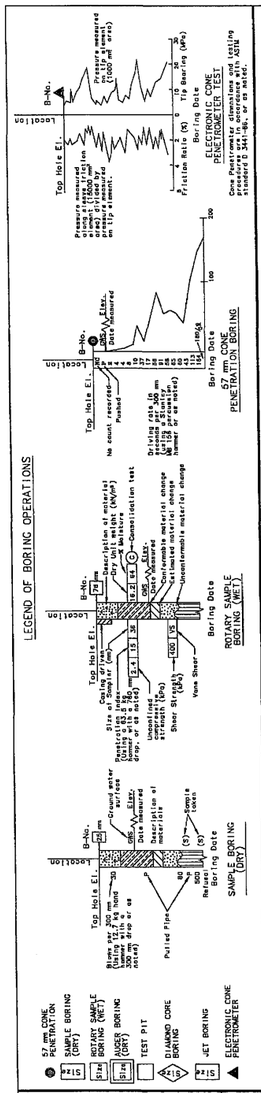
REFERENCE: DKS Associates Redwood Landfill Access Bridge, Alternate 2, 11/01

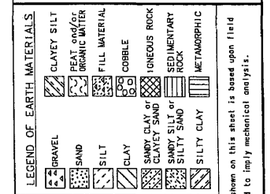
ELEVATION



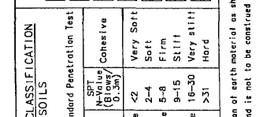
BORING LOGS

LEGEND OF BORING OPERATIONS





LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test

	SPT N-Value (Blows/ft.) (0.3m)	Granular	SPT N-Value (Blows/ft.) (0.3m)	Cohesive
	0-4	Very Loose	<2	Very Soft
	5-10	Loose	2-4	Soft
	11-30	Medium Dense	5-8	Firm
	31-50	Dense	9-15	Stiff
	>50	Very Dense	16-30	Very stiff
			>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT	DESIGN BY		CHARLES I. PERRY	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MICHAEL P. MORISOLI PROJECT ENGINEER	BRIDGE NO. 27-0115	REDWOOD LANDFILL OVERCROSSING
SIGN OFF DATE	CHECKED BY	MICHAEL P. MORISOLI	FIELD INVESTIGATION BY: DATE:			KILOMETER POST 41.1(25.5)	LOG OF TEST BORINGS

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

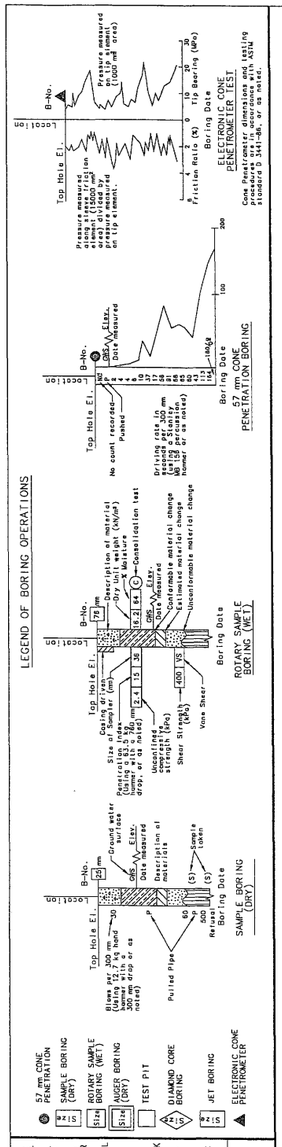
CU
EA

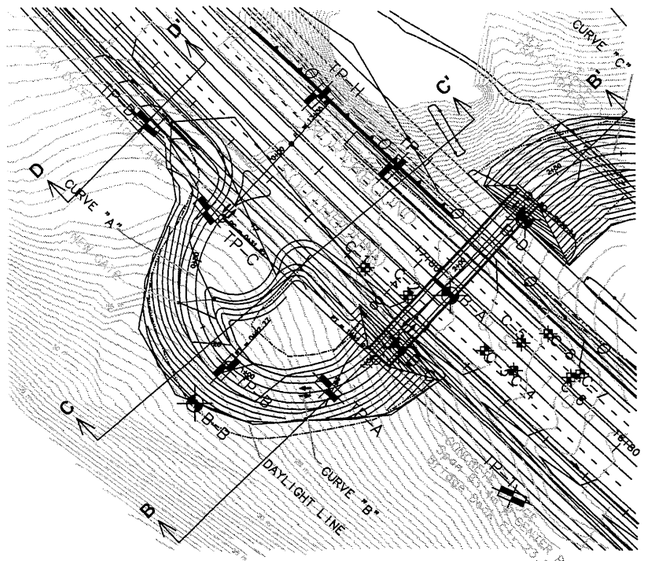
DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 12/7 4/1/05

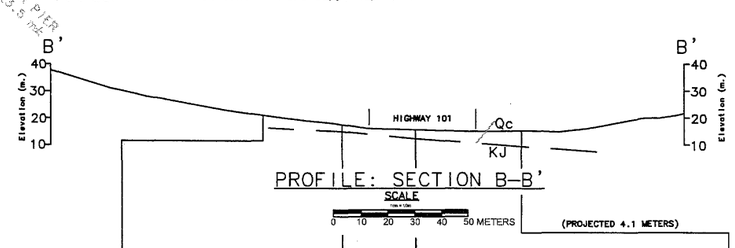
SHEET OF

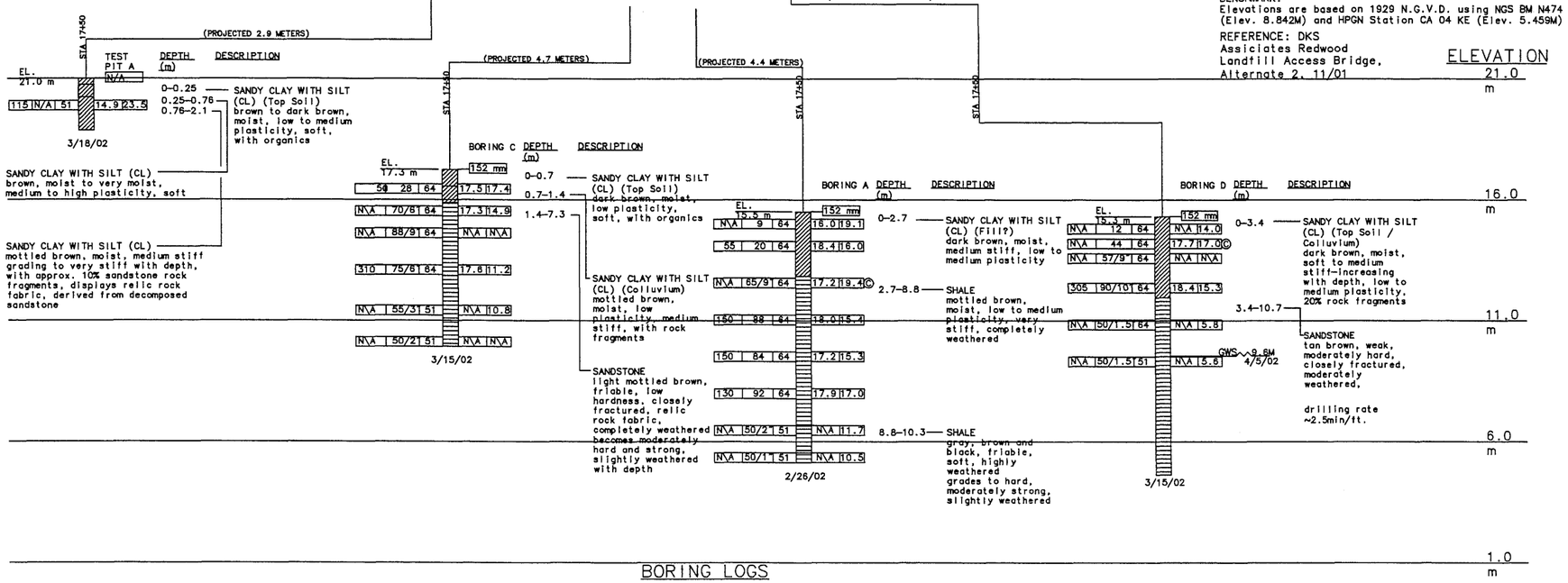
PLATE A-21

Plate A-21









BORING LOGS

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
04	Mrn	101	25.5		

REGISTERED CIVIL ENGINEER — DATE

REDWOOD LANDFILL OVERCROSSING (WIDEN)

LOG OF TEST BORINGS

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 03240
EA: 264071

BRIDGE No. 27-0115

Sheet 22 of 22

BENCHMARK:
Vertical Datum is NAVD 88 (meters). Benchmark is MRN-28, Elevation 8.725m As published by CALTRANS 03/07/01. Basis of bearing for this control schedule is N12 11'07"W between Monuments MRN-28 & GPS Point 207.

REFERENCE: DKS Assiciates Redwood Landfill Access Bridge, Alternate 2, 11/01

CSW Stuber-Stroeh Engineering Group, Inc. Construction Control Hard Copy, 12/14/04

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "N2" LINE
TB-A	335+30	211 ft Left
B-C	335+15	85 ft Left
B-A	335+15	0 ft C.L
B-D	335+15	140 ft Right

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

GEOLOGIC LEGEND: Qc = COLLUVIUM
KJ = FRANCISCAN COMPLEX, PREDOMINENTLY SANDSTONE

PLAN

BENCHMARK:
Elevations are based on 1929 N.G.V.D. using NGS BM N474 (Elev. 8.842M) and HPGN Station CA 04 KE (Elev. 5.459M)

REFERENCE: DKS Assiciates Redwood Landfill Access Bridge, Alternate 2, 11/01

NOTES:

1. 61 mm samples were taken using a Modified California split barrel sampler with an inside diameter (I.D.) of 61 mm and an outside daimeter (O.D.) of 76 mm.
2. A CME automatic hammer was used to advence the sampler using a 63.5 Kg hammer with a 762 mm drop.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	MRN	101	40.5/41.2		

4/4/05
GEOTECHNICAL PROFESSIONAL

REGISTERED PROFESSIONAL ENGINEER — MICHAEL MORRISOU — No. 2541 — Exp. 12/31/04 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

MILLER PACIFIC ENGINEERING GROUP
165 N. REDWOOD DR., SUITE 120
SAN RAFAEL, CALIFORNIA 94903

WASTE MANAGEMENT
8950 REDWOOD HIGHWAY
P.O. BOX 793
NOVATO, CALIFORNIA 94945

DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN BY
CHECKED BY MICHAEL P. MORISOLI
CHARLES I. PERRY
FIELD INVESTIGATION BY:
DATE:
PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
MICHAEL P. MORISOLI
PROJECT ENGINEER
BRIDGE NO. 27-0115
KILOMETER POST 41.1(25.5)
REDWOOD LANDFILL OVERCROSSING
LOG OF TEST BORINGS
CU
EA
REVISION DATES (PRELIMINARY STAGE ONLY) 12/7 4/1/05
SHEET OF

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
DISREGARD PRINTS BEARING EARLIER REVISION DATES →

Plate A-22

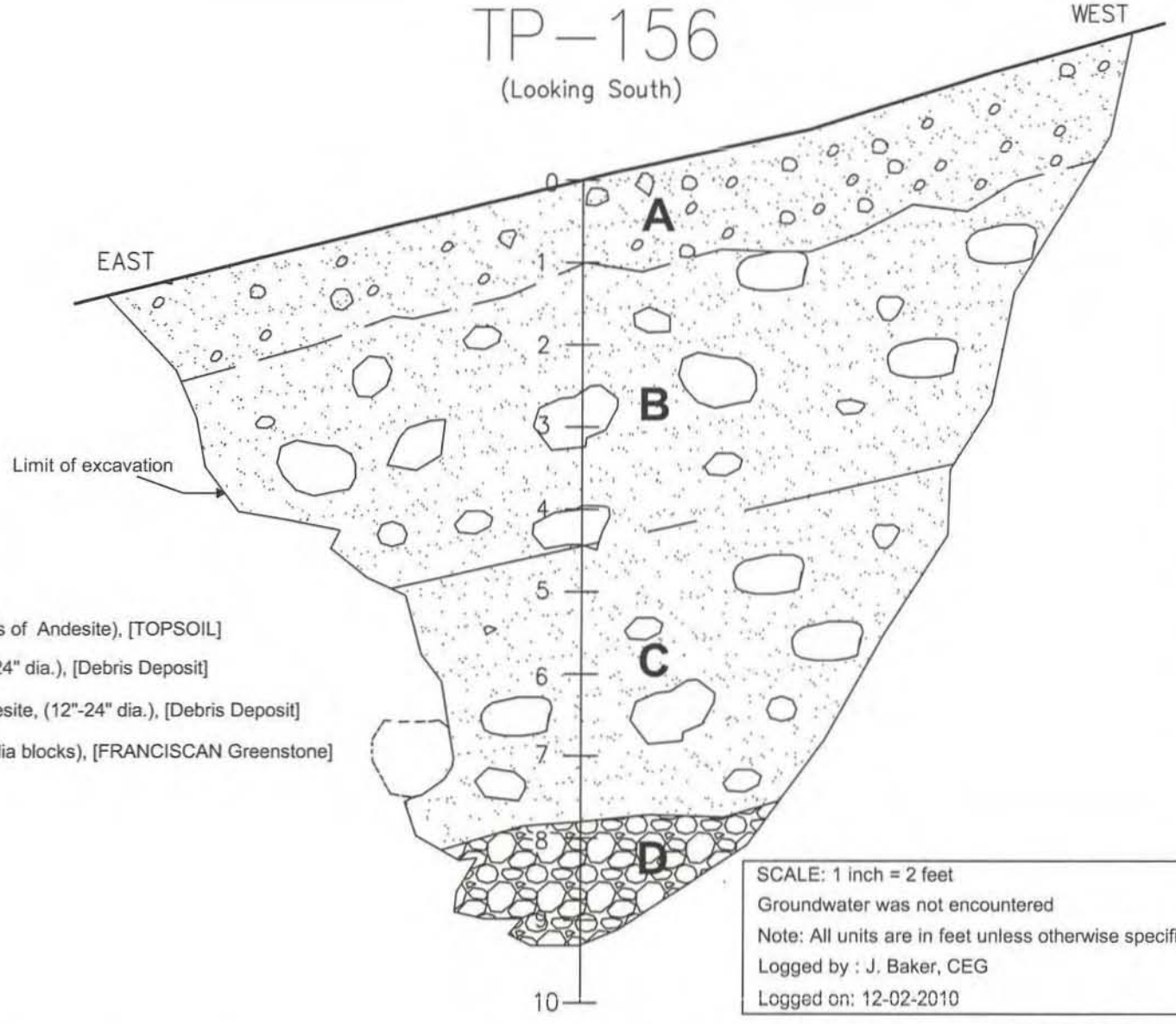
Station : 268+12

Offset : 232 feet Left of "N2" Line

Elevation : 39 ft.

TP–156

(Looking South)



DESCRIPTIONS OF UNITS

A : Dark brown, sandy SILT with gravel (rounded cobbles of Andesite), [TOPSOIL]

B : Light gray, SAND with large blocks of Andesite, (6"-24" dia.), [Debris Deposit]

C : Medium brown, silty SAND with large blocks of Andesite, (12"-24" dia.), [Debris Deposit]

D : Dark gray-green and white, sandy GRAVEL, (2"-4" dia blocks), [FRANCISCAN Greenstone]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 12-02-2010

LOG OF TEST PIT LOG TP-156

PARIKH CONSULTANTS, INC.

GEOTECHNICAL CONSULTANTS

MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT

MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR

PLATE NO. A-24

C:\Documents and Settings\goudtier\My Documents\TestPit_logs\TP-156.dwg, Layout2, 5/27/2011 9:17:05 AM, \\PARIKH-FILE\HP5200

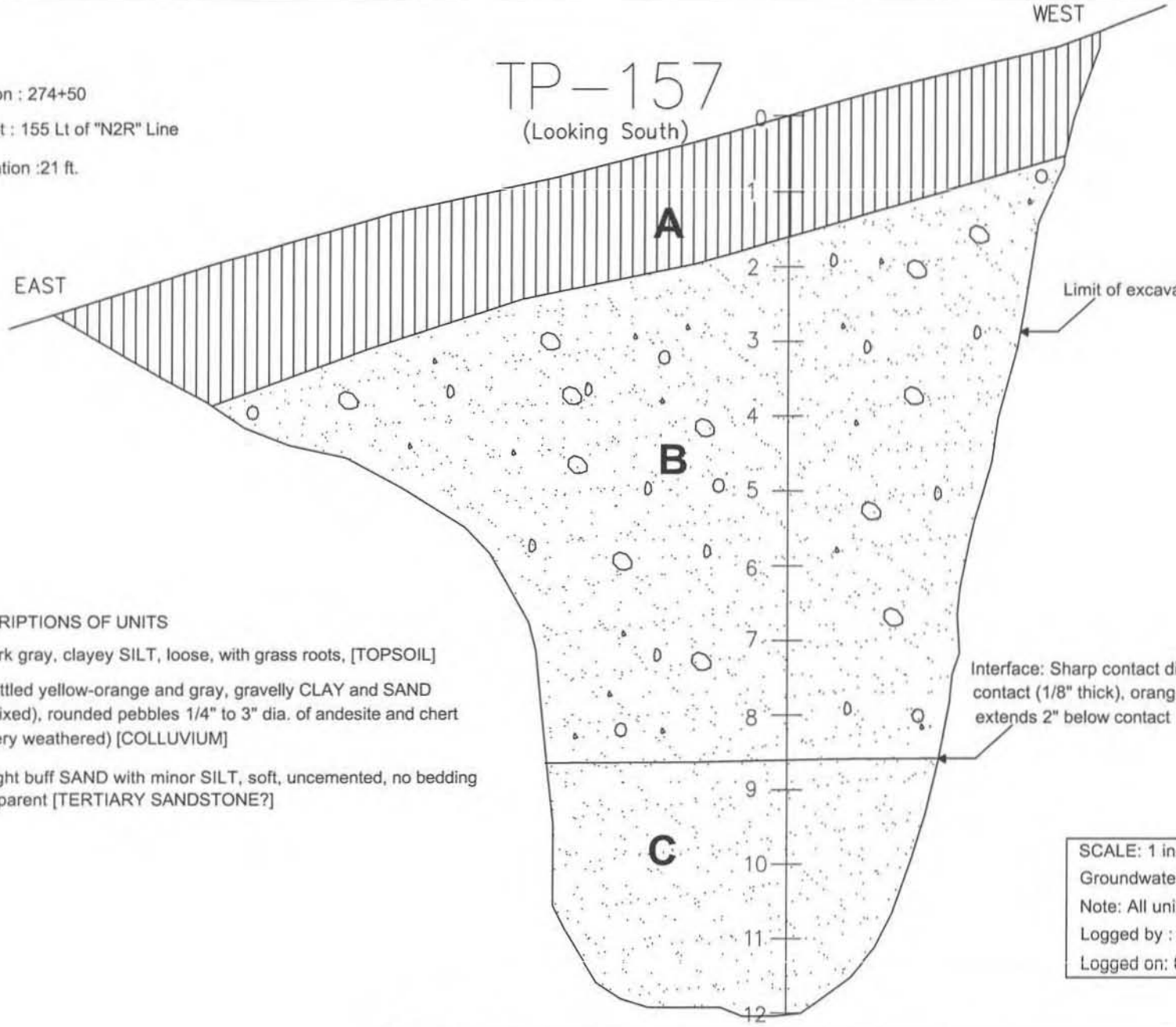
TP–157

(Looking South)

Station : 274+50

Offset : 155 Lt of "N2R" Line

Elevation :21 ft.



DESCRIPTIONS OF UNITS

A : Dark gray, clayey SILT, loose, with grass roots, [TOPSOIL]

B : Mottled yellow-orange and gray, gravelly CLAY and SAND (mixed), rounded pebbles 1/4" to 3" dia. of andesite and chert (very weathered) [COLLUVIUM]

C : Light buff SAND with minor SILT, soft, uncemented, no bedding apparent [TERTIARY SANDSTONE?]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

LOG OF TEST PIT LOG TP-157

PARIKH CONSULTANTS, INC.

GEOTECHNICAL CONSULTANTS

MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT

MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR

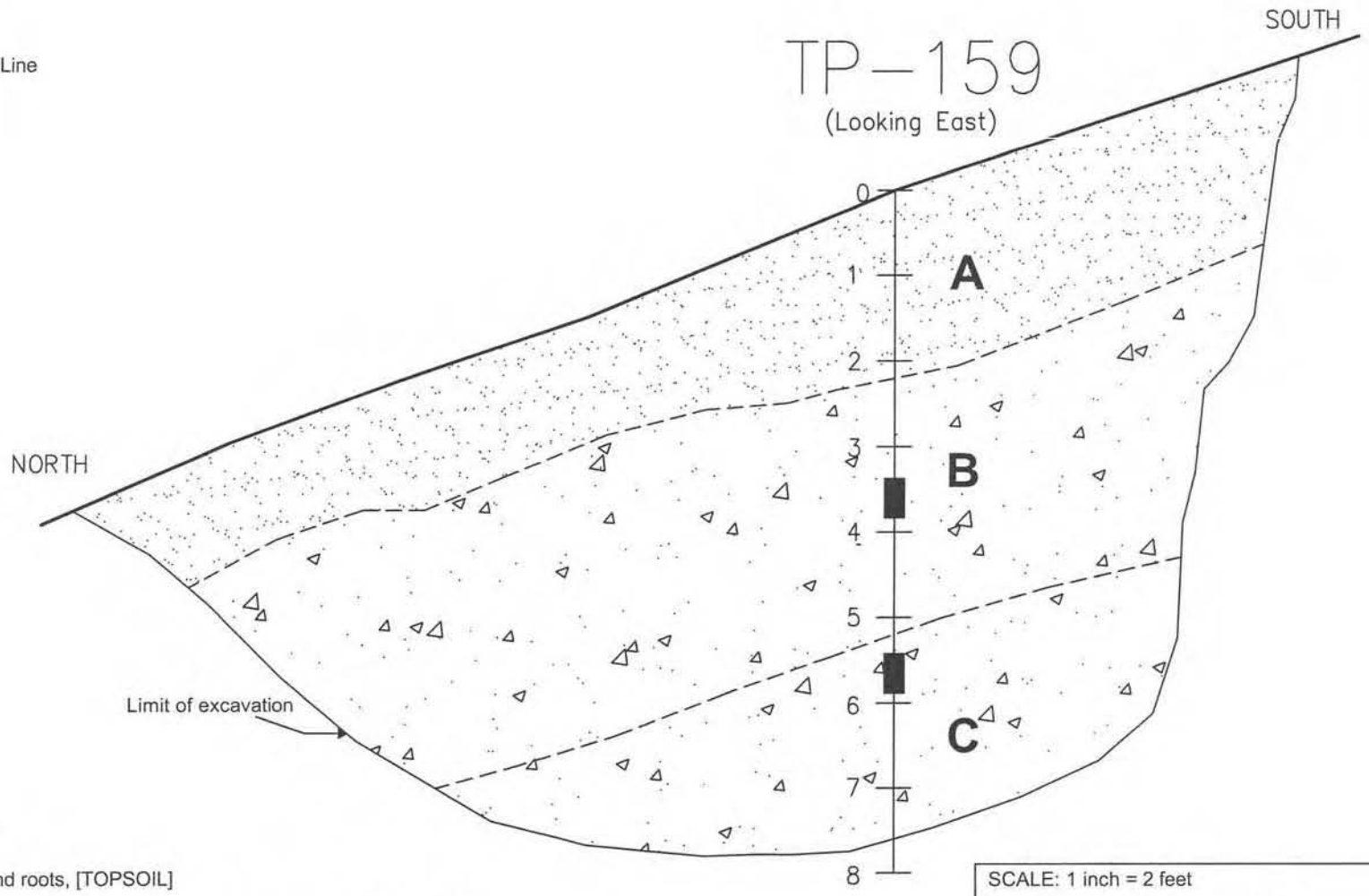
PLATE NO. A-25

C:\Documents and Settings\logoubler\My Documents\TestPit_logs\TP-157.dwg, Layout2, 5/27/2011 9:17:42 AM, \\PARIKH-FILE\HP5200

Station : 331+34

Offset : 214 feet Left of "N2" Line

Elevation : 74 ft.



DESCRIPTIONS OF UNITS

A : Dark brown, sandy SILT and roots, [TOPSOIL]

B : Mottled red brown and gray, clayey GRAVEL, dense, damp [Debris Flow Deposit]

C : Mottled yellow orange and gray, clayey GRAVEL, very dense, dry (1/4"-1/2" dia., clast, angular), [Debris Flow Deposit]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

LOG OF TEST PIT LOG TP-159

LEGEND

■1 Sample Location

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

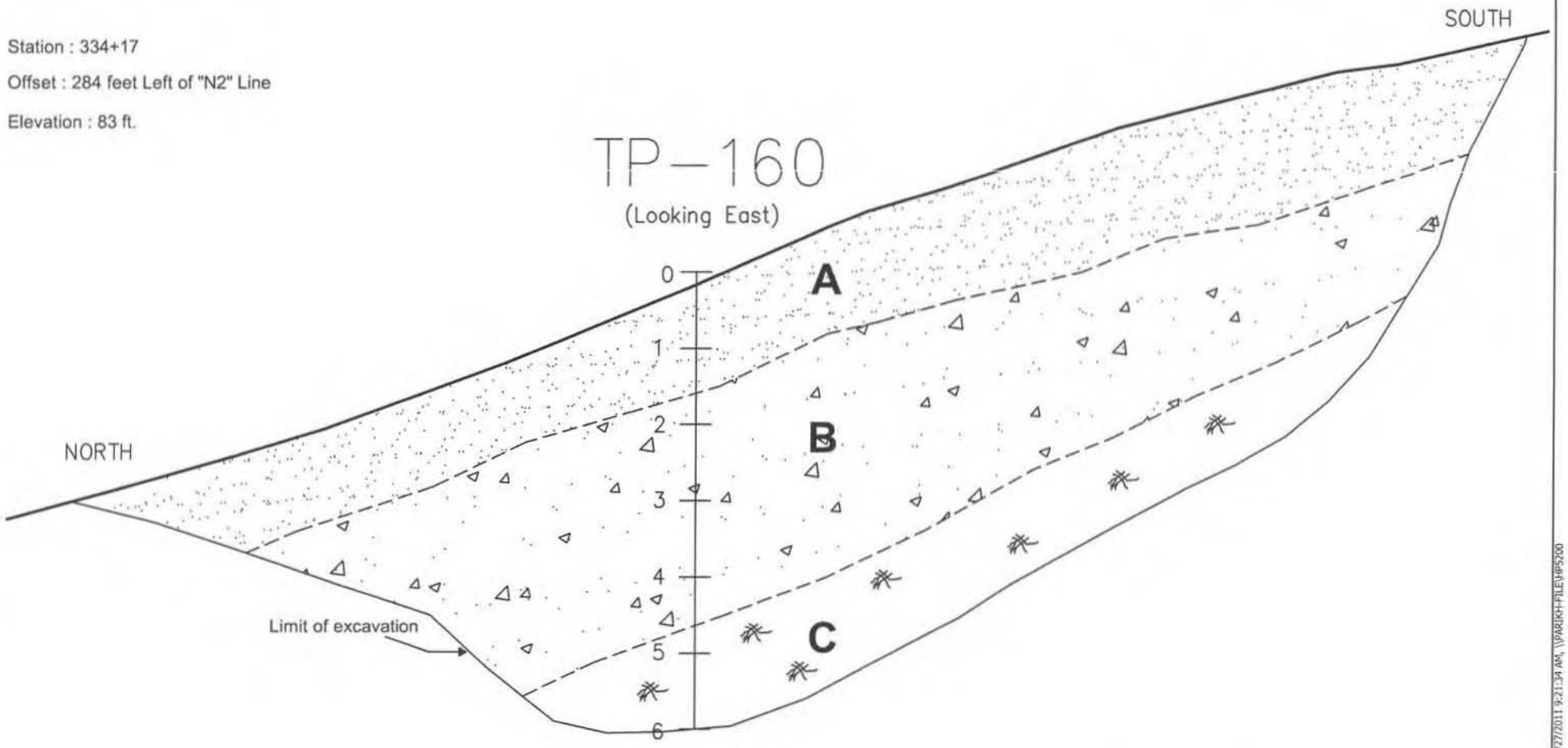
JOB NO.: 208140.GDR | PLATE NO. A-26

C:\Documents and Settings\logouthier\My Documents\TestPit_logs\TP-159.dwg, Layout2, 5/27/2011 9:18:34 AM, \\PARIKH-FILE\HP5200

Station : 334+17

Offset : 284 feet Left of "N2" Line

Elevation : 83 ft.



DESCRIPTIONS OF UNITS

A : Medium brown, sandy SILT with some gravel, [TOPSOIL]

B : Yellow-orange, sandy GRAVEL, damp (2"-4" dia.) [Debris Flow Deposit]

C : Dark yellow-orange, SANDSTONE, hard to very hard, dry, fractured [FRANCISCAN graywacke]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

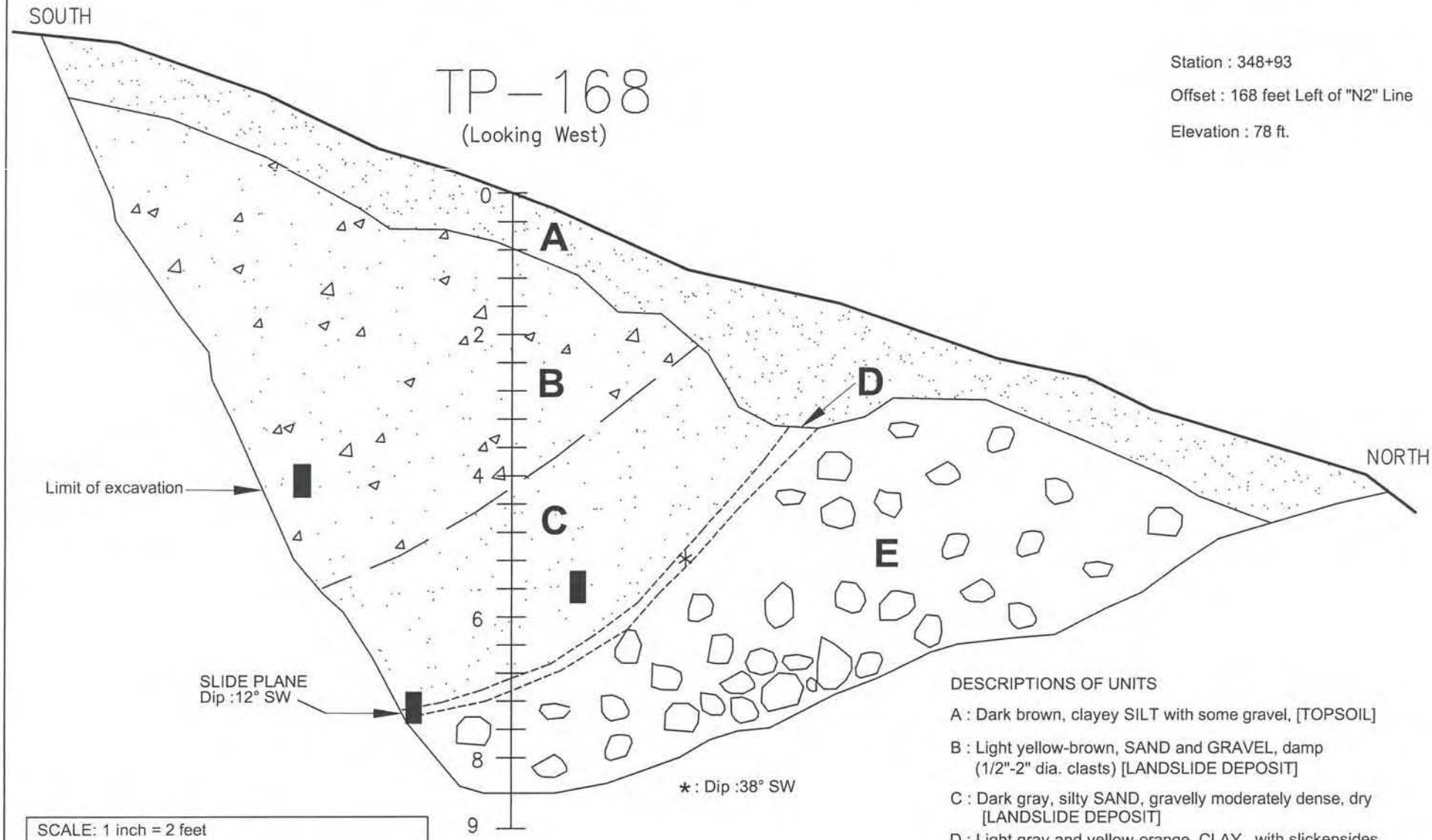
LOG OF TEST PIT LOG TP-160

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO. A-27

C:\Documents and Settings\logouthier\My Documents\TestPit_logs\TP-160.dwg, Layout2, 5/27/2011 9:21:34 AM, \\PARIKH-FILE\HP5200



DESCRIPTIONS OF UNITS

A : Dark brown, clayey SILT with some gravel, [TOPSOIL]

B : Light yellow-brown, SAND and GRAVEL, damp (1/2"-2" dia. clasts) [LANDSLIDE DEPOSIT]

C : Dark gray, silty SAND, gravelly moderately dense, dry [LANDSLIDE DEPOSIT]

D : Light gray and yellow-orange, CLAY, with slickensides [Slide Plane gouge]

E : Light yellow-orange, silty SANDSTONE boulders (6"-30" dia.), very hard in CLAY matrix [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

LEGEND
■1 Sample Location

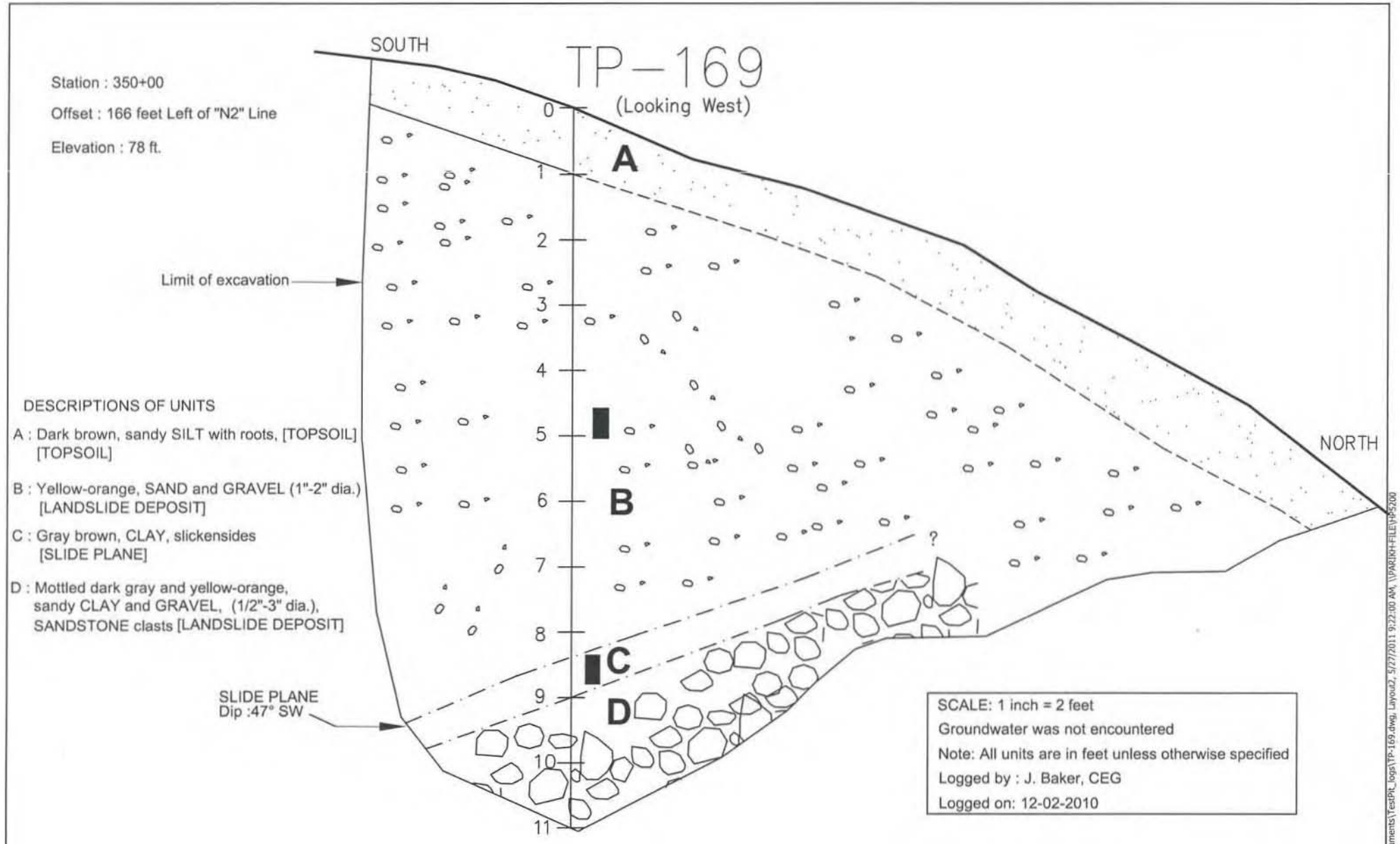
LOG OF TEST PIT TP-168

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO. A-28

C:\Documents and Settings\sgouthier\My Documents\TestPit_logs\TP-168.dwg, Layout2, 5/27/2011 9:21:47 AM, \\PARIKH-FILE\HP5200



LOG OF TEST PIT TP-169

LEGEND
■1 Sample Location

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO. A-29

C:\Documents and Settings\sgauthier\My Documents\TestPit_logs\TP-169.dwg, Layout2, 5/27/2011 9:22:00 AM, \\PARIKH-FILE\HP5200

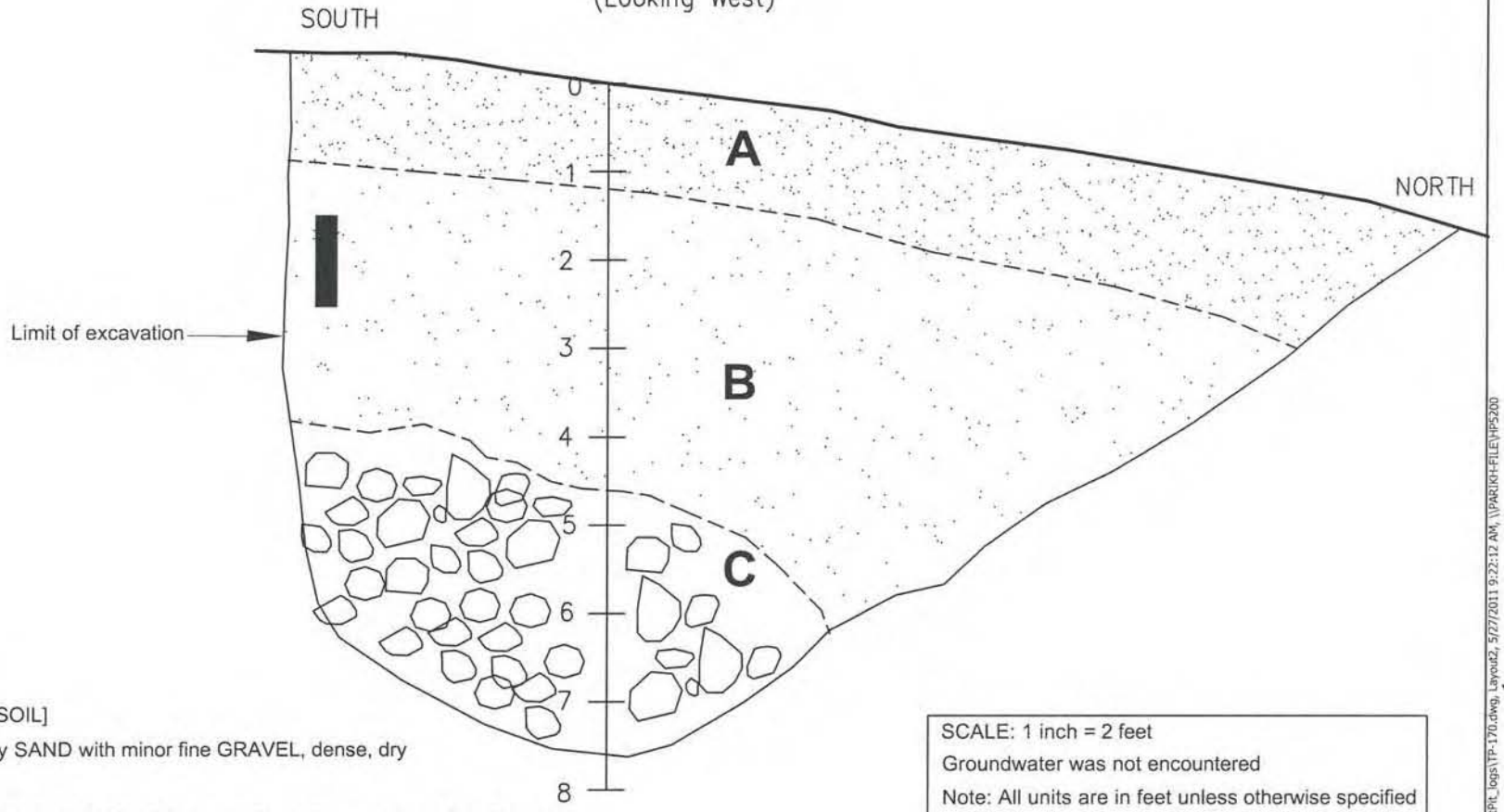
Station : 350+00

Offset : 155 feet Left of "N2" Line

Elevation : 81 ft.

TP–170

(Looking West)



DESCRIPTIONS OF UNITS

A : Dark brown, sandy SILT, [TOPSOIL]

B : Light yellow-orange, silty clayey SAND with minor fine GRAVEL, dense, dry [LANDSLIDE DEPOSIT]

C : Light yellow-orange, SANDSTONE blocks (1"-24") in CLAY matrix, very dense (hard blocks) [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

LOG OF TEST PIT TP-170

LEGEND

■1 Sample Location

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO. A-30

C:\Documents and Settings\gpathier\My Documents\TestPit_logs\TP-170.dwg, Layout2, 5/27/2011 9:22:12 AM, \\PARIKH-FILE\HP5200

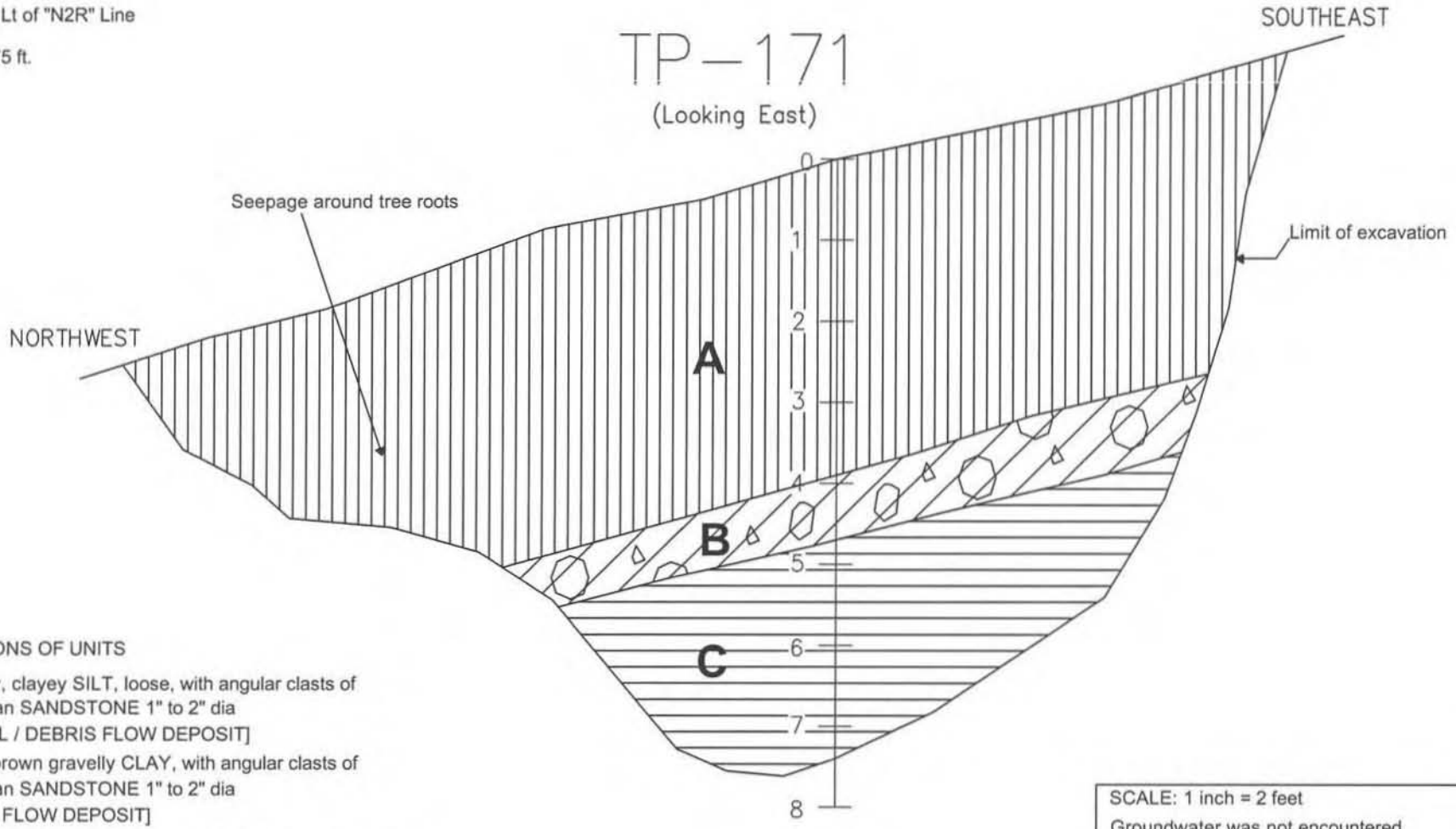
Station : 339+10

Offset : 300 Lt of "N2R" Line

Elevation : 75 ft.

TP–171

(Looking East)



DESCRIPTIONS OF UNITS

A : Dark gray, clayey SILT, loose, with angular clasts of Fransiscan SANDSTONE 1" to 2" dia [TOPSOIL / DEBRIS FLOW DEPOSIT]

B : Yellow - brown gravelly CLAY, with angular clasts of Franciscan SANDSTONE 1" to 2" dia [DEBRIS FLOW DEPOSIT]

C : Medium brown graywacke SANDSTONE, hard, fractured (bedding planes dip=22 degrees NNE) 2" to 4" spacing

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

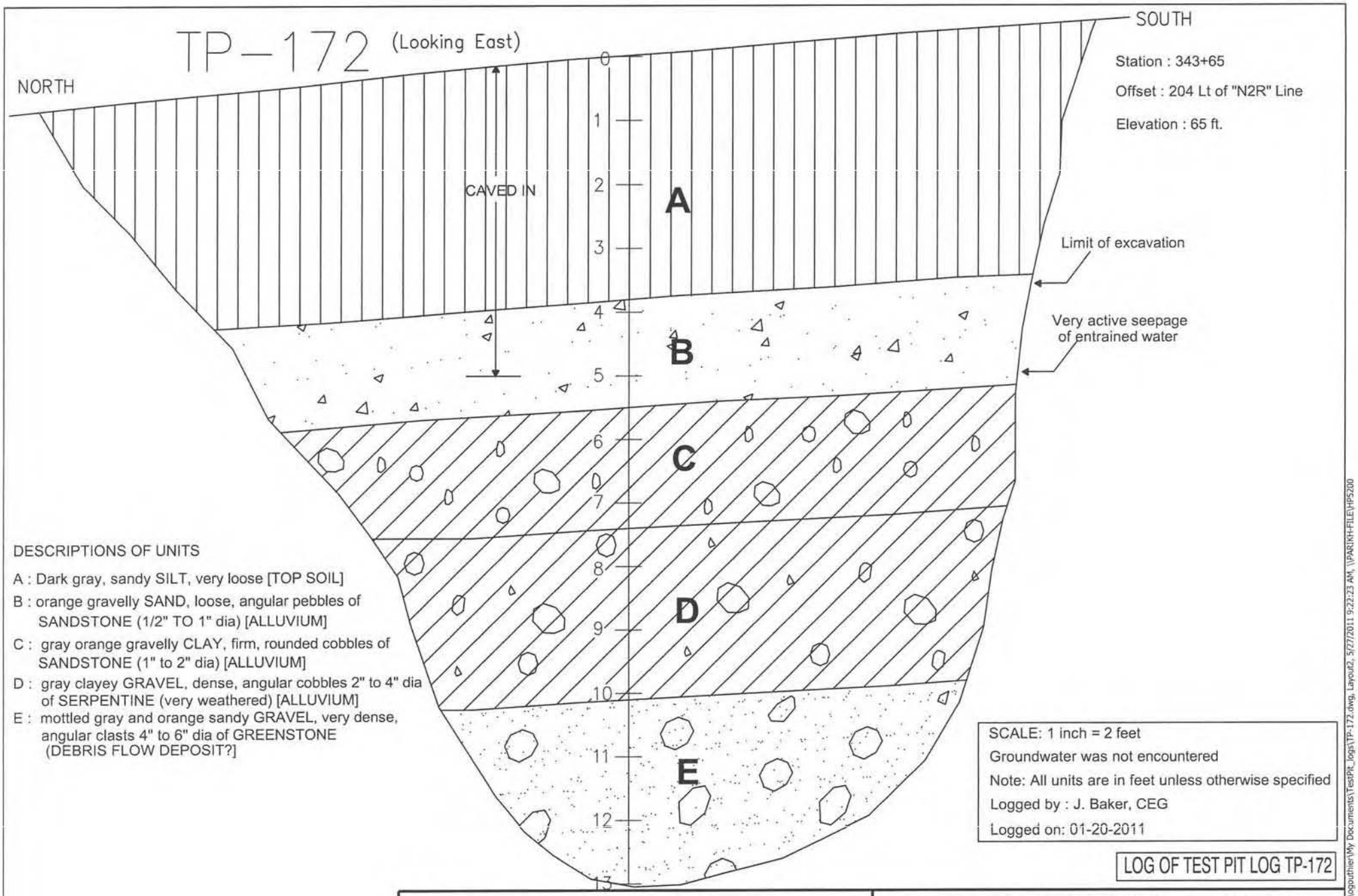
LOG OF TEST PIT TP-171

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO. A-31

S:\Ongoing\Partha Sircar\2008-140-GDR\Test Pit_logs\TP-171.dwg, Layout2, 8/4/2011 12:08:18 PM, \\PARIKH-FILE\HP5200



DESCRIPTIONS OF UNITS

A : Dark gray, sandy SILT, very loose [TOP SOIL]

B : orange gravelly SAND, loose, angular pebbles of SANDSTONE (1/2" TO 1" dia) [ALLUVIUM]

C : gray orange gravelly CLAY, firm, rounded cobbles of SANDSTONE (1" to 2" dia) [ALLUVIUM]

D : gray clayey GRAVEL, dense, angular cobbles 2" to 4" dia of SERPENTINE (very weathered) [ALLUVIUM]

E : mottled gray and orange sandy GRAVEL, very dense, angular clasts 4" to 6" dia of GREENSTONE (DEBRIS FLOW DEPOSIT?]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

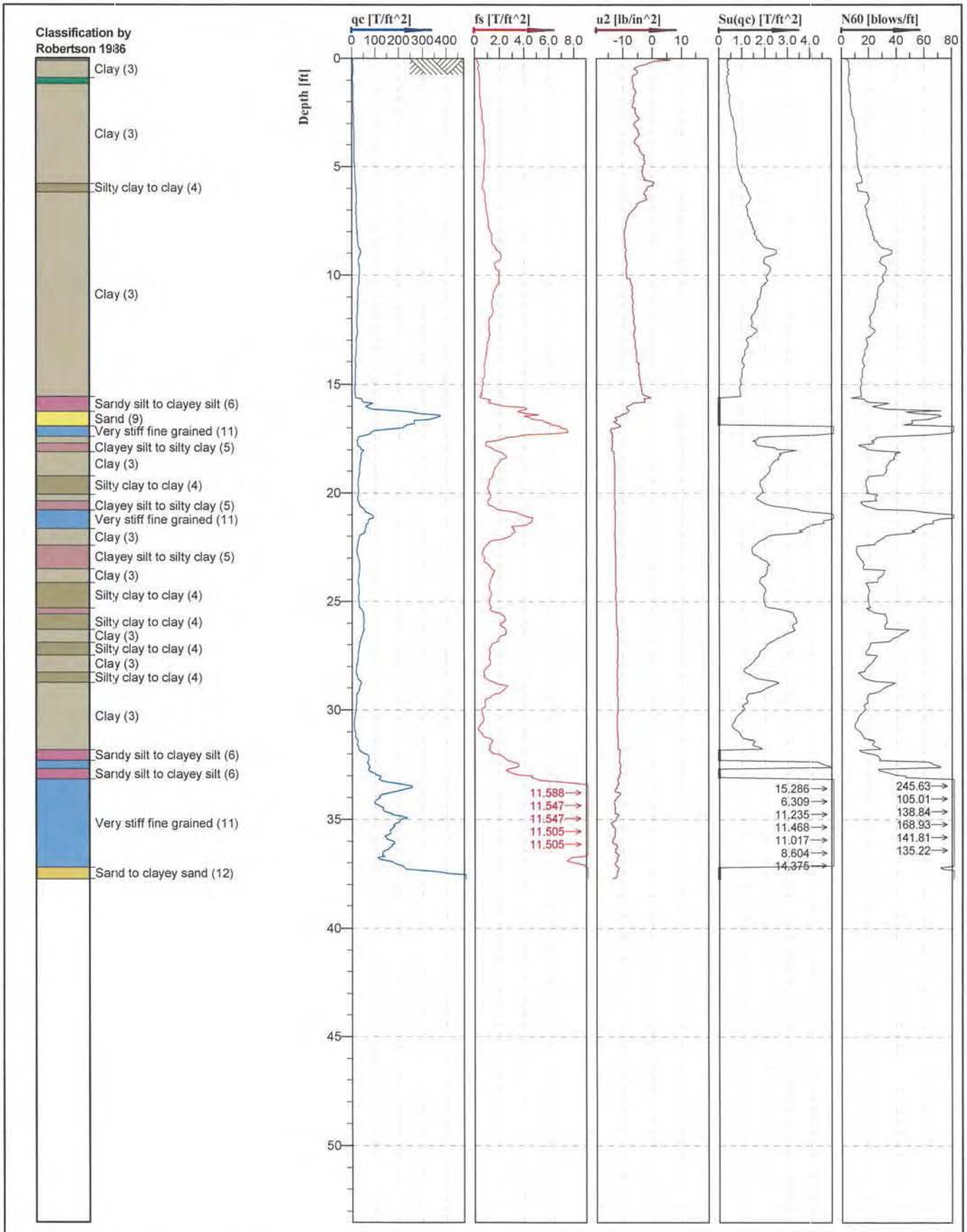
LOG OF TEST PIT LOG TP-172

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO. A-32

C:\Documents and Settings\gouthier\My Documents\TestPit_logs\TP-172.dwg, Layout2, 5/27/2011 9:22:23 AM, \\PARIKH-FILE\HP5200



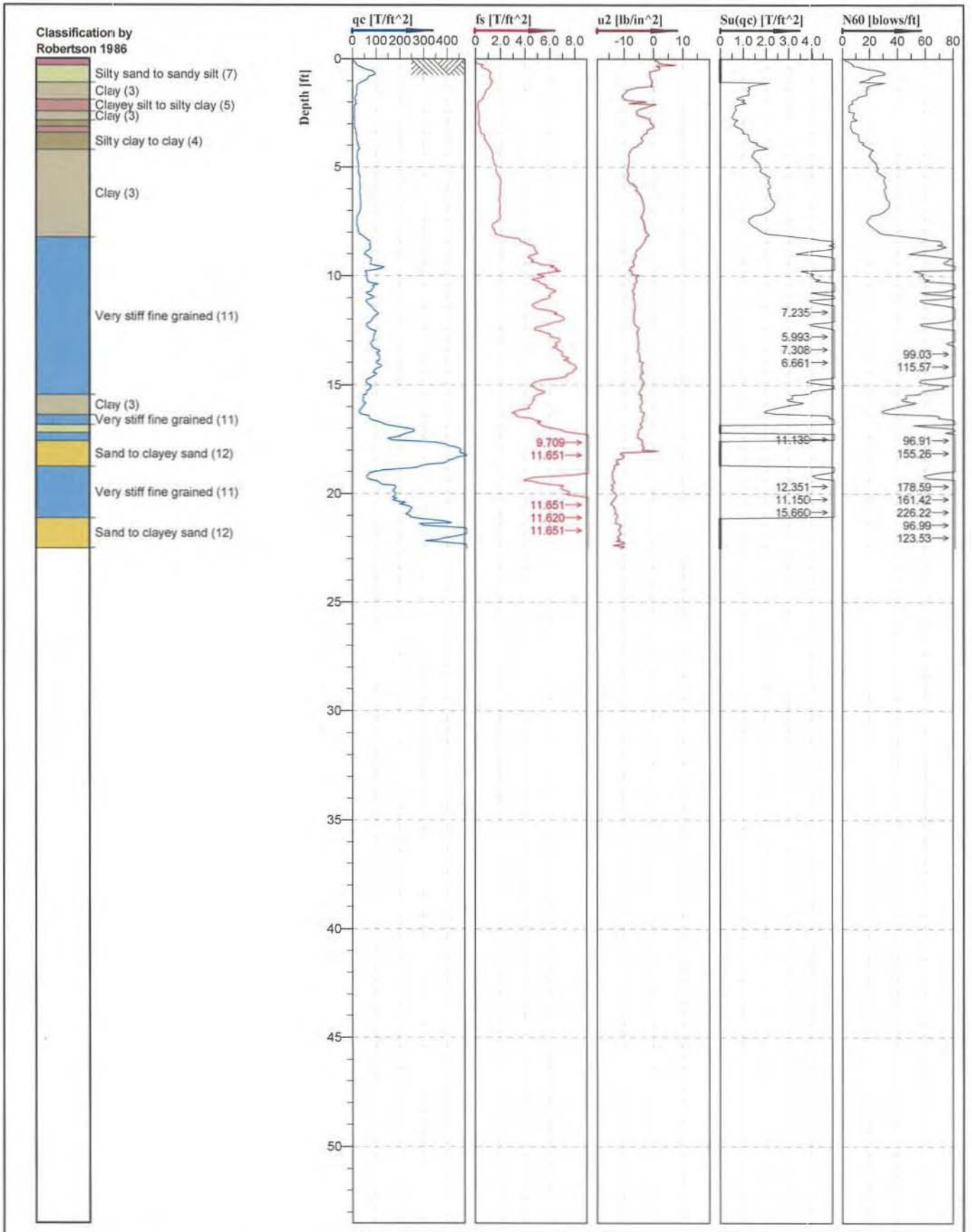
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Novato, California	Position:	Ground level:	Test no: S-1
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contract		Page: 1/1	Fig:
		File: S-1.cpd	

Plate A-33

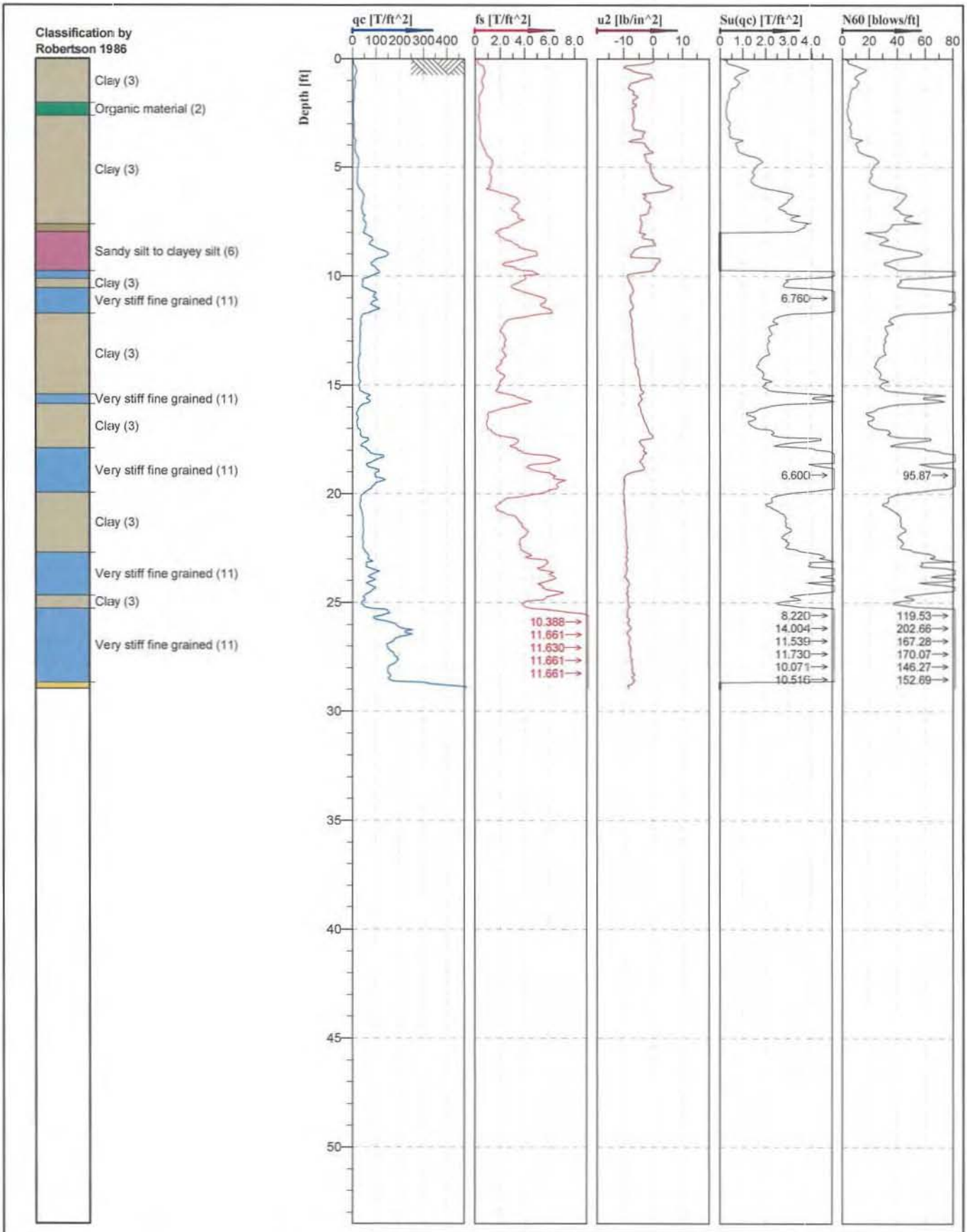


Location: Novato, California	Position:	Ground level:	Test no: S-2
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contract		Page: 1/1	Fig:
		File: S-2.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Plate A-34

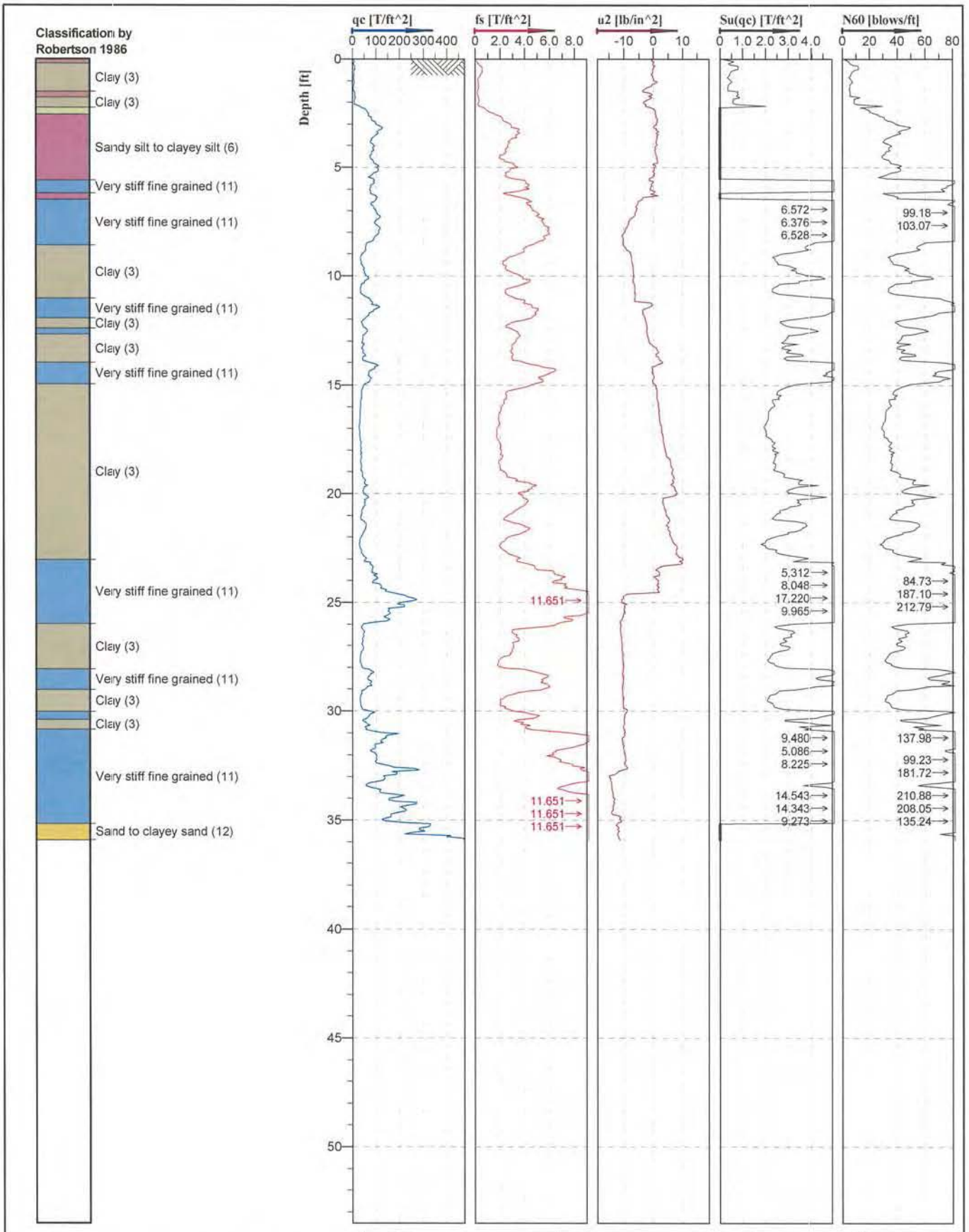


Location: Novato, California	Position:	Ground level:	Test no: S-3
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contract		Page: 1/1	Fig:
		File: S-3.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Location: Novato, California	Position:	Ground level:	Test no: S-4
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contracts		Page: 1/1	Fig:
		File: S-4.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Plate A-36

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2A and Plate B-2C, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results presented on Plate B-3A thru Plate B-3I, "Grain Size Distribution Curves".

Hydrometer Tests

Hydrometer tests (ASTM Test Method D 422) were performed on selected samples to aid in the classification. The results are presented on Plate B-3, " Grain Size Distribution Curves"

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The tests results are presented on Plate B-4A and Plate B-4V.

R-value Tests

R-value tests were performed on representative bulk samples for pavement design. The tests were performed according to California Test Method 301. The test results are presented on Plates B-5A thru B-5O.

APPENDIX B

LABORATORY TESTS

Consolidation Tests

Consolidation tests were performed on selected samples in accordance with ASTM Test Method D 2435. The test results are presented on the Plate B-6A thru Plate B-6C.

Consolidated Undrained Triaxial Compression Tests

Consolidated Undrained Triaxial Compression tests were performed on selected samples in accordance with ASTM Test Method D 4767. The test results are presented on the Plate B-7A thru Plate B-7B.

Unconfined Compression Tests

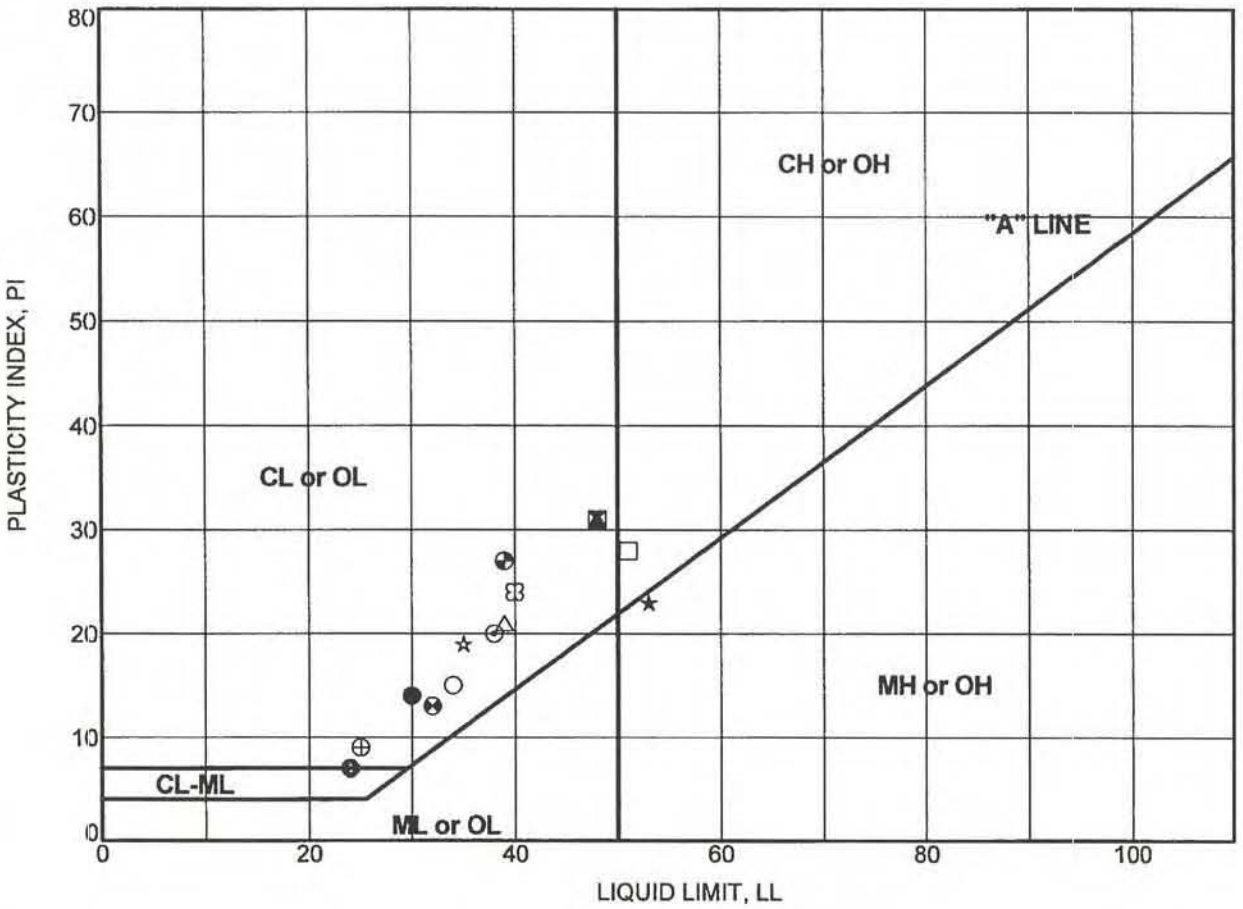
Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Test Borings" and Plate B-8A thru Plate B-8F.

Direct Shear Tests

Direct Shear tests were performed on selected undisturbed samples to determine the shear strength of a soil material in direct shear. The tests were performed according to ASTM Test Method D 3080 by Cooper. The test results are presented on Plate B-9A and Plate B-9B.

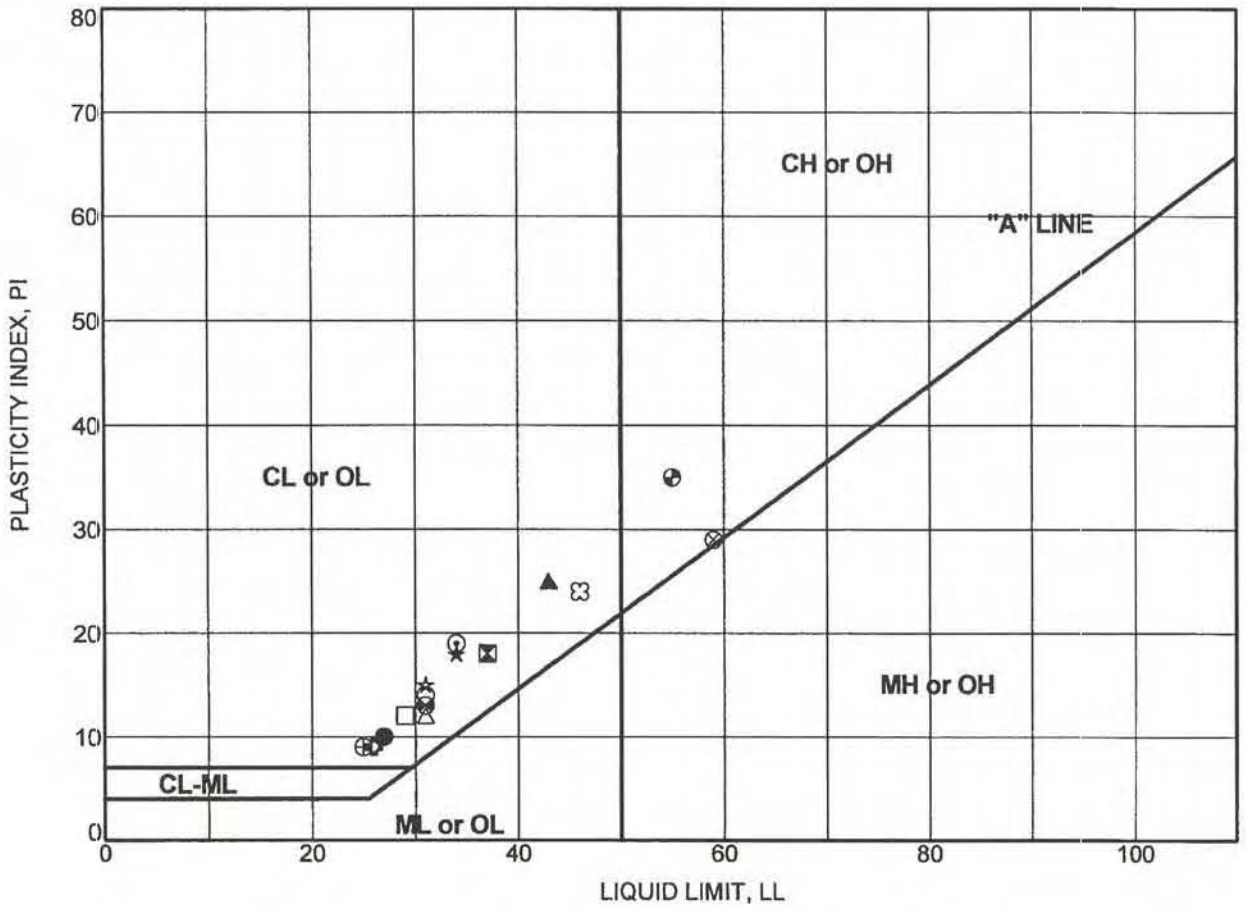
Unconsolidated Undrained Triaxial Compression Tests

Unconsolidated Undrained Triaxial Compression tests were performed on selected samples in accordance with ASTM Test Method D 4767. The test results are presented on the Plate B-10



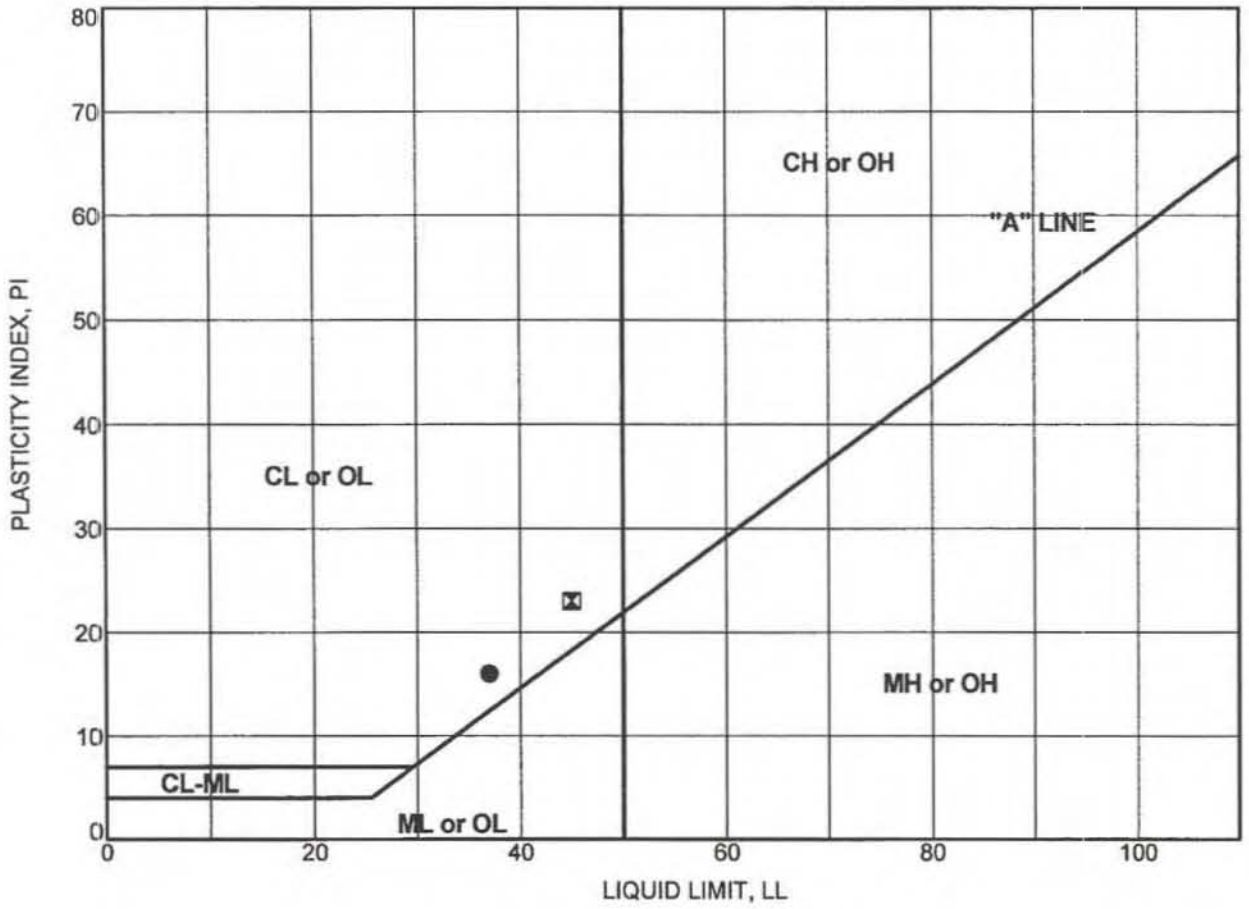
PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-104	MC-2	9.5	●	18	30	16	14	LEAN CLAY WITH SAND (CL)
A-09-105	MC-1	4.5	⊠	19	48	17	31	SANDY LEAN CLAY (CL)
A-09-106	MC-1	4.0	▲	19	48	17	31	LEAN CLAY (CL)
A-09-108	MC-1	2.0	★	15	53	30	23	ELASTIC SILT (MH)
A-09-110	MC-3	9.5	⊙	17	38	18	20	SANDY LEAN CLAY (CL)
A-09-114	MC-2	9.5	✿	17	24	17	7	SILTY CLAY (CL-ML)
A-09-117	BULK-1	5.0	○	15	34	19	15	LEAN CLAY (CL)
A-09-118	BULK-1	5.0	△	20	39	18	21	SANDY LEAN CLAY WITH GRAVEL (CL)
A-09-126	MC-1	4.5	⊗	15	24	17	7	SILTY CLAY (CL-ML)
A-09-128	BULK-1	5.0	⊕	13	25	16	9	SANDY LEAN CLAY (CL)
A-09-133	MC-2	9.5	□	16	51	23	28	FAT CLAY (CH)
A-09-134	MC-1	4.5	⊖	16	32	19	13	SANDY LEAN CLAY (CL)
A-09-137	SPT-2	9.5	◔	16	39	12	27	SILT (ML)
A-09-138	MC-1	4.0	☆	17	35	16	19	LEAN CLAY (CL)
A-09-139	MC-2	9.5	⊠	17	40	16	24	SANDY LEAN CLAY (CL)



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-144	MC-4	19.5	●	18	27	17	10	SANDY LEAN CLAY WITH GRAVEL (CL)
A-09-145	MC-2	9.5	⊠	19	37	19	18	LEAN CLAY (CL)
A-09-149	MC-2	9.5	▲	20	43	18	25	LEAN CLAY WITH SAND (CL)
A-09-150	MC-2	4.5	★	20	34	16	18	LEAN CLAY (CL)
A-09-151	MC-2	4.5	⊙	18	34	15	19	LEAN CLAY (CL)
A-09-152	BULK-1	5.0	✿	15	26	17	9	LEAN CLAY WITH SOME GRAVEL (CL)
A-09-154	BULK-1	5.0	○	19	31	17	14	LEAN CLAY (CL)
A-10-158A	MC-1	2.0	△	24	31	19	12	Lean CLAY (CL)
A-10-162A		32.5	⊗		59	30	29	FAT CLAY (CH)
A-10-163		10.5	⊕	22	25	16	9	LEAN CLAY WITH SAND (CL)
A-10-163		11.0	□	22	29	17	12	LEAN CLAY (CL)
A-10-163		16.0	◍	25	31	18	13	LEAN CLAY (CL)
A-10-164	MC-9	13.0	◒	22	55	20	35	SILTY SAND (SM)
R-10-165	MC-2	5.5	☆		31	16	15	LEAN CLAY (CL)
TP-159		3.6	⊠		46	22	24	LEAN CLAY (CL)



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
TP-159		5.6	●		37	21	16	CLAYEY SAND (SC)
TP-168		5.5	⊠		45	22	23	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

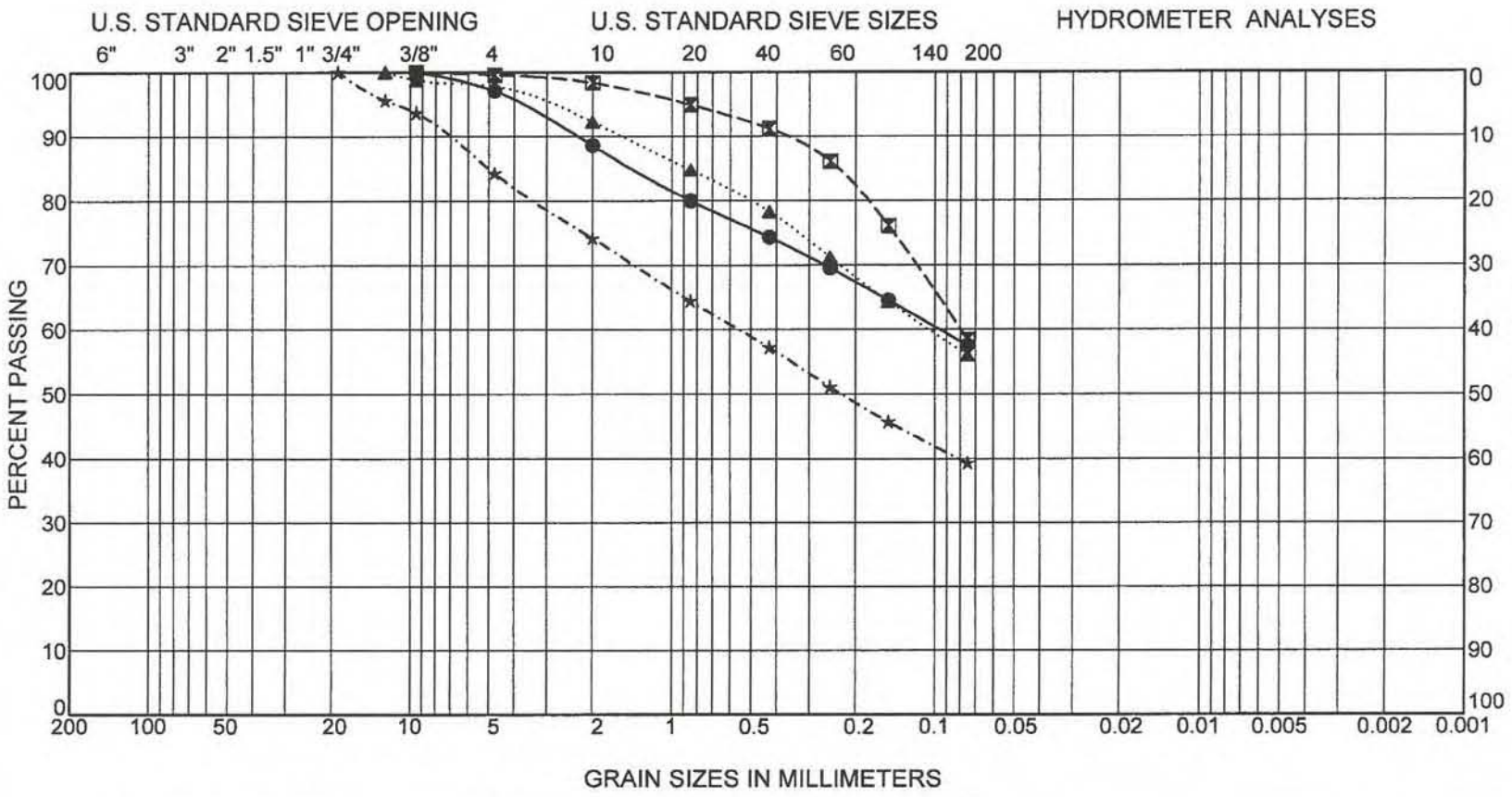
JOB NO: 208140.GDR

PLATE NO: B-2C

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-001	MC-2	4.5	●			SANDY LEAN CLAY (CL)
A-09-101	MC-2	4.5	⊠			SANDY LEAN CLAY (CL)
A-09-110	MC-2	4.5	▲			SANDY LEAN CLAY (CL)
A-09-111	MC-2	4.5	★			CLAYEY SAND WITH GRAVEL (SC)

JOB NO: 208140.GDR

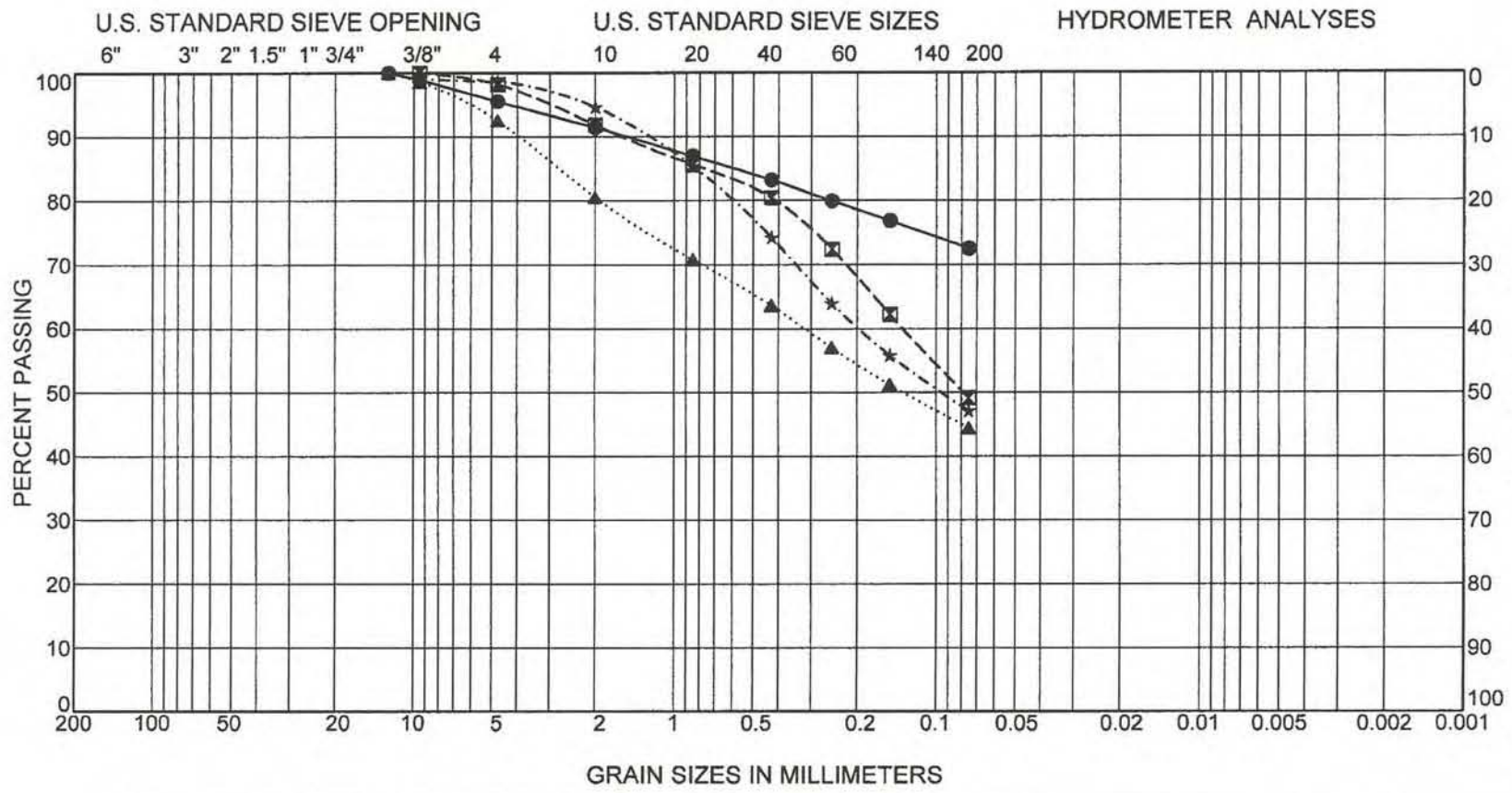
PLATE NO: B-3A

MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT

MARIN COUNTY, CALIFORNIA

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-111	MC-6	24.5	●			LEAN CLAY WITH SAND (CL)
A-09-114	MC-3	14.5	⊠			CLAYEY SAND (SC)
A-09-117	BULK-1	5.0	▲	34	15	LEAN CLAY (CL)
A-09-120	MC-2	9.5	★			CLAYEY SAND (SC)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

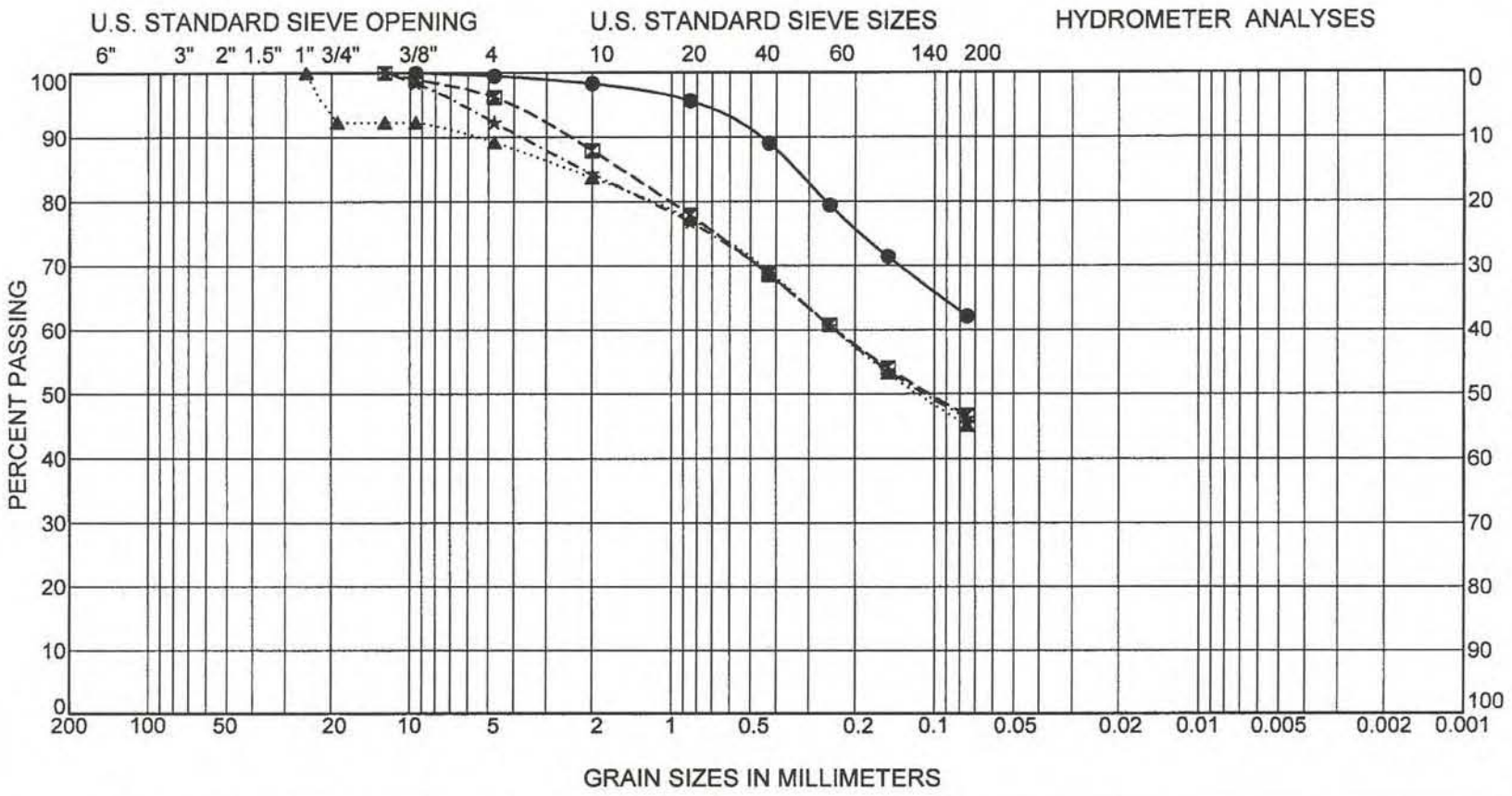
MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.GDR

PLATE NO: B-3B

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-120	MC-3	12.5	●			SANDY LEAN CLAY (CL)
A-09-129	MC-1	2.0	⊠			SILTY SAND WITH GRAVEL (SM)
A-09-135	MC-2	4.5	▲			SILTY SAND (SM)
A-09-136	MC-1	4.5	★			CLAYEY SAND (SC)

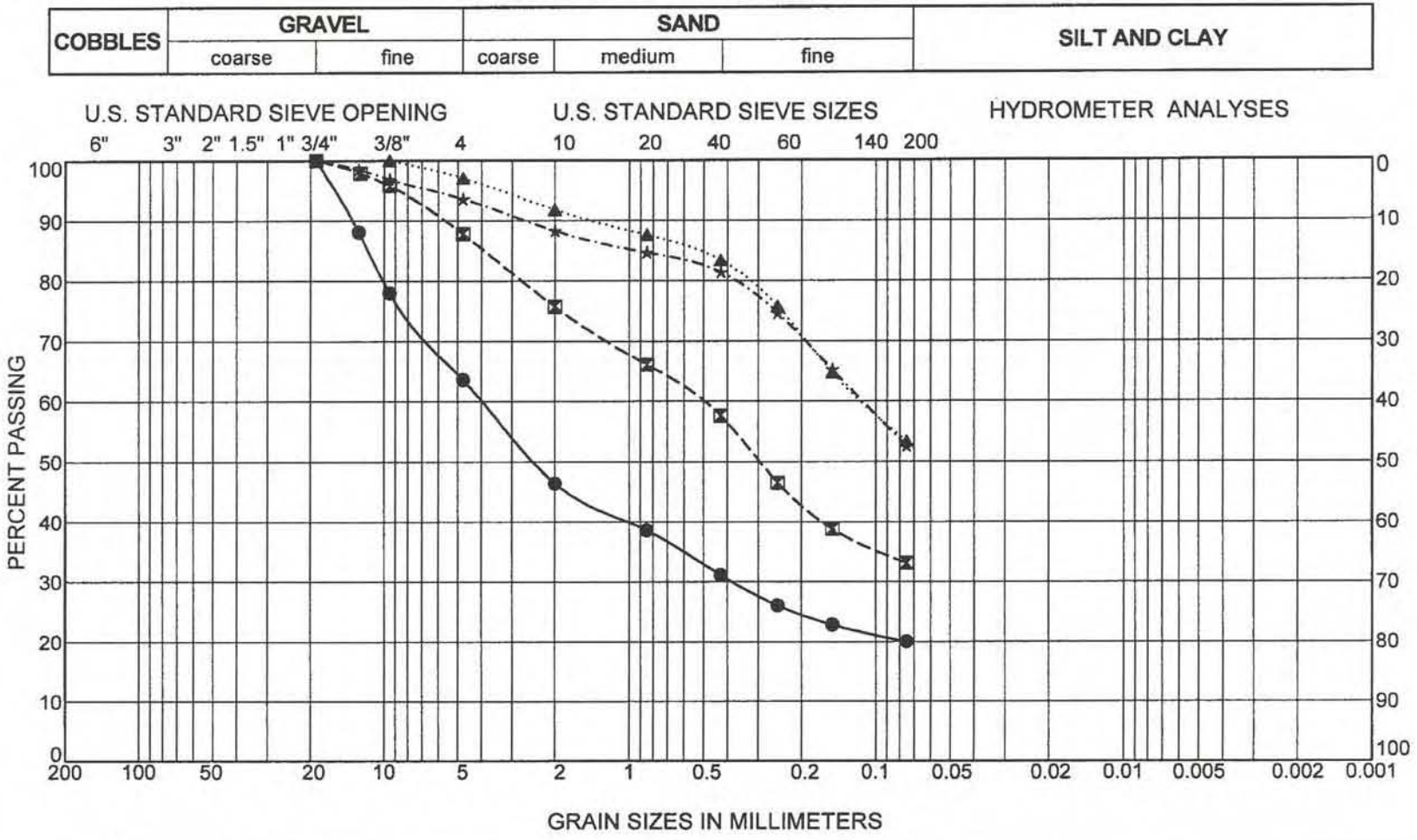
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.GDR

PLATE NO: B-3C

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-143	SPT-3	14.5	●			CLAYEY SAND WITH GRAVEL (SC)
A-09-143	SPT-5	24.5	⊠			CLAYEY SAND WITH GRAVEL (SC)
A-09-144	MC-1	4.0	▲			SANDY SILTY CLAY (CL-ML)
A-09-144	MC-5	24.5	★			SANDY LEAN CLAY WITH GRAVEL (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

JOB NO: 208140.GDR

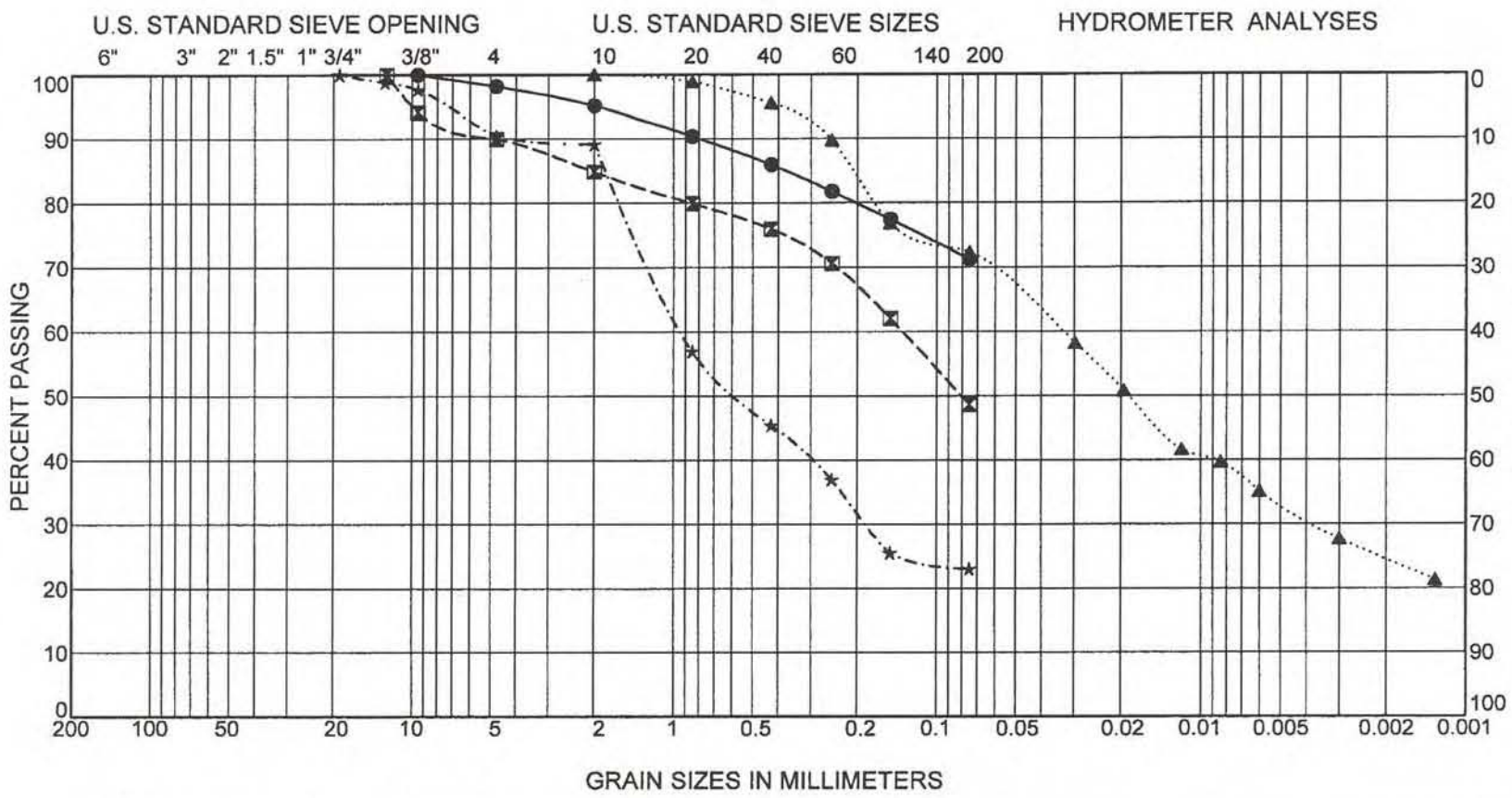
MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

PLATE NO: B-3D

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-146	MC-2	9.5	●			LEAN CLAY WITH SAND (CL)
A-09-153	BULK-1	5.0	⊠			SILTY SAND (SM)
A-10-162A	MC-1	3.5	▲			LEAN CLAY WITH SAND (CL)
A-10-162A	MC-2	5.0	★			SILTY SAND (SM)

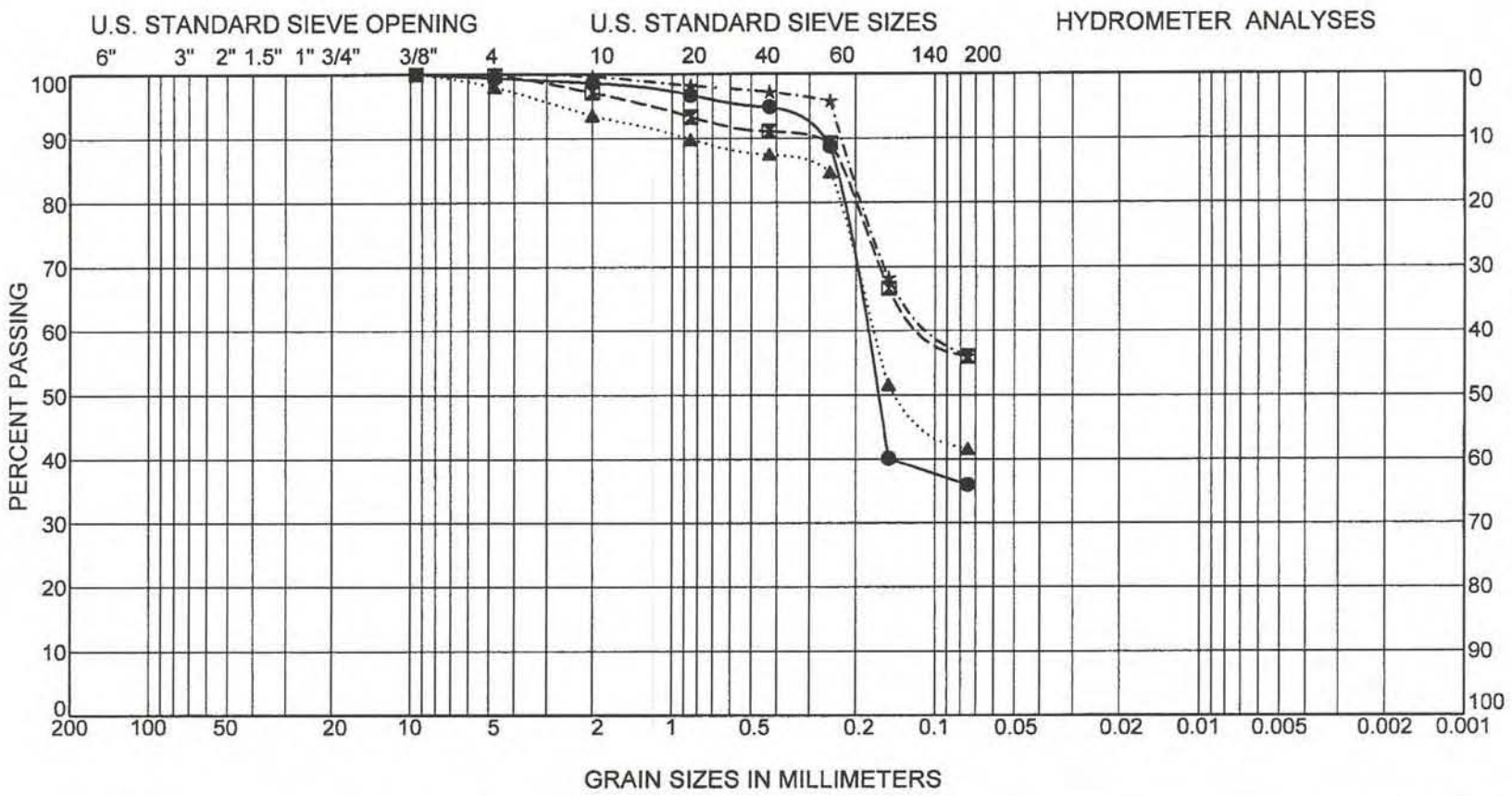
JOB NO: 208140.GDR

MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

PLATE NO: B-3E

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-10-162A	MC-3B	8.5	●			SILTY SAND (SM)
A-10-163		11.5	⊠			SANDY LEAN CLAY (CL)
A-10-163		14.5	▲			CLAYEY SAND (SC)
A-10-163		16.0	★	31	13	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

JOB NO: 208140.GDR

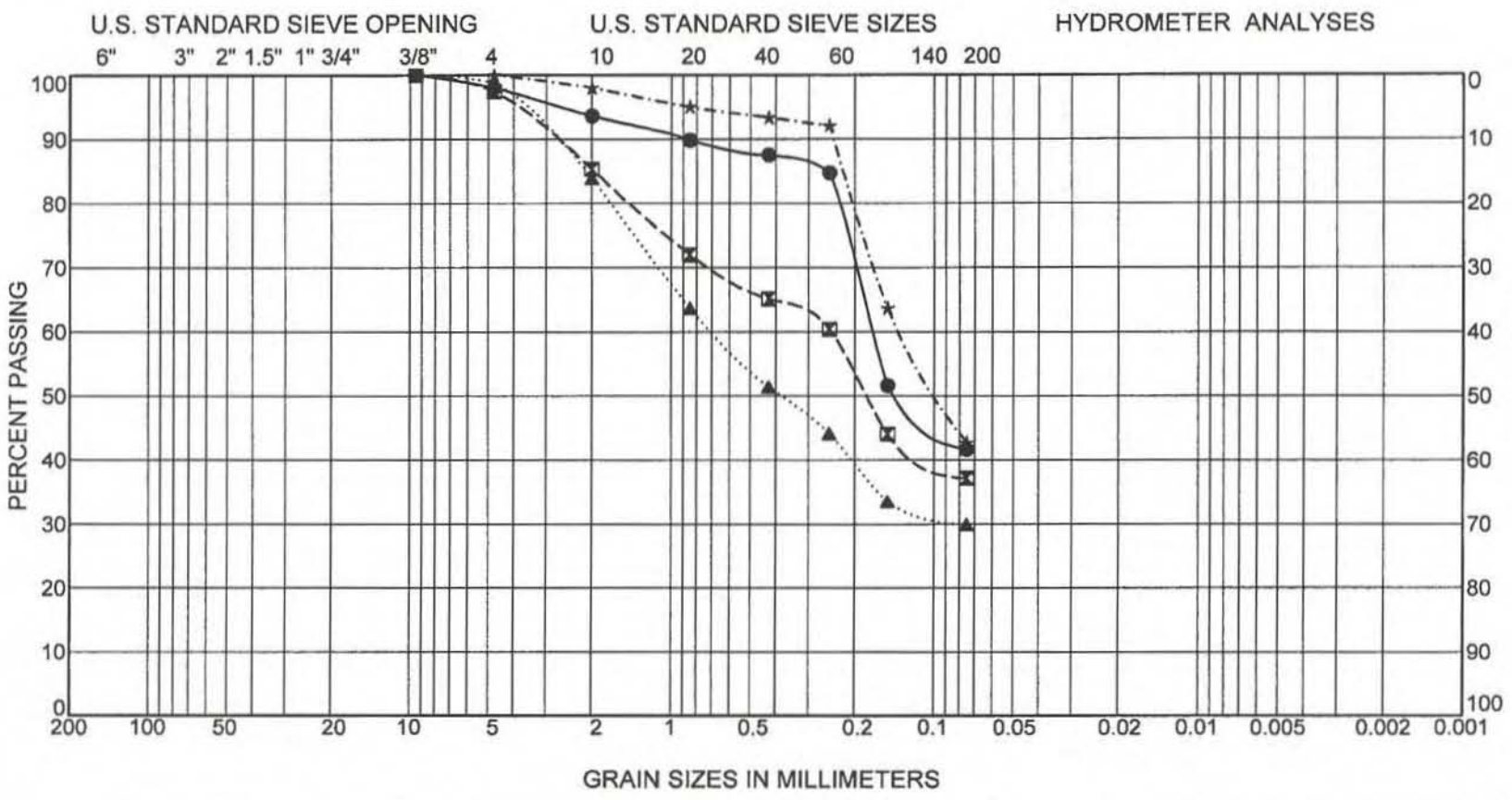
MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

PLATE NO: B-3F

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-10-163		16.5	●			SANDY LEAN CLAY (CL)
A-10-164	MC-4	5.5	⊠			CLAYEY SAND (SC)
A-10-164	MC-6	8.5	▲			CLAYEY SAND (SC)
A-10-164	MC-9	13.0	★	55	35	SILTY SAND (SM)

JOB NO: 208140.GDR

PLATE NO: B-3G

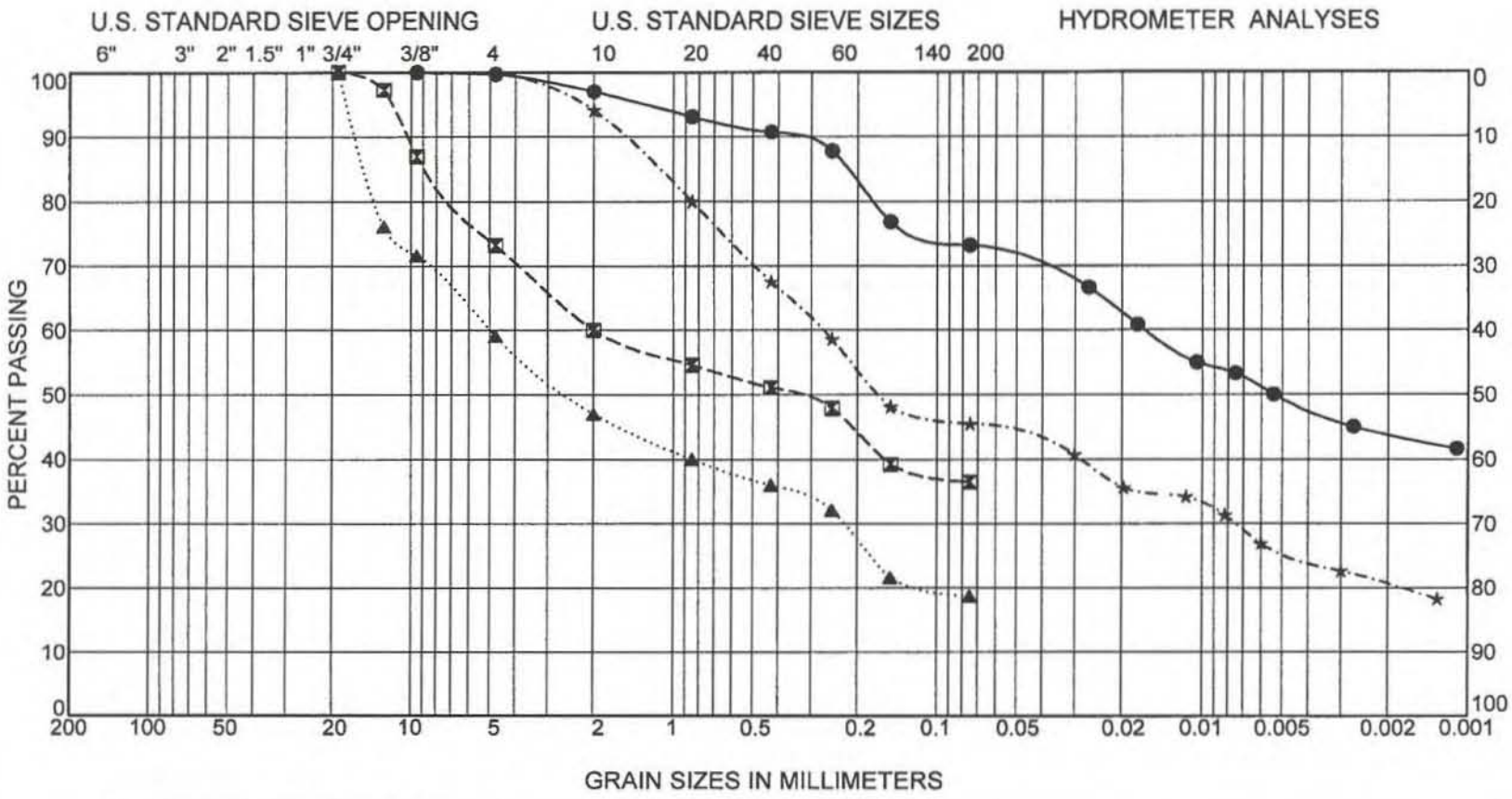
MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT

MARIN COUNTY, CALIFORNIA

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-10-164		15.5	●			FAT CLAY (CH)
R-10-167	MC-3	10.0	⊠			CLAYEY SAND WITH GRAVEL
R-10-167	MC-4	15.5	▲			CLAYEY GRAVEL WITH SAND (GC)
TP-159		5.6	★	37	16	CLAYEY SAND (SC)

JOB NO: 208140.GDR

PLATE NO: B-3H

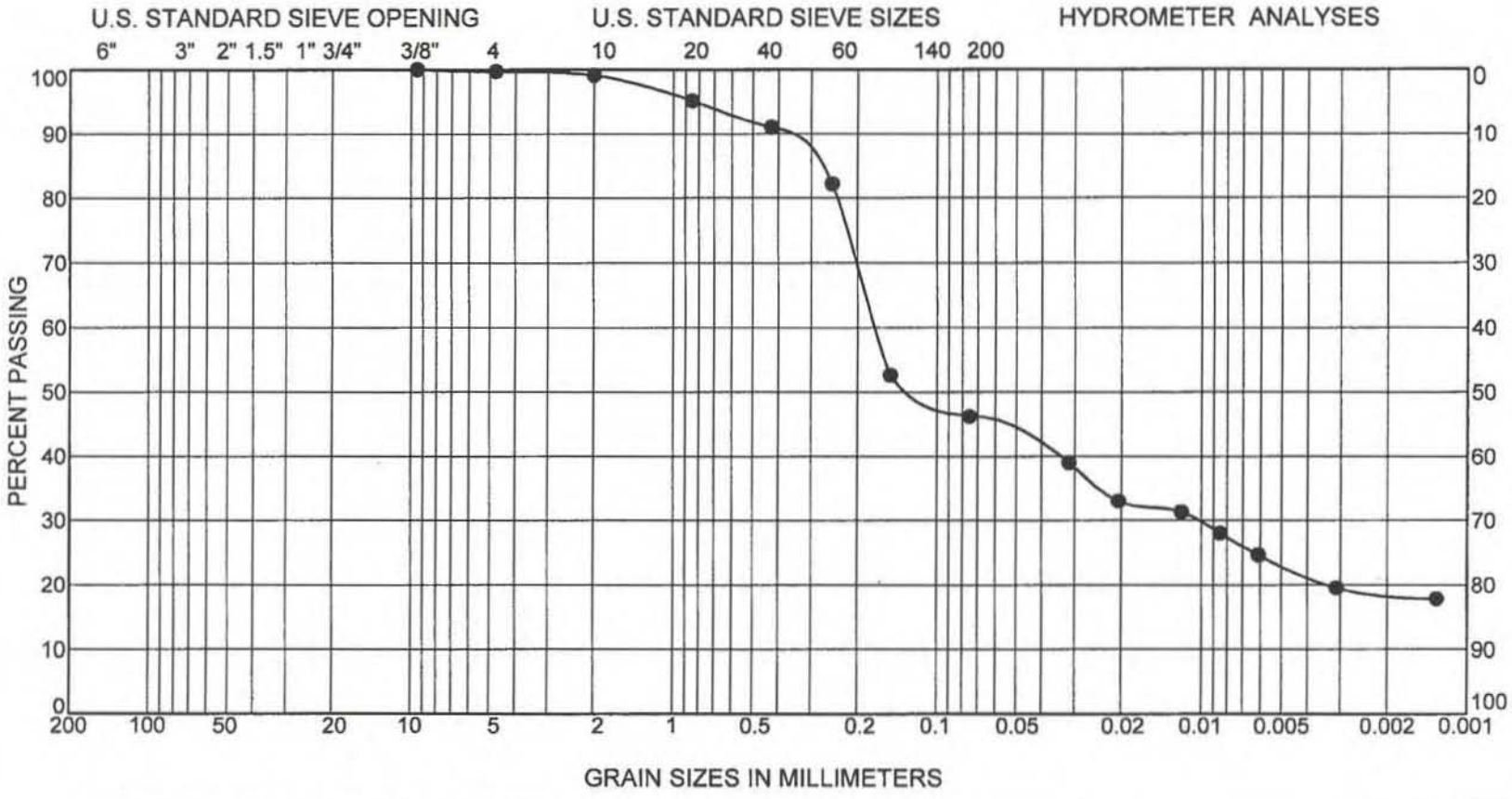
MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT

MARIN COUNTY, CALIFORNIA

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

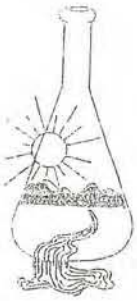


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
TP-170		1.5	●			CLAYEY SAND (SC)

MARIN-SONOMA NARROWS CONTRACT B-1REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.GDR

PLATE NO: B-3I



Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 08/05/2009
Date Submitted 07/29/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWD LAN Site ID : B102 #1@2".
Thank you for your business.

* For future reference to this analysis please use SUN # 56360-113793.

EVALUATION FOR SOIL CORROSION

Soil pH	5.79		
Minimum Resistivity	2.68 ohm-cm (x1000)		
Chloride	16.4 ppm	00.00164	%
Sulfate	0.4 ppm	00.00004	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4A

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : 103 @ 0-5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112898.

EVALUATION FOR SOIL CORROSION

Soil pH	5.81	
Minimum Resistivity	5.63 ohm-cm (x1000)	
Chloride	10.5 ppm	00.00105 %
Sulfate	10.1 ppm	00.00101 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 4 2009
By

PLATE NO.: B-4B

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : B104 #1 @ 4'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112902.

EVALUATION FOR SOIL CORROSION

Soil pH	6.71	
Minimum Resistivity	1.15 ohm-cm (x1000)	
Chloride	63.2 ppm	00.00632 %
Sulfate	27.6 ppm	00.00276 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 4 2009
By

PLATE NO.: B-4C

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : B114 #1@4'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112901.

EVALUATION FOR SOIL CORROSION

Soil pH	4.10		
Minimum Resistivity	7.50 ohm-cm (x1000)		
Chloride	8.0 ppm	00.00080	%
Sulfate	4.1 ppm	00.00041	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL - 4 2009
By

PLATE NO.: B-4D

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/15/2009
Date Submitted 07/09/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : REDWD. LND./208140.G Site ID : B116 (0-5').
Thank you for your business.

* For future reference to this analysis please use SUN # 56131-113258.

EVALUATION FOR SOIL CORROSION

Soil pH	7.47	
Minimum Resistivity	2.01 ohm-cm (x1000)	
Chloride	20.8 ppm	00.00208 %
Sulfate	24.2 ppm	00.00242 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 18 2009
By

PLATE NO.: B-4E

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney RW
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B117 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113590.

EVALUATION FOR SOIL CORROSION

Soil pH	3.72	
Minimum Resistivity	2.68 ohm-cm (x1000)	
Chloride	31.8 ppm	00.00318 %
Sulfate	18.2 ppm	00.00182 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

PLATE NO.: B-4F

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/15/2009
Date Submitted 07/09/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : REDWD. LND./208140.G Site ID : B124.
Thank you for your business.

* For future reference to this analysis please use SUN # 56131-113259.

EVALUATION FOR SOIL CORROSION

Soil pH	7.74	
Minimum Resistivity	2.47 ohm-cm (x1000)	
Chloride	21.5 ppm	00.00215 %
Sulfate	43.5 ppm	00.00435 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 18 2009
By

PLATE NO.: B-4G

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B126#2 @ 9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113087.

EVALUATION FOR SOIL CORROSION

Soil pH	6.48	
Minimum Resistivity	1.31 ohm-cm (x1000)	
Chloride	28.3 ppm	00.00283 %
Sulfate	28.1 ppm	00.00281 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009
By

PLATE NO.: B-4H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/15/2009
Date Submitted 07/09/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager RH

The reported analysis was requested for the following location:
Location : REDWD. LND./208140.G Site ID : B128.
Thank you for your business.

* For future reference to this analysis please use SUN # 56131-113260.

EVALUATION FOR SOIL CORROSION

Soil pH	6.76	
Minimum Resistivity	5.36 ohm-cm (x1000)	
Chloride	15.4 ppm	00.00154 %
Sulfate	16.9 ppm	00.00169 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 18 2009
By

PLATE NO.: B-4I

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Cliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B129 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113591.

EVALUATION FOR SOIL CORROSION

Soil pH	5.18	
Minimum Resistivity	5.36 ohm-cm (x1000)	
Chloride	13.4 ppm	00.00134 %
Sulfate	1.9 ppm	00.00019 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

PLATE NO.: B-4J

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B134#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113085.

EVALUATION FOR SOIL CORROSION

Soil pH	5.47		
Minimum Resistivity	2.57 ohm-cm (x1000)		
Chloride	20.3 ppm	00.00203	%
Sulfate	15.9 ppm	00.00159	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 1 1 2009
By

PLATE NO.: B-4K

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B135 #3@9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113589.

EVALUATION FOR SOIL CORROSION

Soil pH	4.23	
Minimum Resistivity	2.68 ohm-cm (x1000)	
Chloride	57.1 ppm	00.00571 %
Sulfate	6.4 ppm	00.00064 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4L

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : 140 @ 0-5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112900.

EVALUATION FOR SOIL CORROSION

Soil pH	5.97	
Minimum Resistivity	3.48 ohm-cm (x1000)	
Chloride	17.2 ppm	00.00172 %
Sulfate	11.0 ppm	00.00110 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 4 2009
By

PLATE NO.: B-4N

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B137#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113084.

EVALUATION FOR SOIL CORROSION

Soil pH	6.73	
Minimum Resistivity	1.05 ohm-cm (x1000)	
Chloride	56.1 ppm	00.00561 %
Sulfate	23.2 ppm	00.00232 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009

PLATE NO.: B-4M

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B143#2 @ 9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113086.

EVALUATION FOR SOIL CORROSION

Soil pH	6.15	
Minimum Resistivity	1.88 ohm-cm (x1000)	
Chloride	19.5 ppm	00.00195 %
Sulfate	4.9 ppm	00.00049 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009

PLATE NO.: B-4O

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : 145 @ 0-5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112899.

EVALUATION FOR SOIL CORROSION

Soil pH	5.58		
Minimum Resistivity	4.02 ohm-cm (x1000)		
Chloride	9.7 ppm	00.00097	%
Sulfate	4.4 ppm	00.00044	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL - 4 2009
By

PLATE NO.: B-4P

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/15/2009
Date Submitted 07/09/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager RH

The reported analysis was requested for the following location:
Location : REDWD. LND./208140.G Site ID : B147.
Thank you for your business.

* For future reference to this analysis please use SUN # 56131-113261.

EVALUATION FOR SOIL CORROSION

Soil pH	7.53	
Minimum Resistivity	0.91 ohm-cm (x1000)	
Chloride	41.6 ppm	00.00416 %
Sulfate	47.7 ppm	00.00477 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 18 2009
By

PLATE NO.: B-4R

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B149 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113592.

EVALUATION FOR SOIL CORROSION

Soil pH	6.78	
Minimum Resistivity	0.54 ohm-cm (x1000)	
Chloride	137.2 ppm	00.01372 %
Sulfate	109.7 ppm	00.01097 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

PLATE NO.: B-4S

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B151#3@9.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113588.

EVALUATION FOR SOIL CORROSION

Soil pH	6.09	
Minimum Resistivity	0.94 ohm-cm (x1000)	
Chloride	42.9 ppm	00.00429 %
Sulfate	37.5 ppm	00.00375 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

PLATE NO.: B-4T

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 352-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B146#1 @ 4'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113088.

EVALUATION FOR SOIL CORROSION

Soil pH	7.80	
Minimum Resistivity	0.29 ohm-cm (x1000)	
Chloride	245.1 ppm	00.02451 %
Sulfate	813.7 ppm	00.08137 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009
By

PLATE NO.: B-4Q

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/15/2009
Date Submitted 07/09/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager RH

The reported analysis was requested for the following location:
Location : REDWD. LND./208140.G Site ID : B152.
Thank you for your business.

* For future reference to this analysis please use SUN # 56131-113262.

EVALUATION FOR SOIL CORROSION

Soil pH	7.19	
Minimum Resistivity	3.22 ohm-cm (x1000)	
Chloride	16.9 ppm	00.00169 %
Sulfate	20.7 ppm	00.00207 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 18 2009
By

PLATE NO.: B-4U

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/15/2009
Date Submitted 07/09/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager RH

The reported analysis was requested for the following location:
Location : REDWD. LND./208140.G Site ID : B154.
Thank you for your business.

* For future reference to this analysis please use SUN # 56131-113263.

EVALUATION FOR SOIL CORROSION

Soil pH	6.76	
Minimum Resistivity	1.34 ohm-cm (x1000)	
Chloride	18.2 ppm	00.00182 %
Sulfate	25.6 ppm	00.00256 %

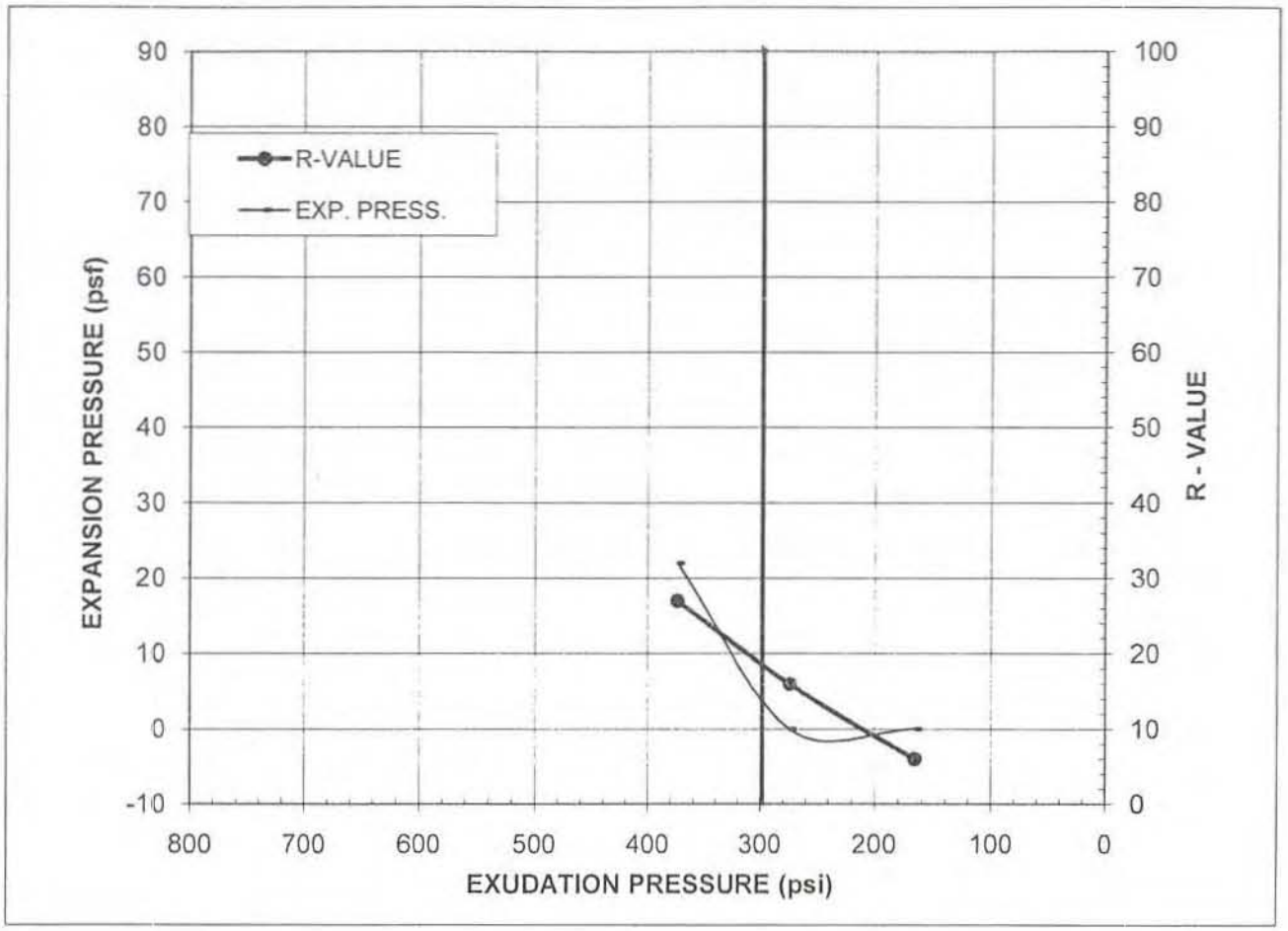
METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 18 2009
By
PLATE NO.: B-4V

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	6/30/09
Client:	BKF			Project #:	208140.GDR
Sample #:	103	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy Silty, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	166	274	374
Expansion Pressure, psf	0	0	22
R-Value	6	16	27
Moisture Content at Test, %	21.3	19.4	17.5
Dry Density at Test, pcf	102.5	106.2	109.5

R-Value @ 300 psi Exudation Pressure = **19**

Expansion Pressure @ 300 psi Exudation, psf = **4**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

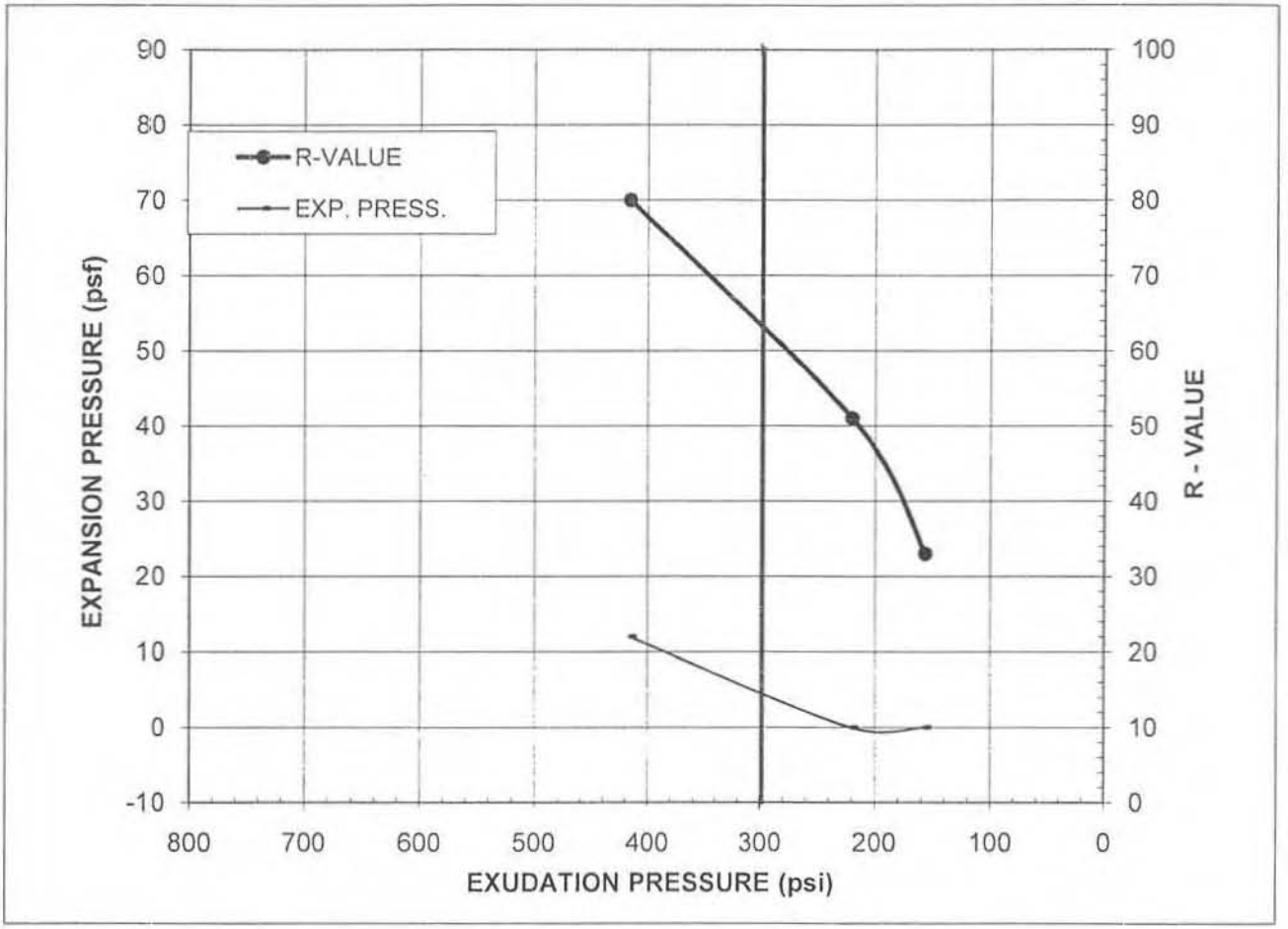
PLATE NO.: B-5A

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/20/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B115	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Silty Sand with Gravel, brown			Sampled By:	



	Specimen No.	A	B	C	
	Exudation Pressure, psi	157	220	416	
	Expansion Pressure, psf	0	0	12	
	R-Value	33	51	80	
	Moisture Content at Test, %	13.6	12.7	12.3	
	Dry Density at Test, pcf	114.4	115.7	116.7	

R-Value @ 300 psi Exudation Pressure =	**63**	Expansion Pressure @300 psi Exudation, psf =	**5**
Minimum R-Value Requirement:			

Comments:

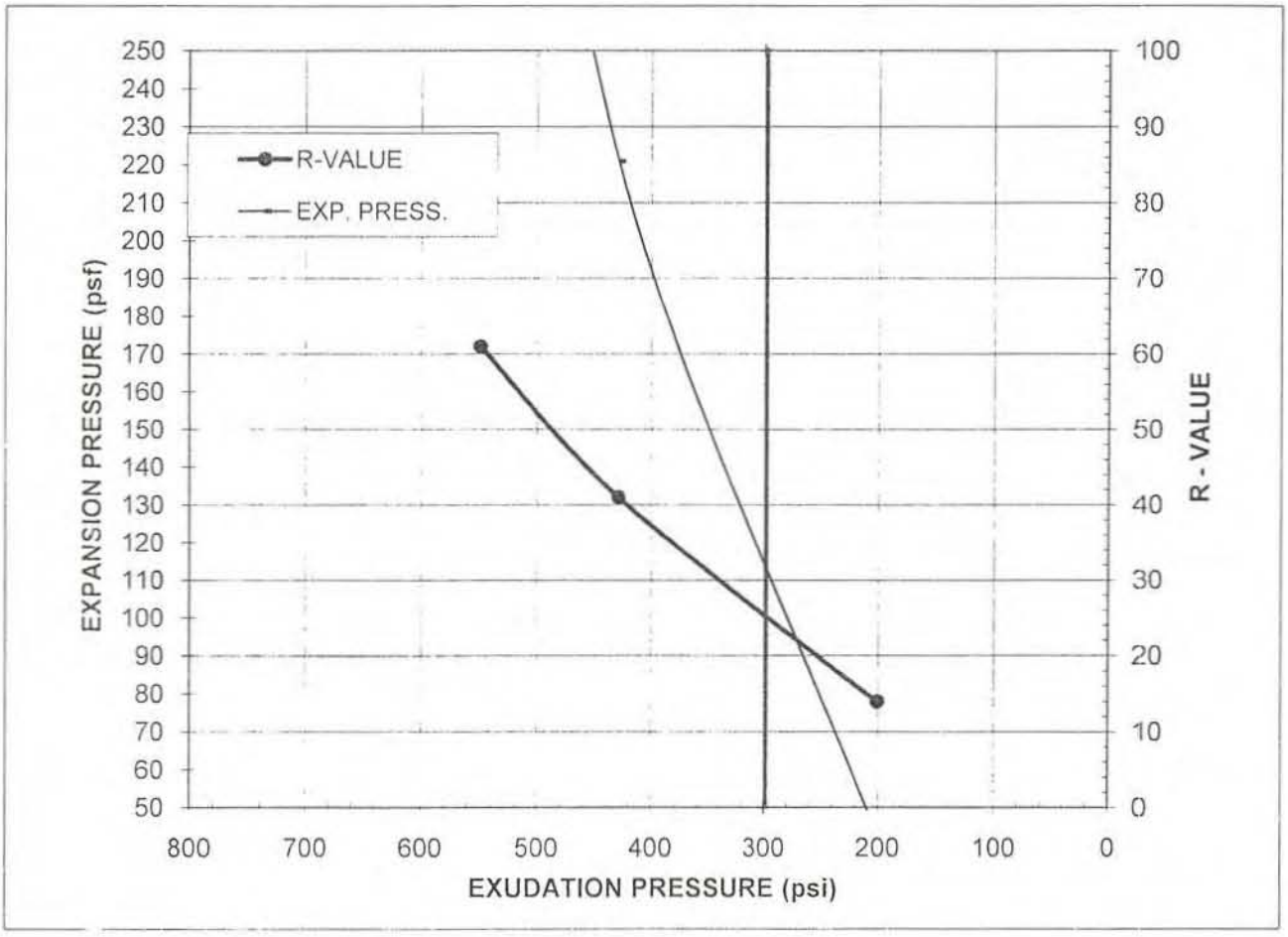
Report By: Prav Dayah

PLATE NO.: B-5B

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/13/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B116	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy Lean Clay with some Gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	201	429	549
Expansion Pressure, psf	43	221	433
R-Value	14	41	61
Moisture Content at Test, %	12.1	10.8	9.9
Dry Density at Test, pcf	124.2	128.2	129.8

R-Value @ 300 psi Exudation Pressure =	**25**	Expansion Pressure @300 psi Exudation, psf =	**112**
Minimum R-Value Requirement:			

Comments:

Report By: Prav Dayah

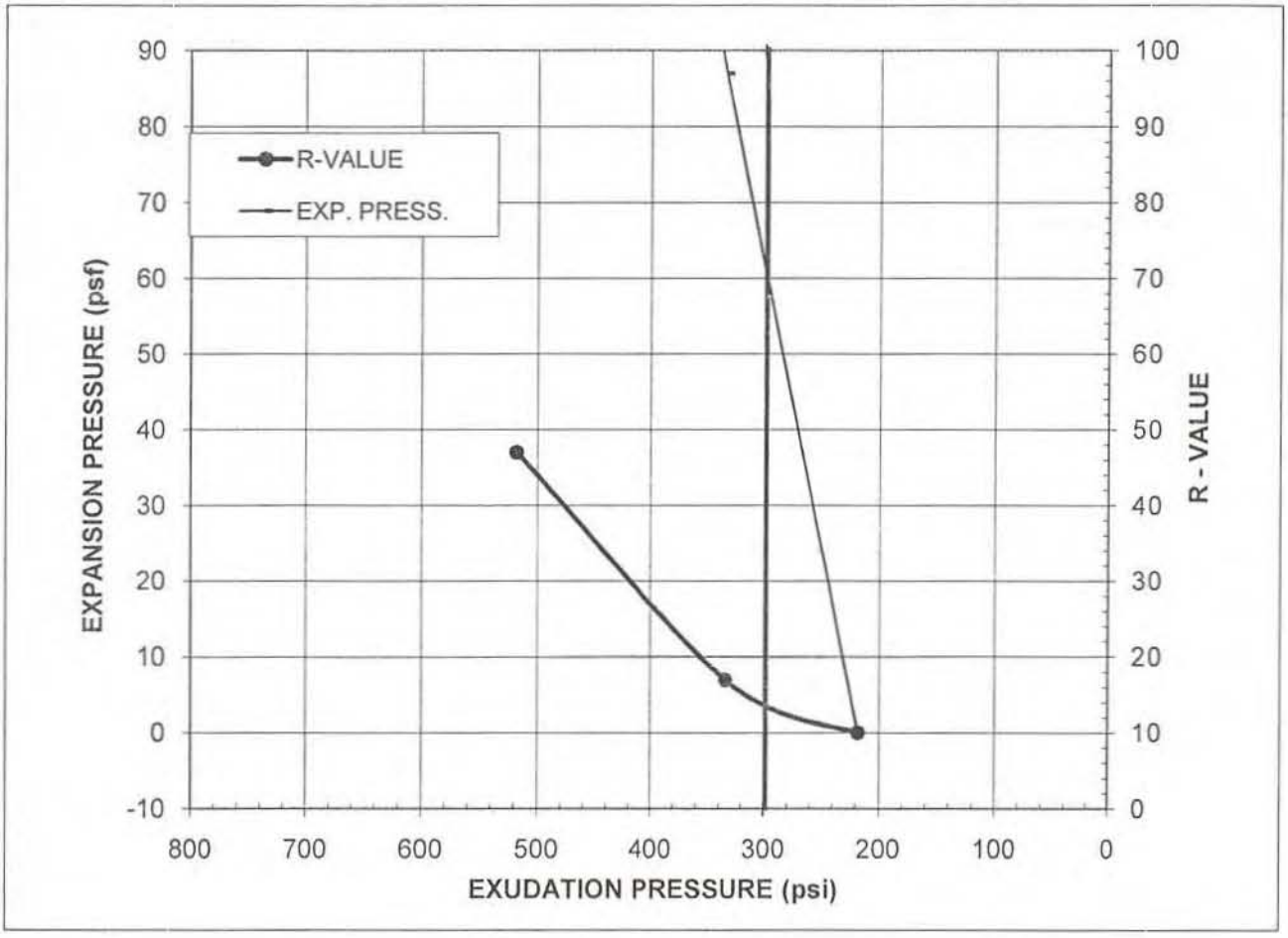
PLATE NO.: B-5C

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	11/04/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B117	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Lean clay with some gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	218	334	518
Expansion Pressure, psf	0	87	225
R-Value	10	17	47
Moisture Content at Test, %	15.1	13.7	12.3
Dry Density at Test, pcf	116.6	119.8	123.8

R-Value @ 300 psi Exudation Pressure = 14

Expansion Pressure @300 psi Exudation, psf = **70**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

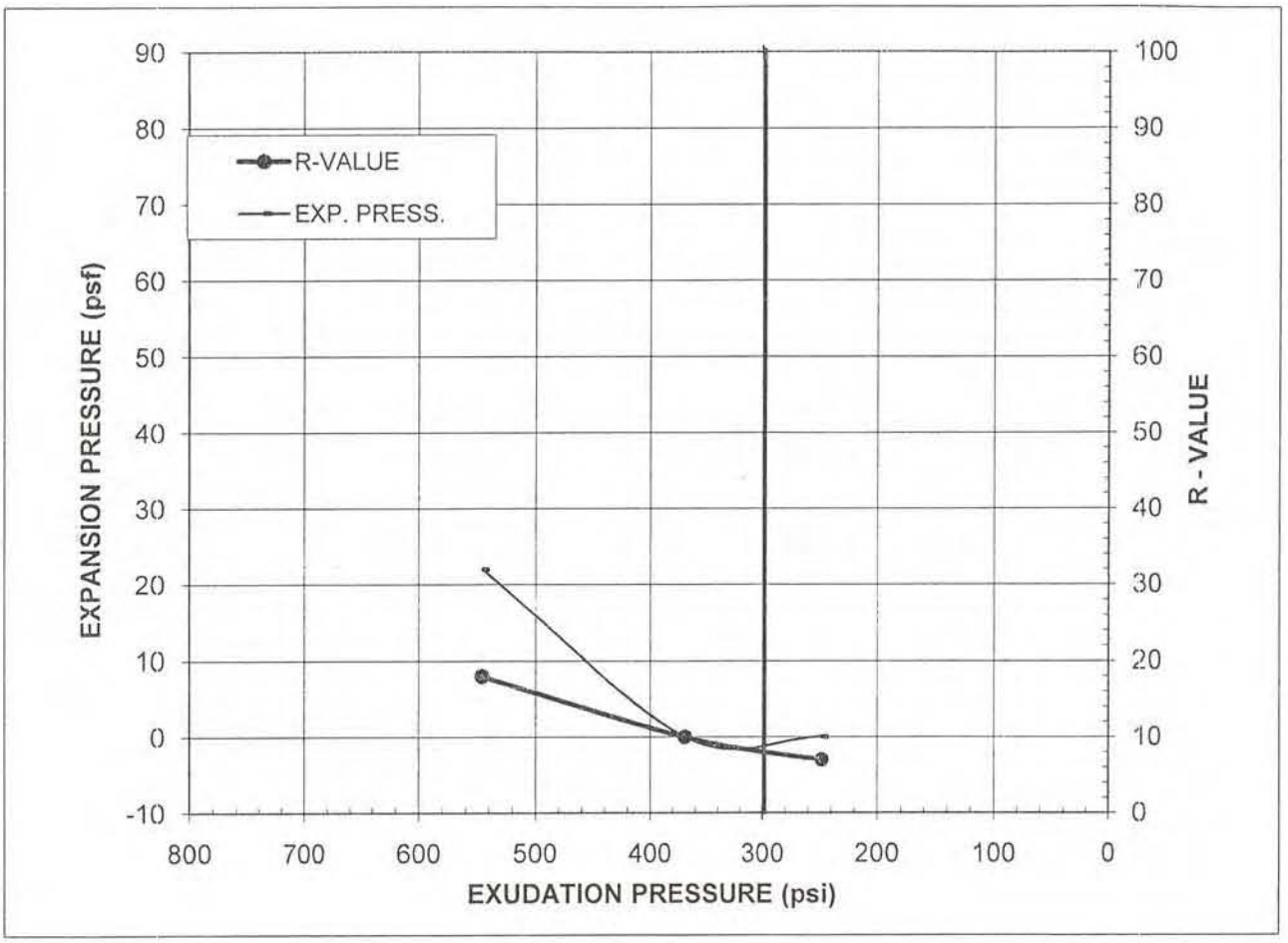
PLATE NO.: B-5D

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	11/04/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B118	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy lean clay with some gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	248	369	546
Expansion Pressure, psf	0	0	22
R-Value	7	10	18
Moisture Content at Test, %	19.6	18.1	16.7
Dry Density at Test, pcf	105.1	108.5	109.0

R-Value @ 300 psi Exudation Pressure = 8

Expansion Pressure @300 psi Exudation, psf = 0

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

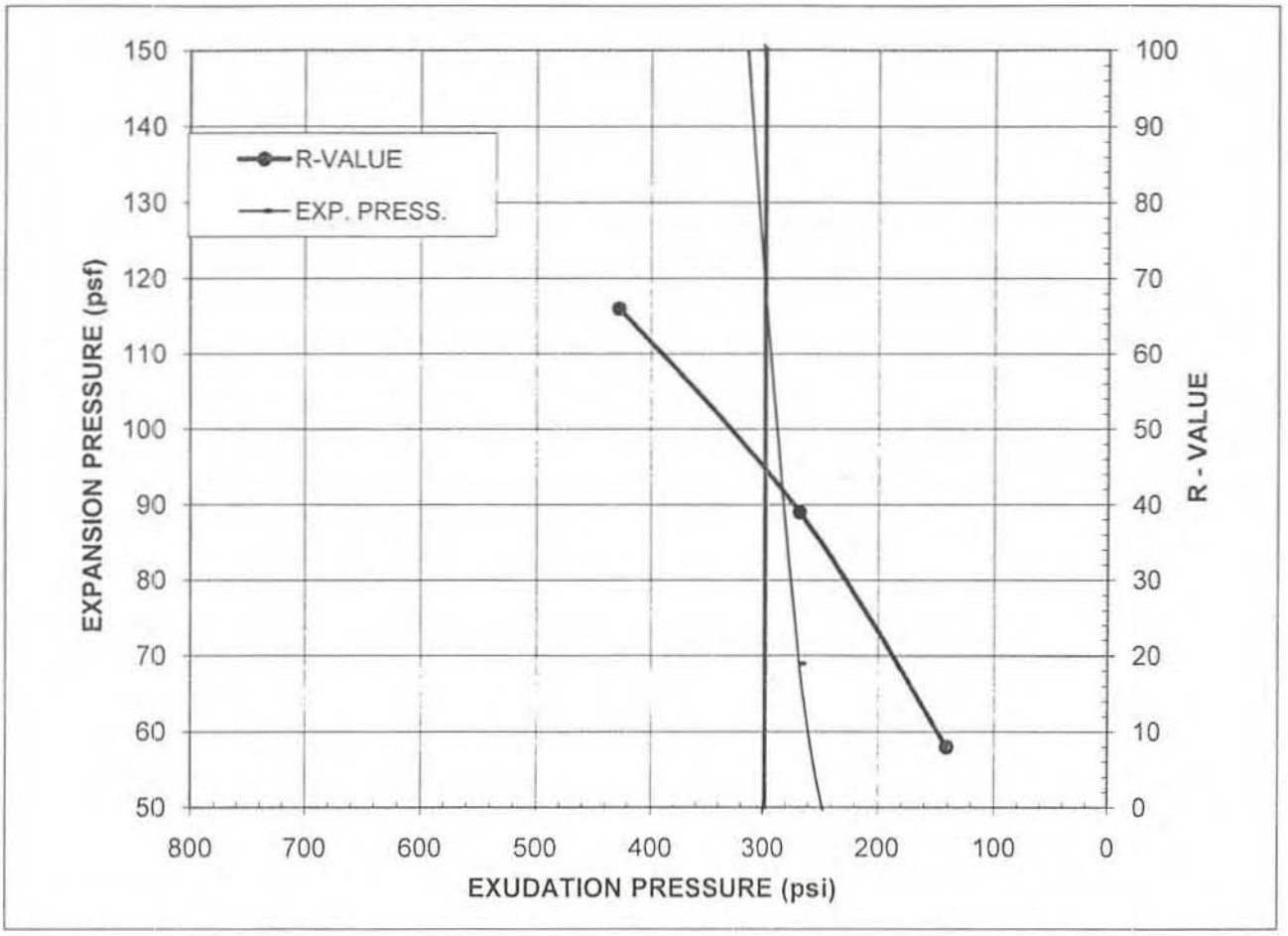
PLATE NO.: B-5E

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	6/30/09
Client:	BKF			Project #:	208140.GDR
Sample #:	119	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy Silty, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	141	268	428
Expansion Pressure, psf	0	69	394
R-Value	8	39	66
Moisture Content at Test, %	14.7	12.9	11.6
Dry Density at Test, pcf	117.9	121.4	125.6

R-Value @ 300 psi Exudation Pressure = 44

Expansion Pressure @300 psi Exudation, psf = **120**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

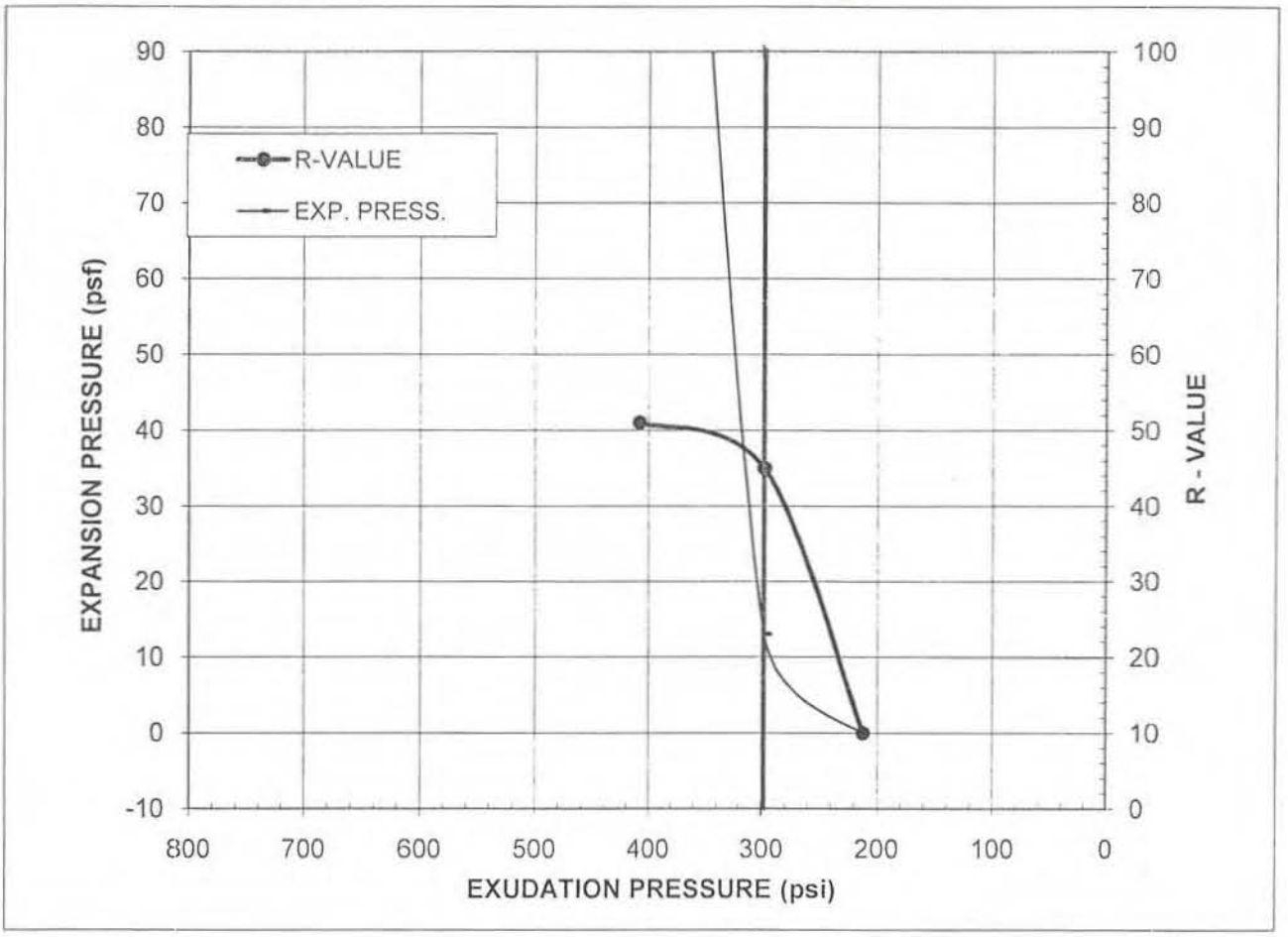
PLATE NO.: B-5F

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/13/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B124	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy Silt with some Gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	212	298	408
Expansion Pressure, psf	0	13	217
R-Value	10	45	51
Moisture Content at Test, %	15.4	14.4	13.5
Dry Density at Test, pcf	117.1	119.6	122.7

R-Value @ 300 psi Exudation Pressure =	**45**	Expansion Pressure @300 psi Exudation, psf =	**11**
Minimum R-Value Requirement:			

Comments:

Report By: Prav Dayah

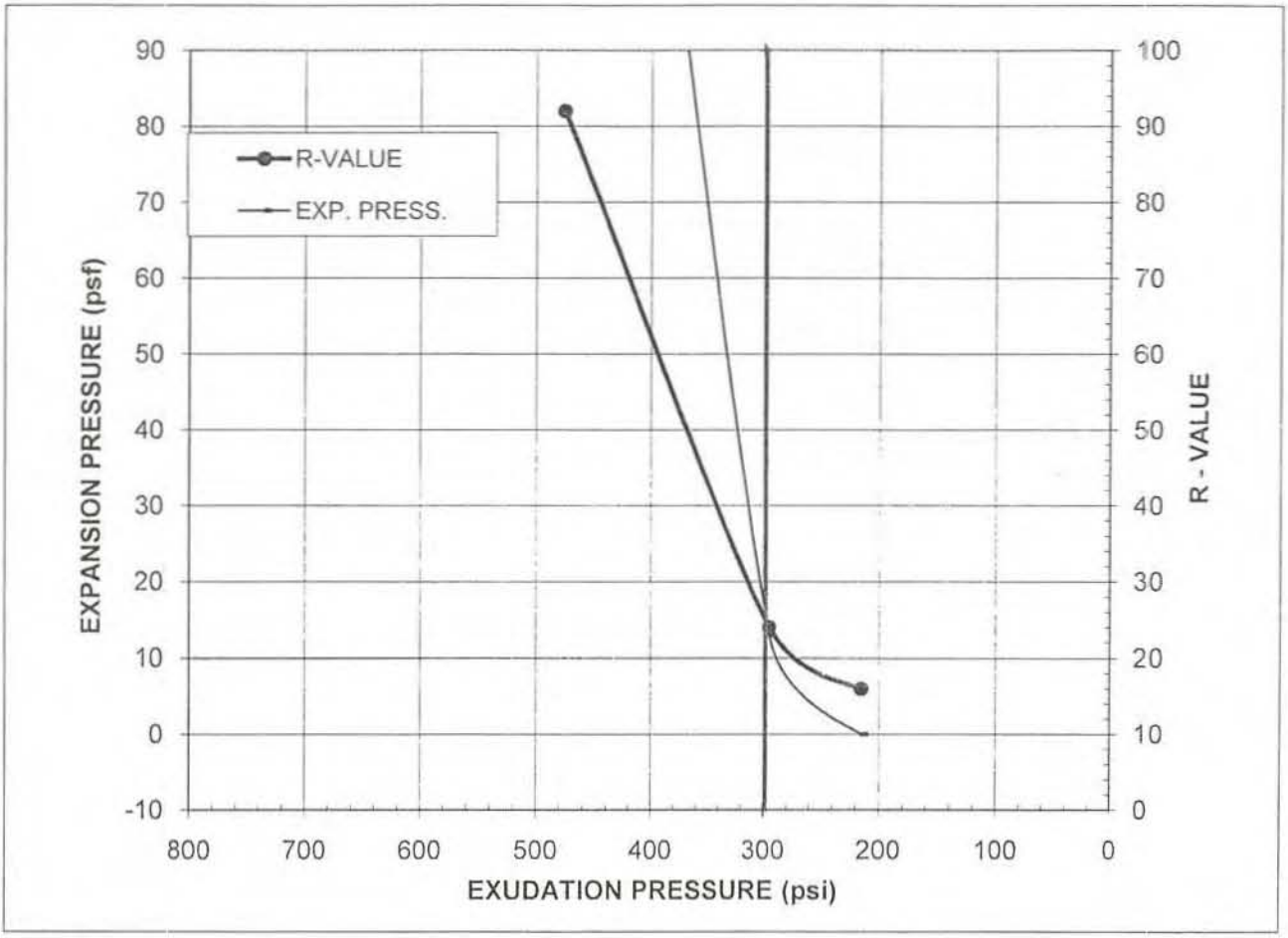
PLATE NO.: B-5G

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/13/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B128	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy Lean Clay with some Gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	215	295	476
Expansion Pressure, psf	0	13	217
R-Value	16	24	92
Moisture Content at Test, %	13.4	12.4	11.5
Dry Density at Test, pcf	115.5	117.5	123.7

R-Value @ 300 psi Exudation Pressure = 24

Expansion Pressure @300 psi Exudation, psf = **13**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

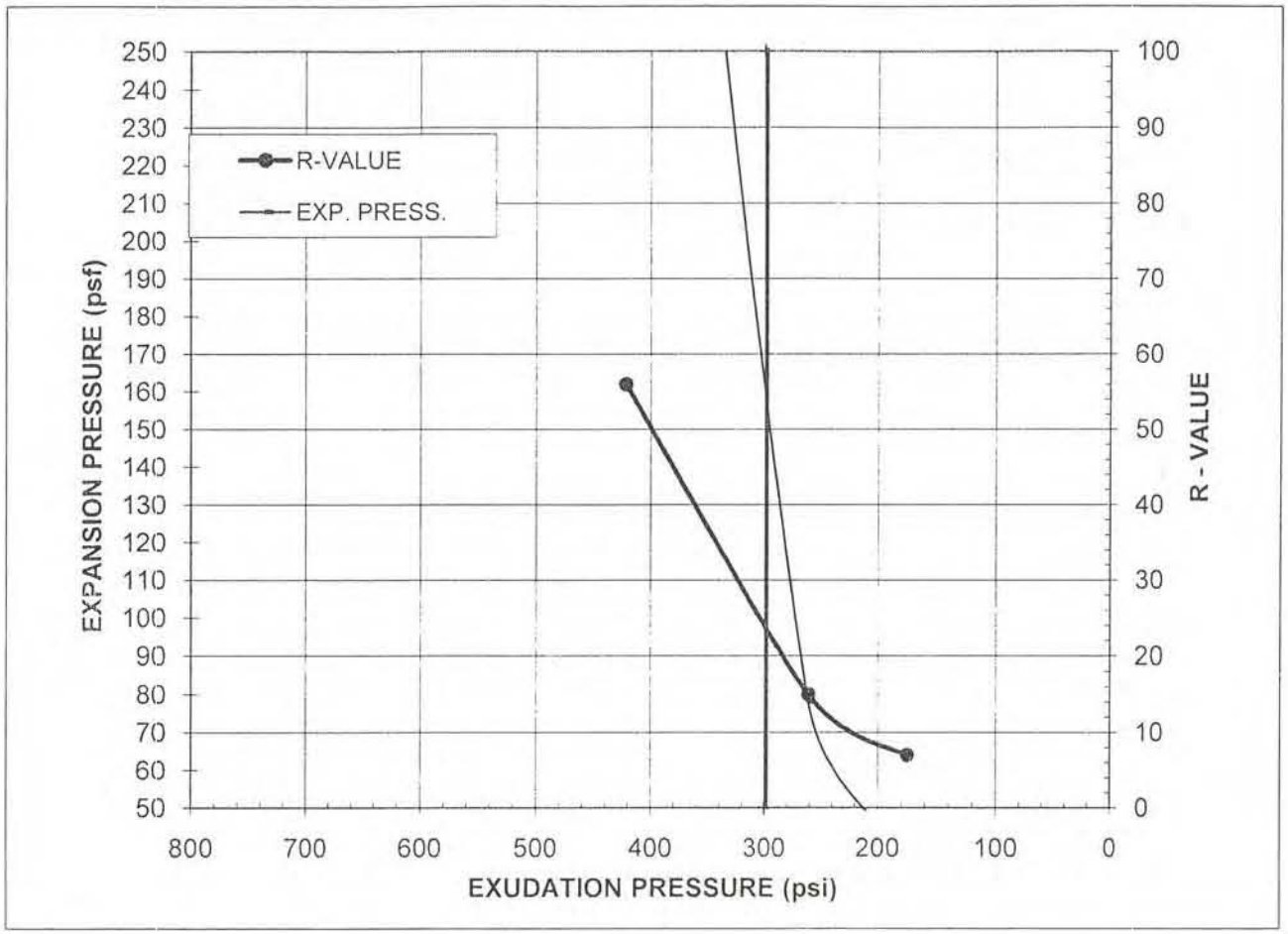
PLATE NO.: B-5H

RVALUE with calcs.pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	6/30/09
Client:	BKF			Project #:	208140.GDR
Sample #:	140	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy lean clay with gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	175	261	422
Expansion Pressure, psf	39	78	472
R-Value	7	15	56
Moisture Content at Test, %	17.8	15.5	12.8
Dry Density at Test, pcf	112.2	116.0	123.8

R-Value @ 300 psi Exudation Pressure = **23**

Expansion Pressure @300 psi Exudation, psf = **155**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

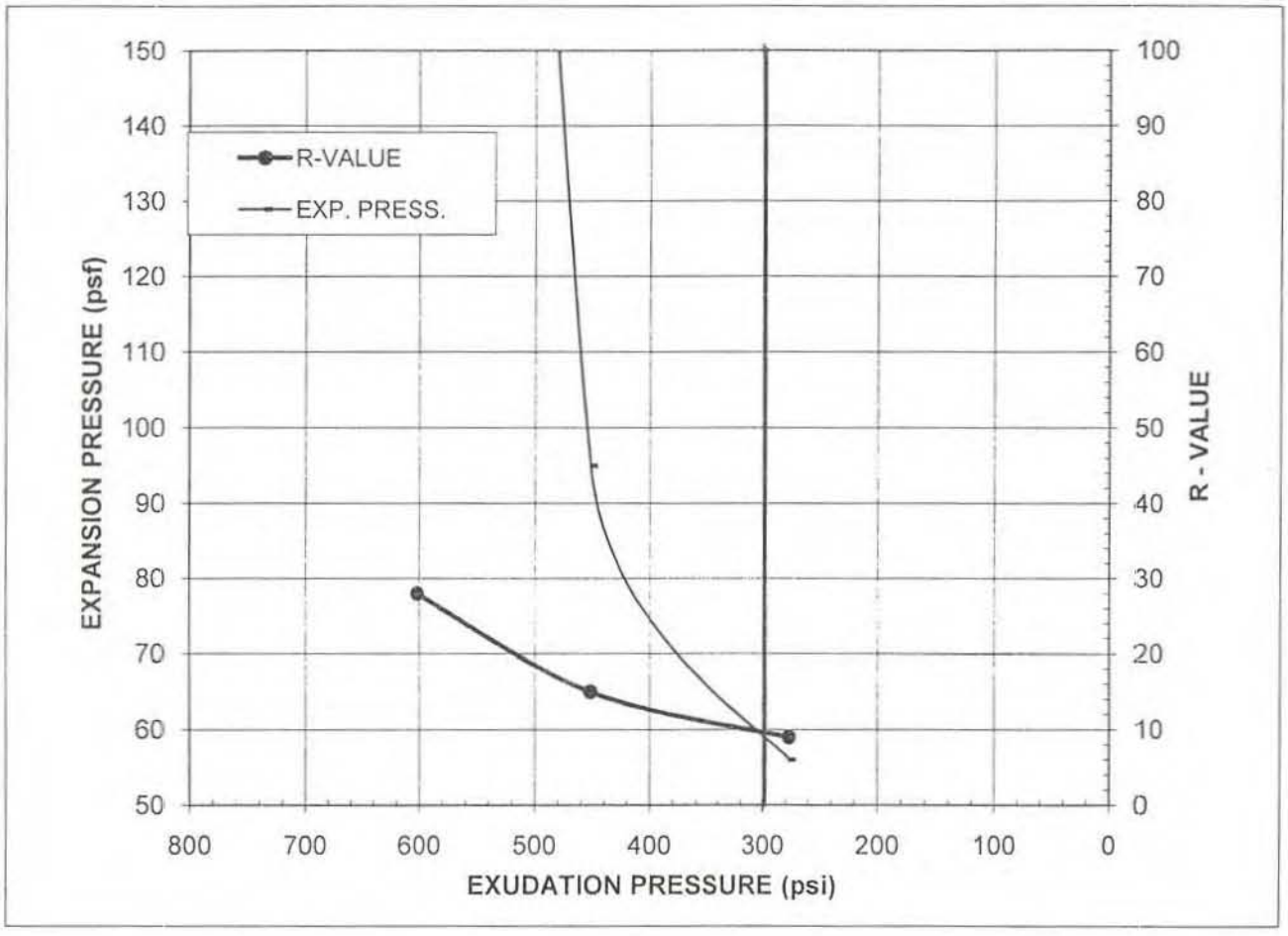
PLATE NO.: B-5I

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	6/30/09
Client:	BKF			Project #:	208140.GDR
Sample #:	142	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy lean clay, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	277	452	602
Expansion Pressure, psf	56	95	541
R-Value	9	15	28
Moisture Content at Test, %	21.5	18.8	16.9
Dry Density at Test, pcf	103.6	106.3	114.8

R-Value @ 300 psi Exudation Pressure = 10

Expansion Pressure @300 psi Exudation, psf = 59

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

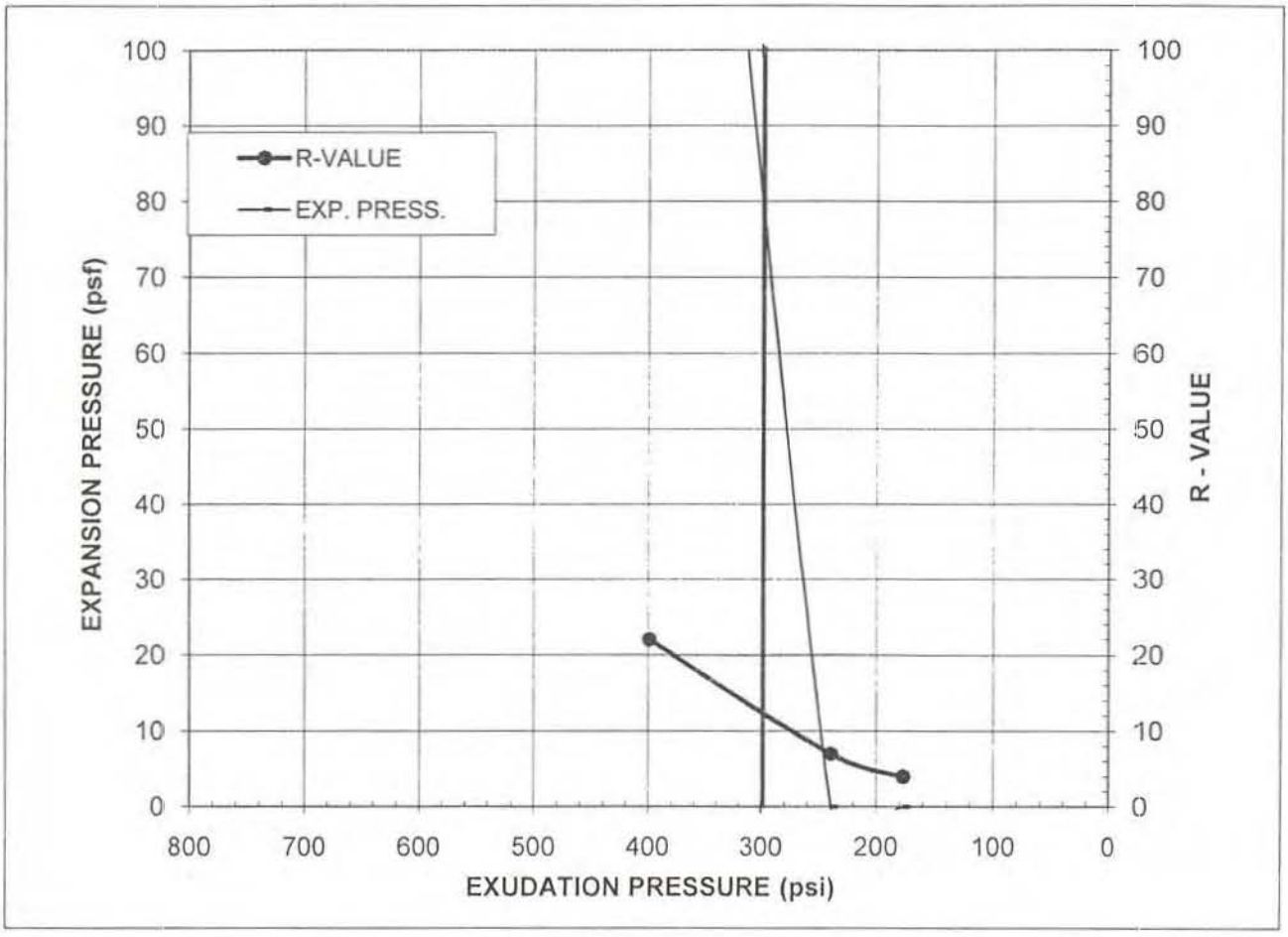
PLATE NO.: B-5J

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	6/30/09
Client:	BKF			Project #:	208140.GDR
Sample #:	145	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Sandy lean clay with some gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	177	239	399
Expansion Pressure, psf	0	0	229
R-Value	4	7	22
Moisture Content at Test, %	18.9	17.0	14.7
Dry Density at Test, pcf	108.8	112.9	119.0

R-Value @ 300 psi Exudation Pressure = 13

Expansion Pressure @300 psi Exudation, psf = **80**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

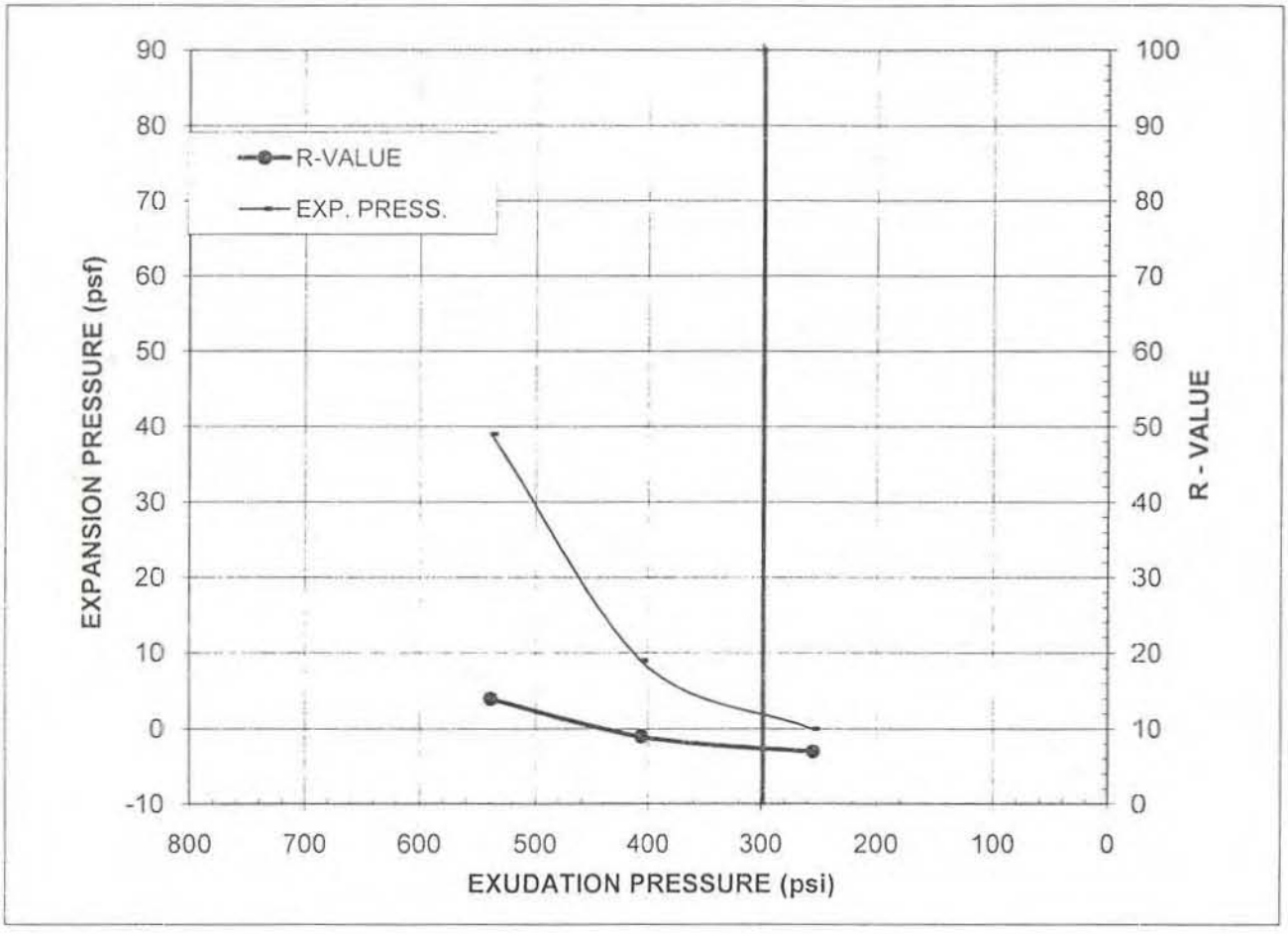
PLATE NO.: B-5K

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/9/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B147	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Lean Clay with some gravel, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	255	406	539
Expansion Pressure, psf	0	9	39
R-Value	7	9	14
Moisture Content at Test, %	26.7	23.4	20.5
Dry Density at Test, pcf	95.4	96.6	107.5

R-Value @ 300 psi Exudation Pressure =	7	Expansion Pressure @300 psi Exudation, psf =	3
Minimum R-Value Requirement:			

Comments:

Report By: Prav Dayah

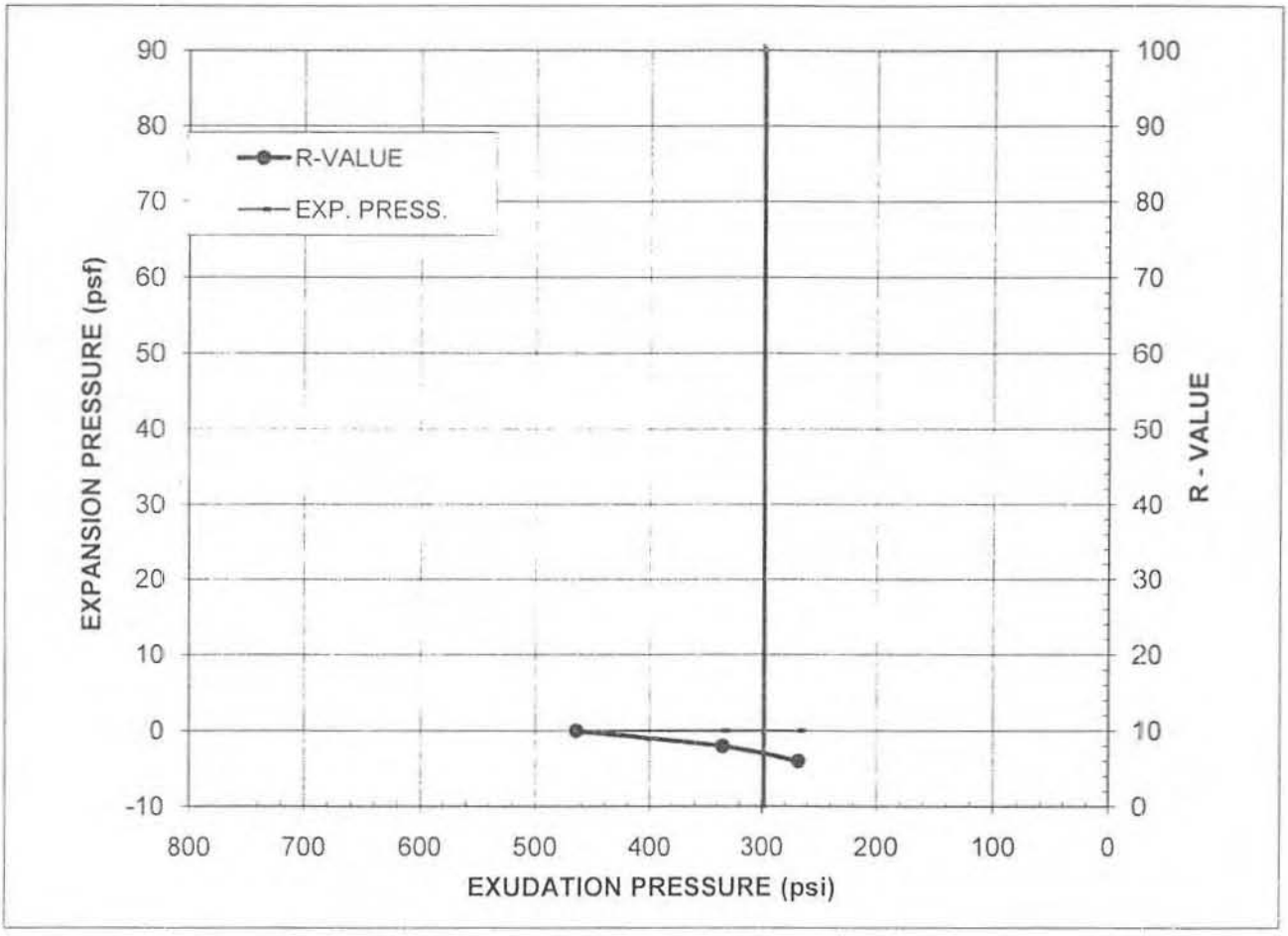
PLATE NO.: B-5L

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/9/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B148	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Lean Clay, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	268	335	465
Expansion Pressure, psf	0	0	0
R-Value	6	8	10
Moisture Content at Test, %	22.9	20.9	19.0
Dry Density at Test, pcf	93.9	101.1	104.6

R-Value @ 300 psi Exudation Pressure = 6

Expansion Pressure @300 psi Exudation, psf = 0

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

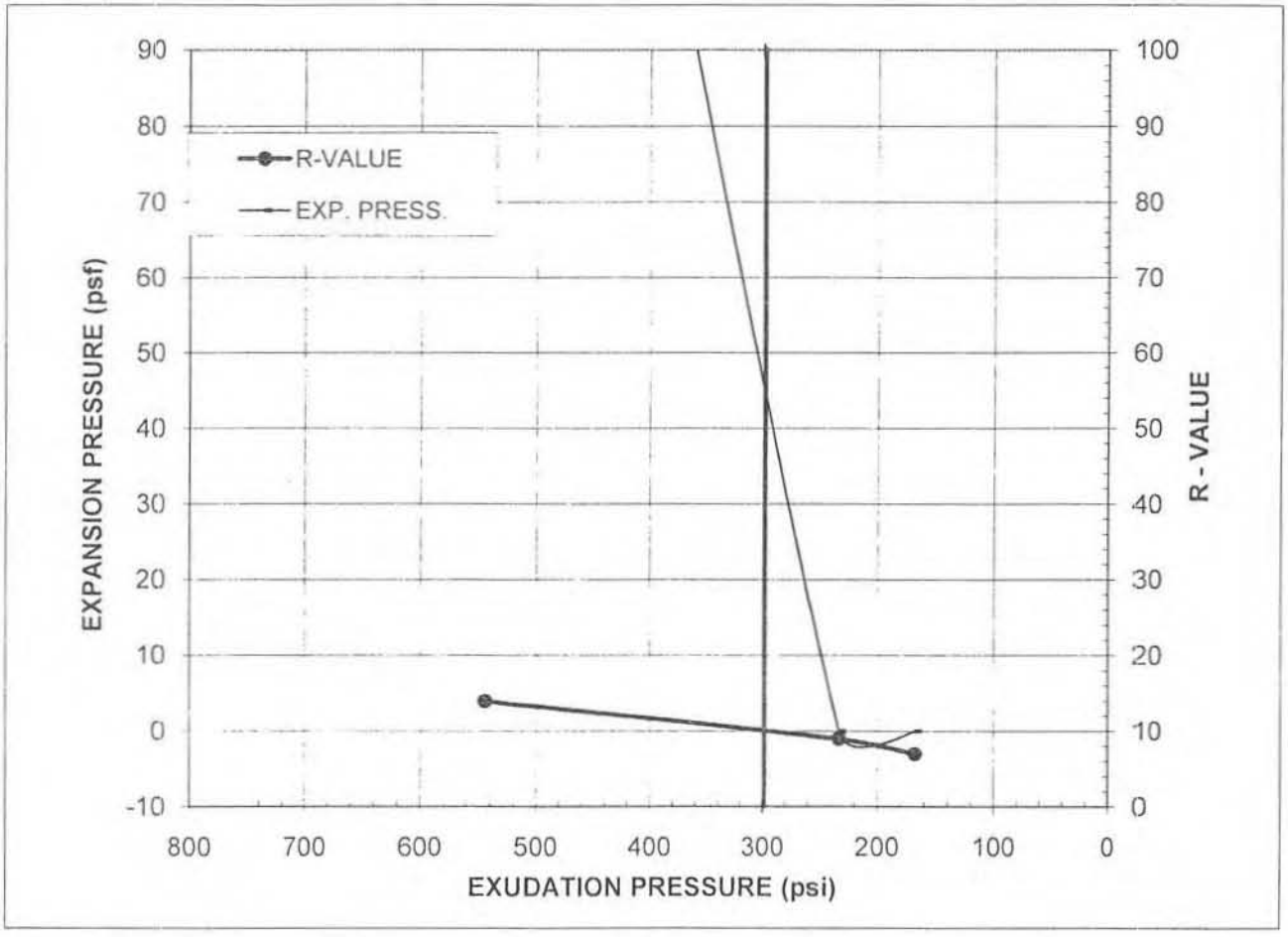
PLATE NO.: B-5M

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/9/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B152	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Lean Clay with some gravel, dark brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	168	233	544
Expansion Pressure, psf	0	0	229
R-Value	7	9	14
Moisture Content at Test, %	15.4	14.0	11.6
Dry Density at Test, pcf	110.5	116.5	119.7

R-Value @ 300 psi Exudation Pressure = 10

Expansion Pressure @300 psi Exudation, psf = **43**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

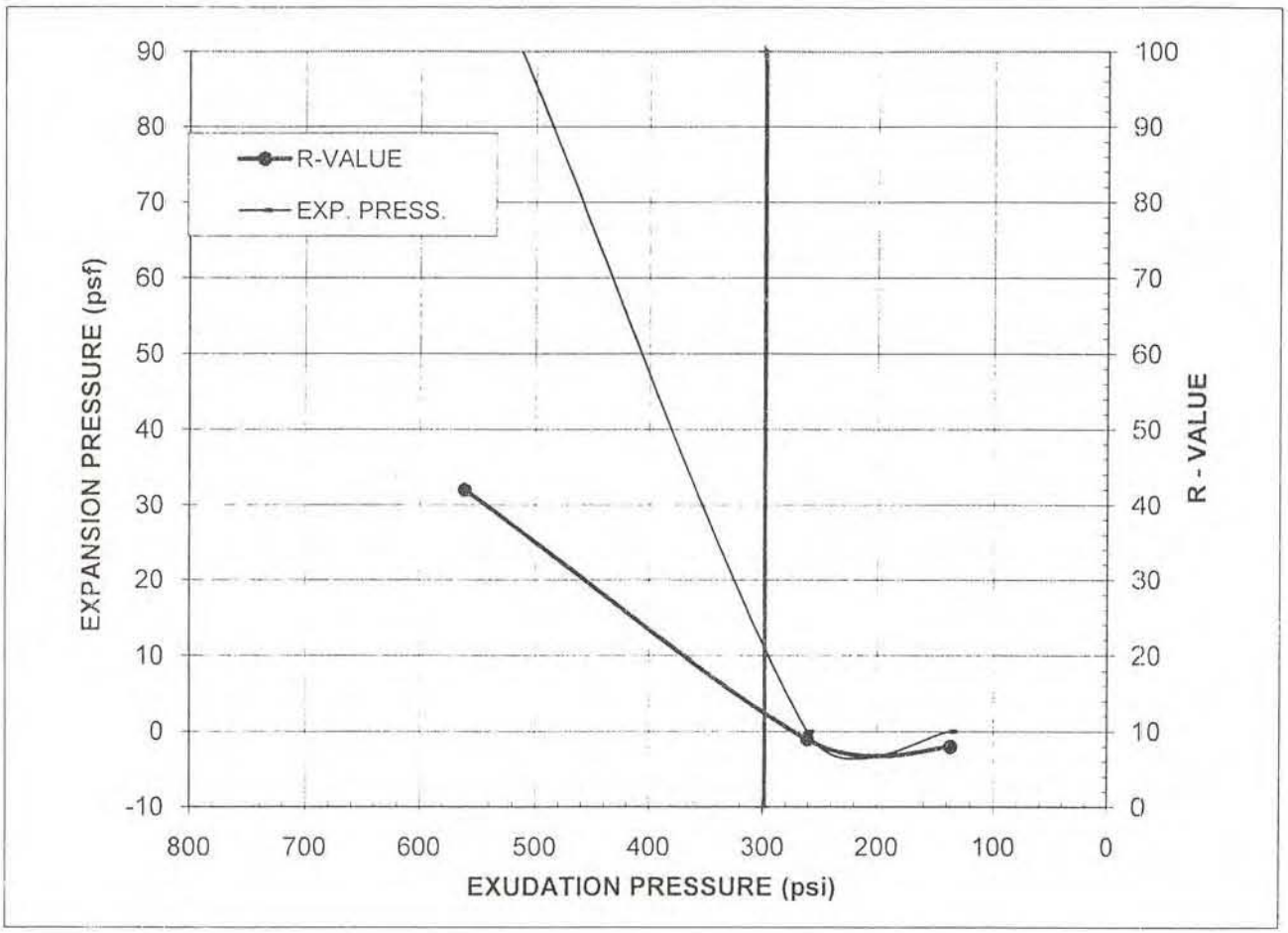
PLATE NO.: B-5N

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Redwood Landfill Interchange			Date:	7/13/09
Client:	BKF			Project #:	208140.GDR
Sample #:	B154	Depth:	0' - 5'	Lab #:	M757
Location / Source:		Onsite / Native		Sample Date:	
Material :	Lean Clay with traces of Gravel, black			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	137	261	561
Expansion Pressure, psf	0	0	108
R-Value	8	9	42
Moisture Content at Test, %	18.6	17.1	14.7
Dry Density at Test, pcf	103.8	105.3	111.0

R-Value @ 300 psi Exudation Pressure = **12**

Expansion Pressure @ 300 psi Exudation, psf = **10**

Minimum R-Value Requirement:

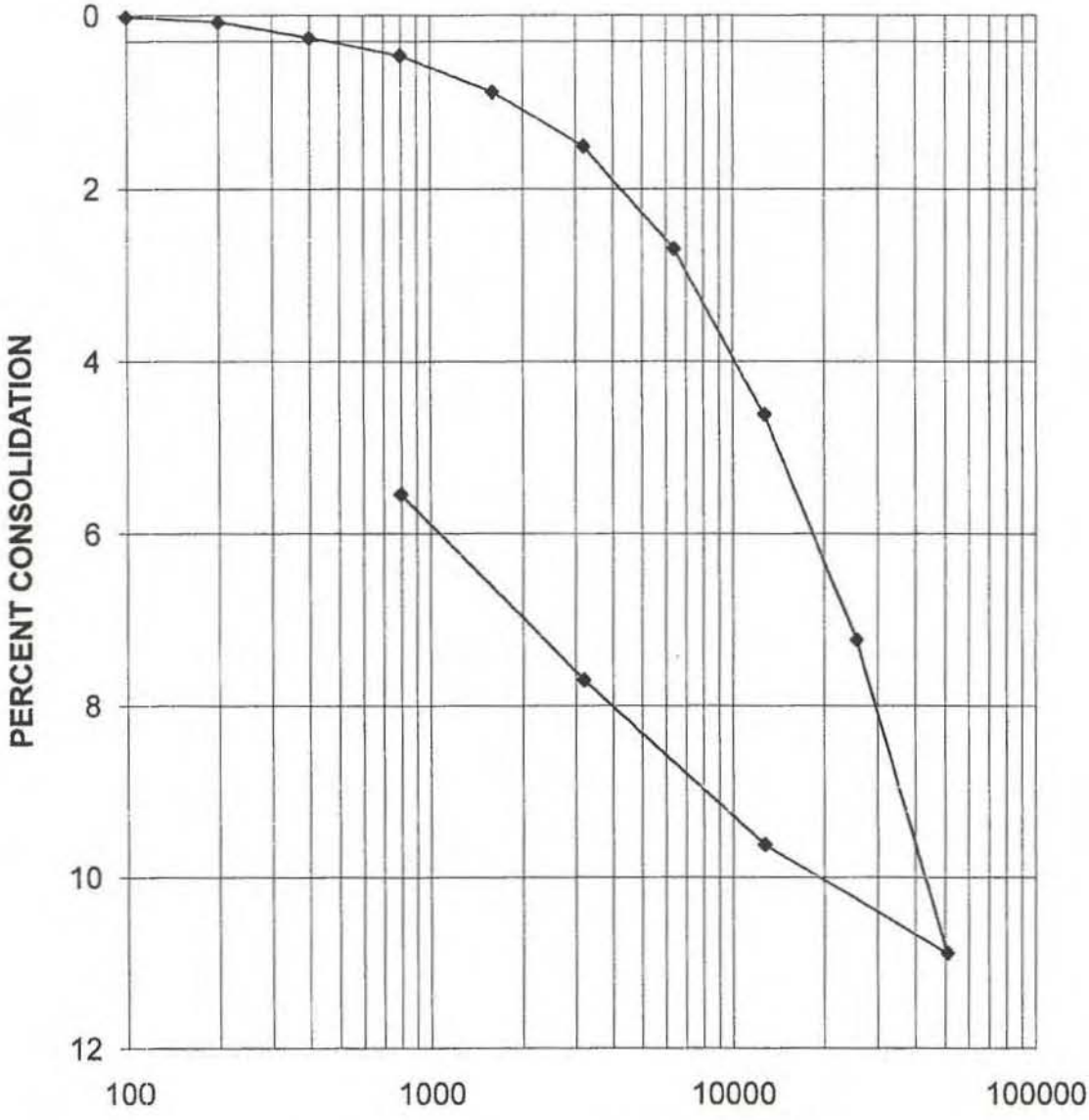
Comments:

Report By: Prav Dayah

PLATE NO.: B-5O

RVALUE with calcs pdp

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	16.7	119.4	1.0000	2.416
FINAL	15.4	126.4	0.9446	2.416

BORING NO.	B110	SAMPLE NO.	3	ELEV. OR DEPTH	9.5'
DESCRIPTION	Sandy Lean Clay, brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Reedwood Landfill Interchange
MARIN COUNTY / BKF

DATE	JOB NO:
7/21/2009	208140.GDR

Reported by: Prav Dayah

PLATE NO.: B-6A

CONSOLIDATION TEST - TIME CURVE

JOB #: 208140.GDR

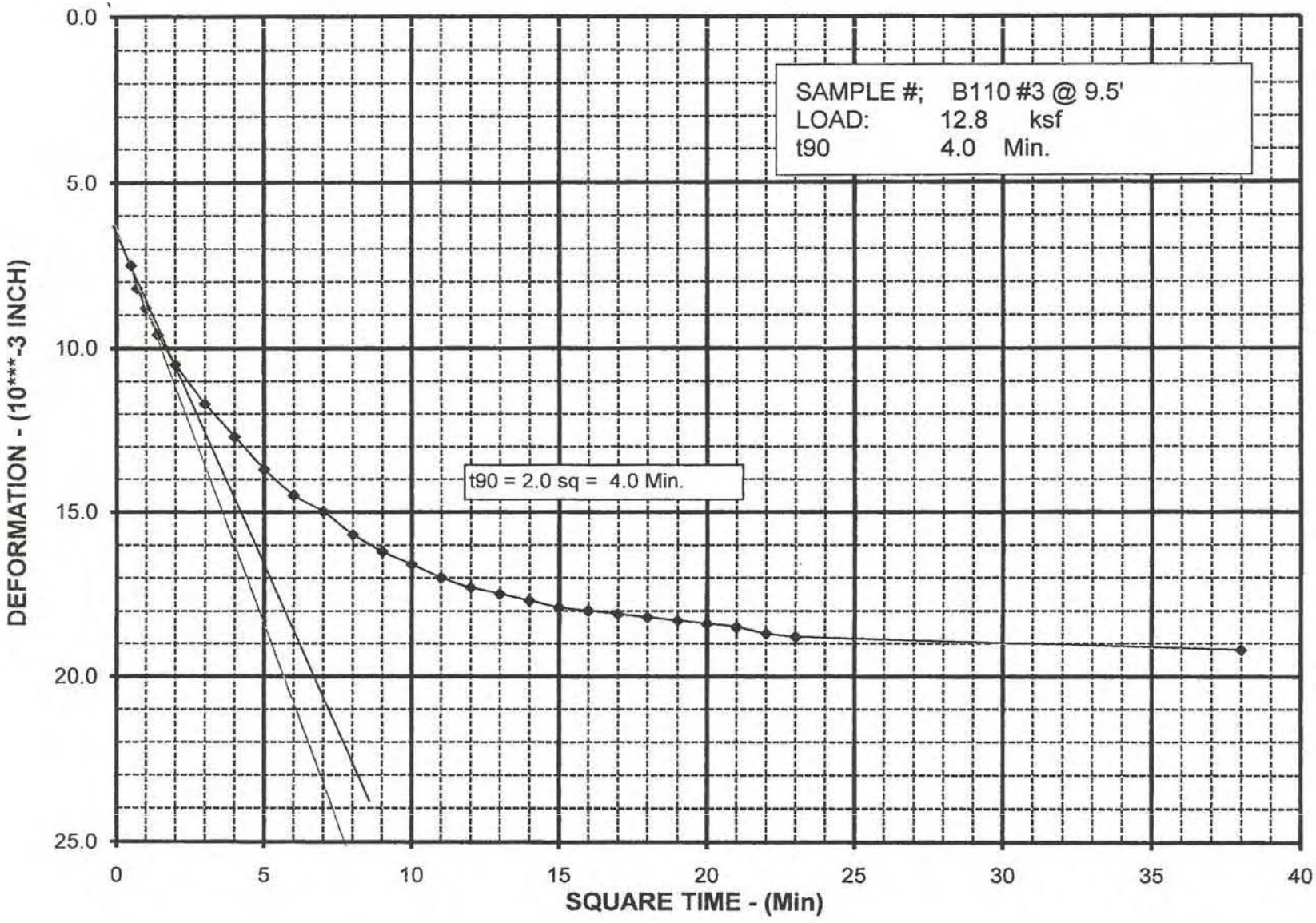


PLATE NO.: B-6B

CONSOLIDATION TEST - TIME CURVE

JOB #: 208140.GDR

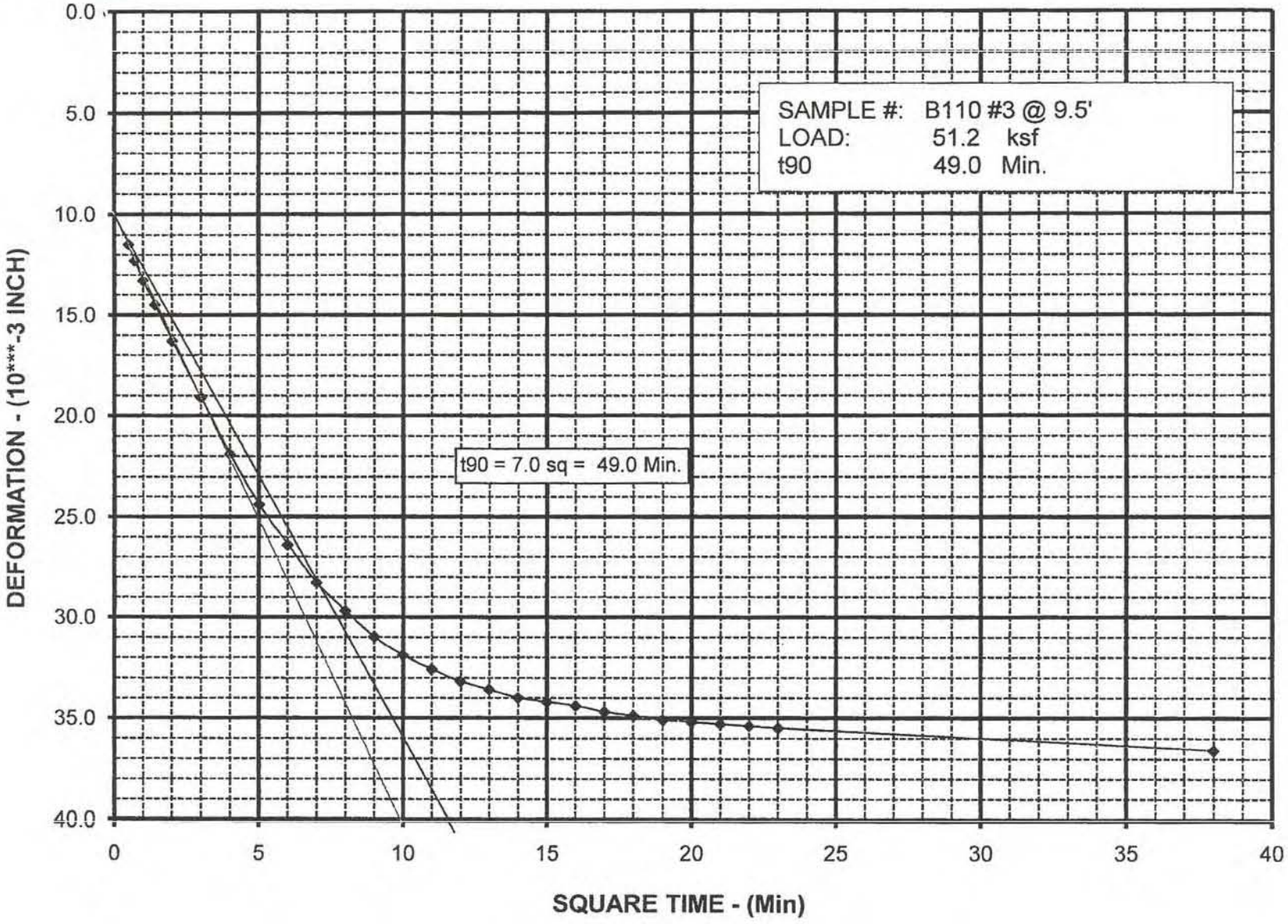
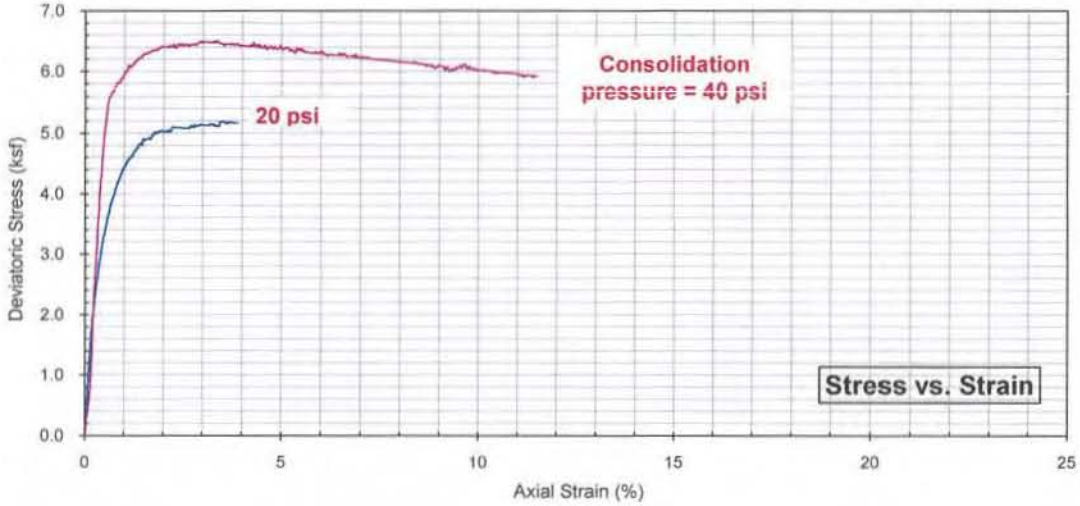
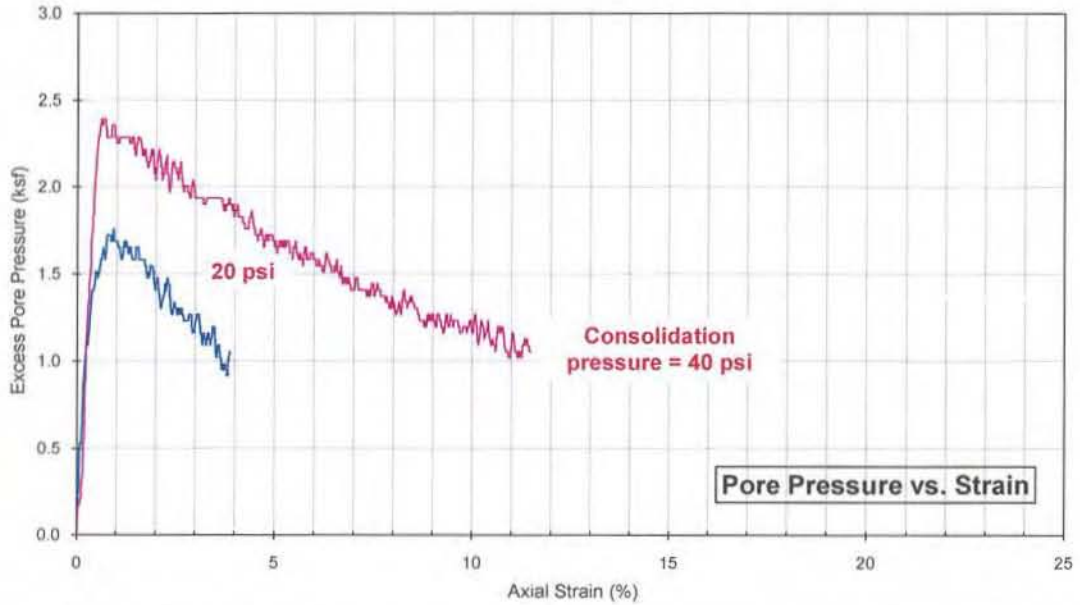


PLATE NO.: B-6C

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST





Boring No.	R-10-162
Sample No.	
Elev. or Depth (ft)	32.5'- 33.5'
Soil Description	Fat Clay, yellowish brown

	Stage	1	2
INITIAL	Moisture (%)	31.8	--
	Dry density (pcf)	88.7	--
	Diameter (inch)	2.416	2.446
	Height (inch)	5.0	4.8
AT TEST	Moisture (%)	--	31.9
	Area (sq. inch)	4.52	4.67
	Height (inch)	4.98	4.81
	B-value	1	1
	Total Cell Pressure (ksf)	6.91	9.79
	Back Pressure (ksf)	4.03	4.03
	Effective Cell Pressure (ksf)	2.9	5.8
	Strain Rate (%/min)	0.18	0.18
	Max. Deviator Stress (ksf)	5.12	6.54
	Strain @ Failure (%)	3.1	3.28
	Excess Pore Pressure @ Failure (ksf)	1.23	1.93
	σ_1' @ failure	6.77	10.37
	σ_3' @ failure	1.65	3.83

Remark:

Date: 12/2/2010
File Name: CU-R-10-162

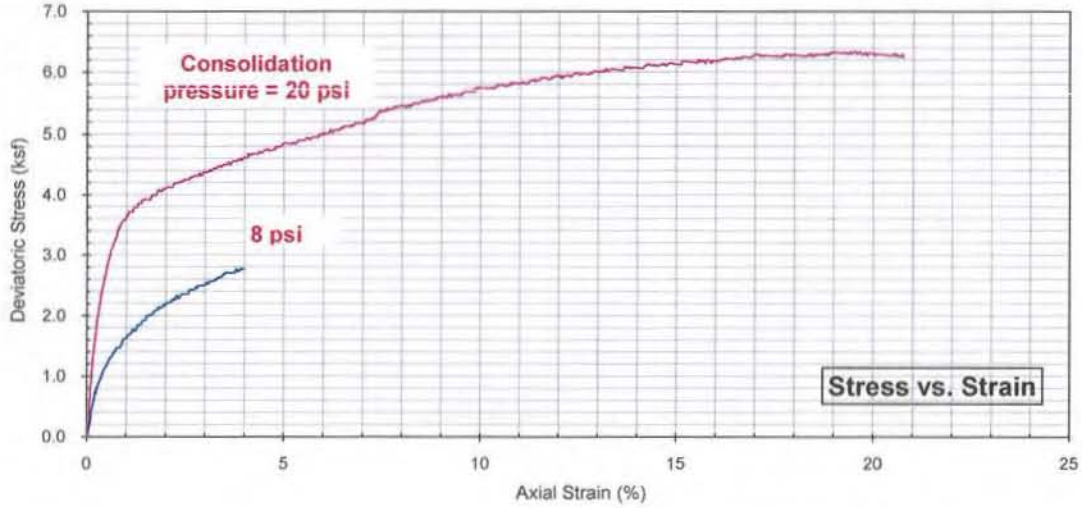
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

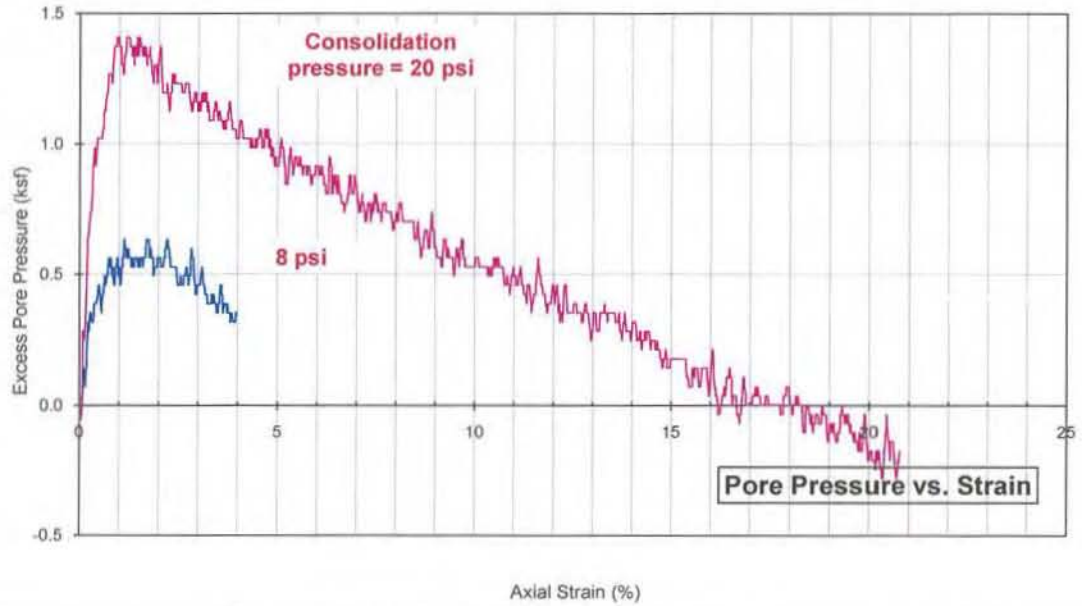
MARIN SONOMA NARROWS CONTRACT B1 - MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.LLS

PLATE NO. 7A

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST





Boring No. A-10-164

Sample No.

Elev. or Depth (ft) 15.5 - 16

Soil Description Fat Clay with Sand, dark brown

	Stage	1	2
INITIAL	Moisture (%)	24.6	--
	Dry density (pcf)	97.9	--
	Diameter (inch)	2.416	2.447
	Height (inch)	5.0	4.8
AT TEST	Moisture (%)	--	28.6
	Area (sq. inch)	4.51	4.68
	Height (inch)	5.03	4.84
	B-value	1	1
	Total Cell Pressure (ksf)	5.18	6.91
	Back Pressure (ksf)	4.03	4.03
	Effective Cell Pressure (ksf)	1.2	2.9
	Strain Rate (%/min)	0.18	0.18
	Max. Deviator Stress (ksf)	2.77	6.38
	Strain @ Failure (%)	4.0	20.57
	Excess Pore Pressure @ Failure (ksf)	0.35	0.00
	σ_1' @ failure	3.57	9.26
	σ_3' @ failure	0.80	2.88

Remark:

Date: 12/20/2010
File Name: A-10-164

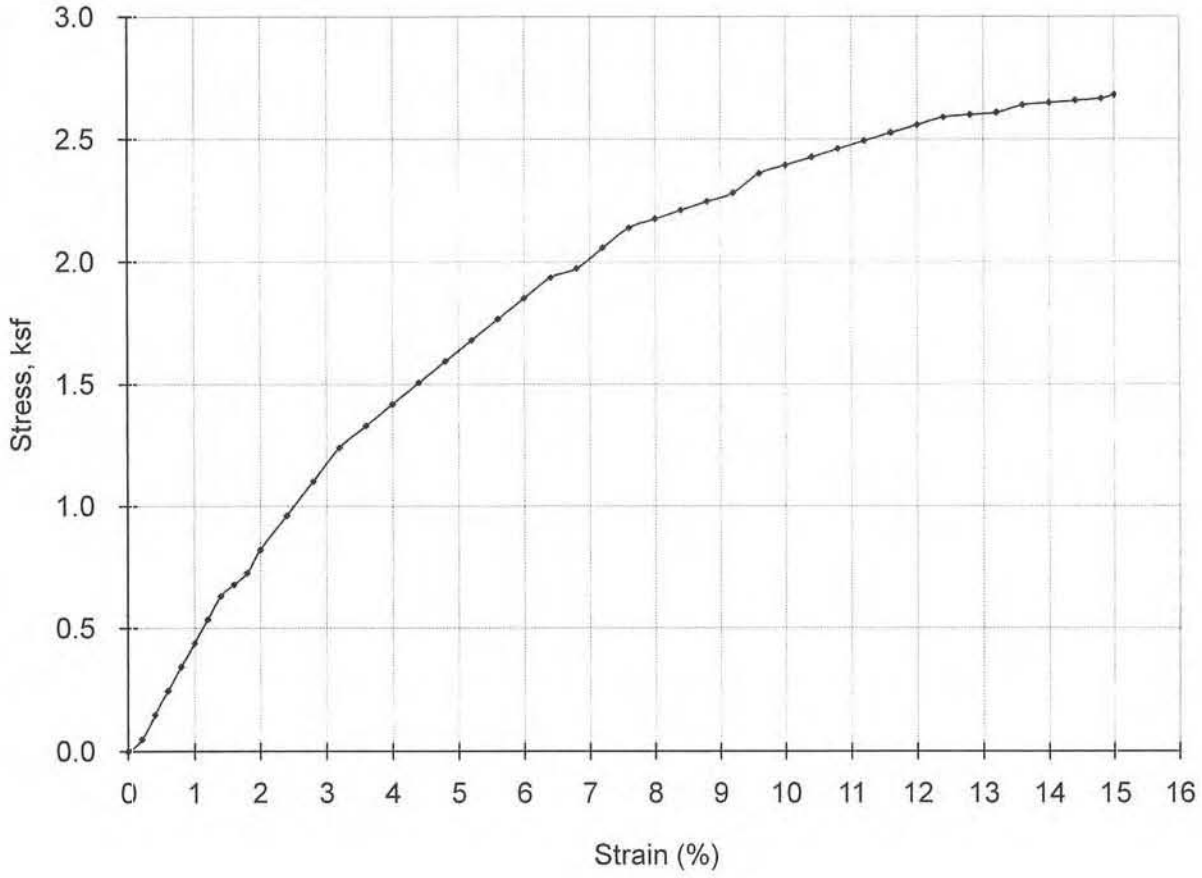
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

REDWOOD LANDFILL INTERCHANGE - LANDSLIDE STUDY

JOB NO.: 2008-140-LLS

PLATE NO. 7B

UNCONFINED COMPRESSION TEST



Boring No.: A-10-158A

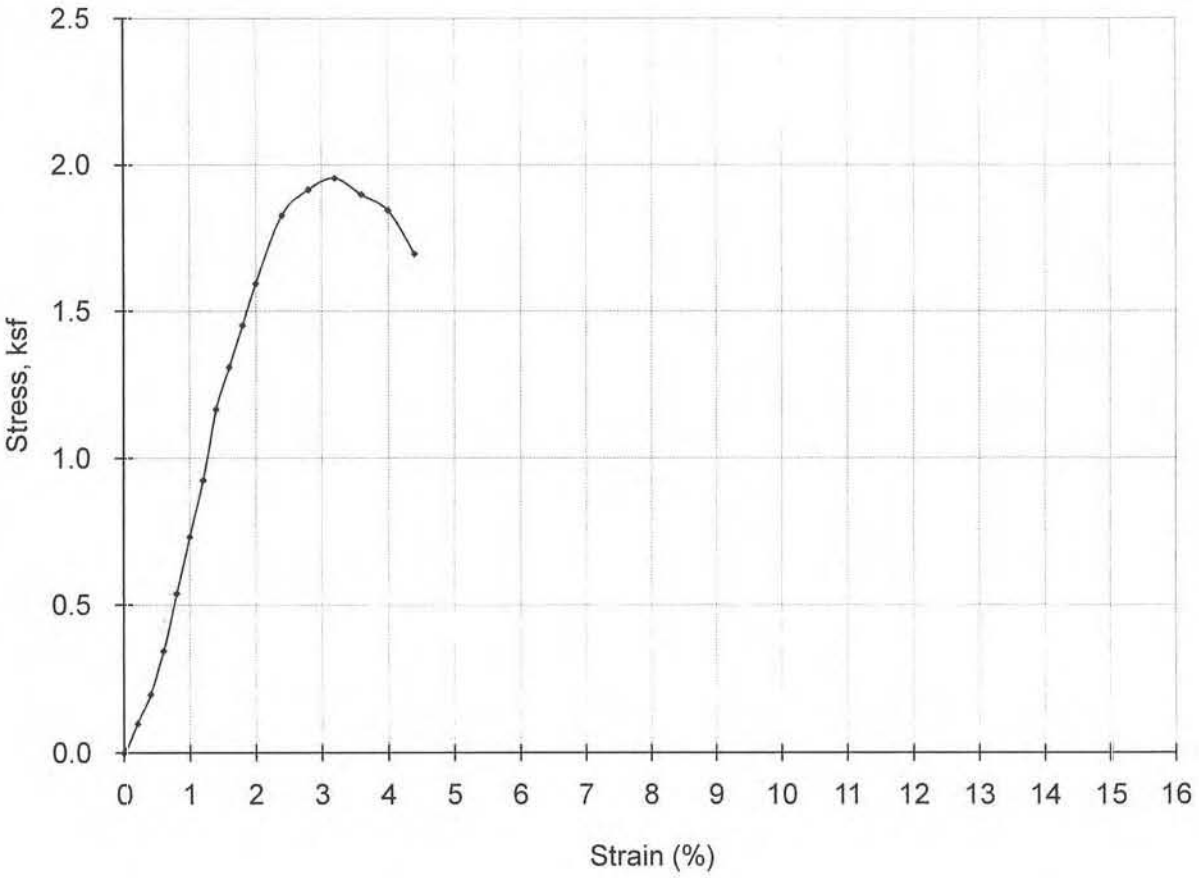
Sample No. : 1 **Strength (ksf):** 2.68

Depth (feet): 2 **Strain (%):** 15.00

Material Description:
Stiff, Lean Clay

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	REDWOOD LANDFILL INTERCHANGE PROJECT MARINE COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-GDR	PLATE NO.: 8E

UNCONFINED COMPRESSION TEST



Boring No.: A-10-158A

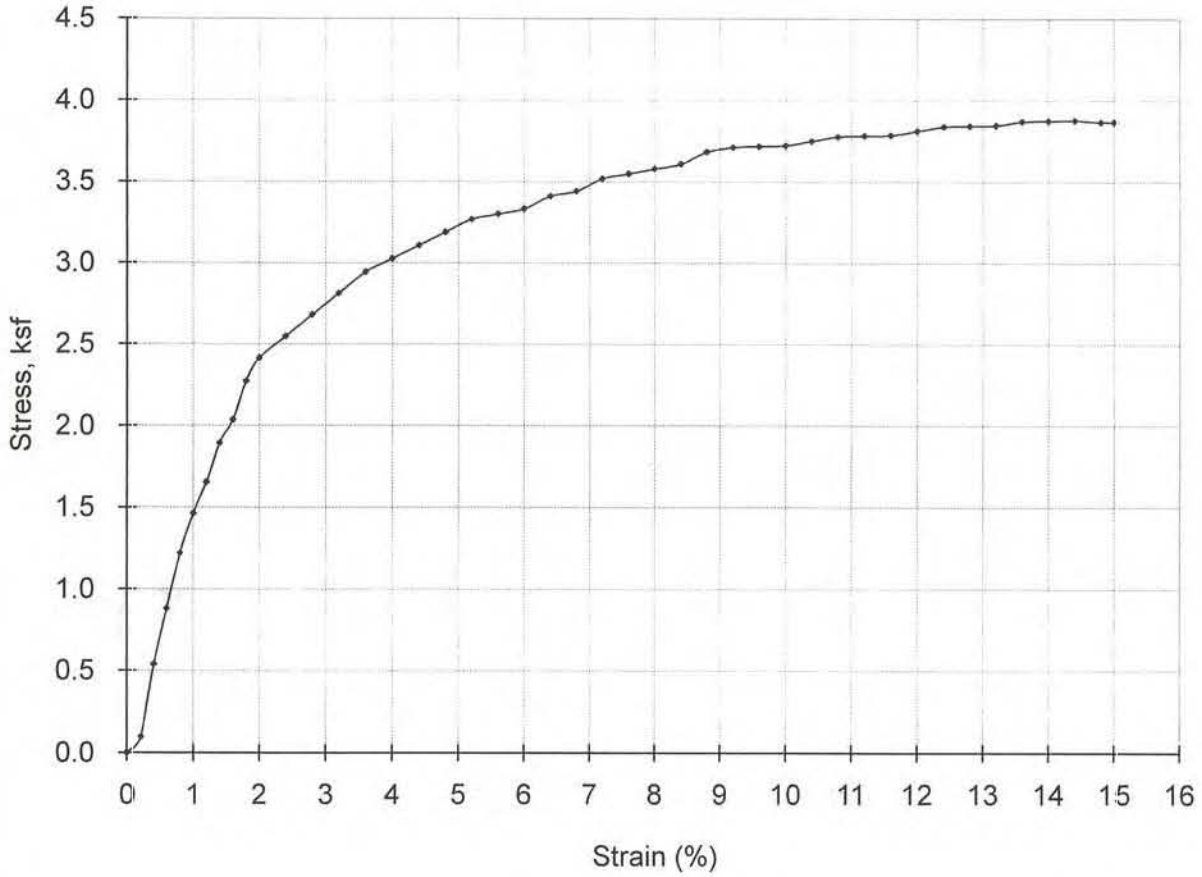
Sample No. : 2 **Maximum Strength (ksf):** 1.95

Depth (feet): 5 **Strain @ Failure (%):** 3.20

Material Description:
Firm, Sandy Lean Clay with Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	REDWOOD LANDFILL INTERCHANGE PROJECT MARINE COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-GDR	PLATE NO.: 8F

UNCONFINED COMPRESSION TEST



Boring No.: A-10-163

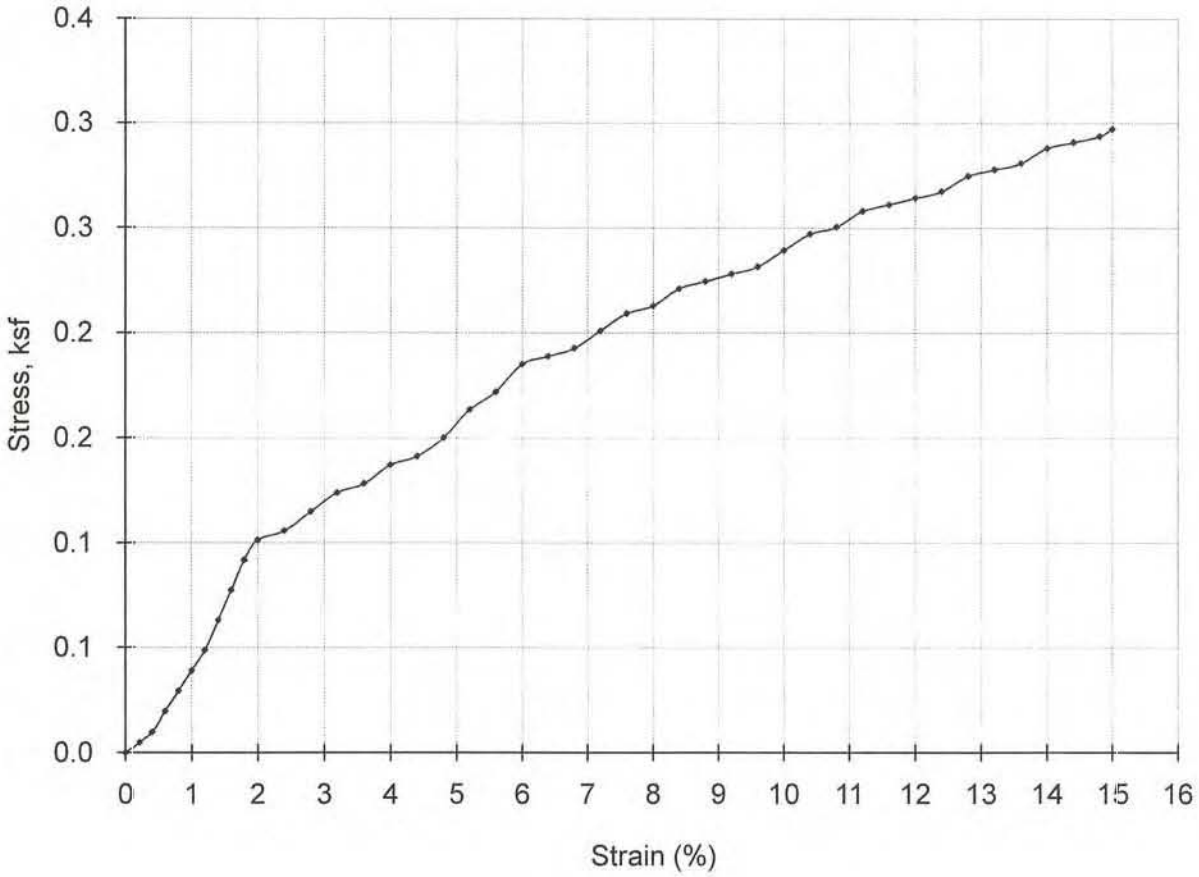
Sample No. : 3 **Strength (ksf):** 3.87

Depth (feet): 8.5 **Strain (%):** 15.00

Material Description:
Very Stiff, Lean Clay

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-LLS	PLATE NO.: 8C

UNCONFINED COMPRESSION TEST



Boring No.: A-10-163

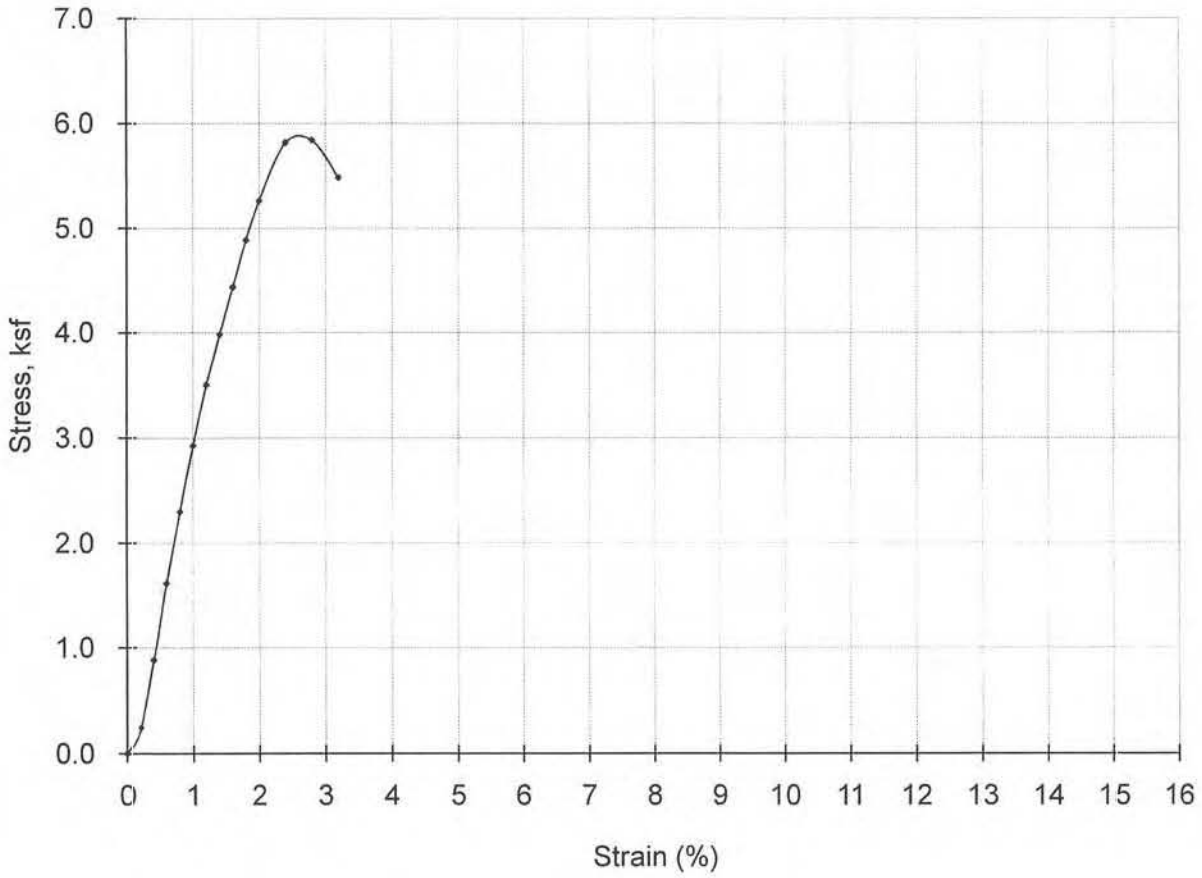
Sarnple No. : 5 **Strength (ksf):** 0.30

Depth (feet): 10-11.5 **Strain (%):** 15.00

Material Description:
Very Soft, Lean Clay with some Sand and Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-LLS	PLATE NO.: 8D

UNCONFINED COMPRESSION TEST



Boring No.: R-10-165

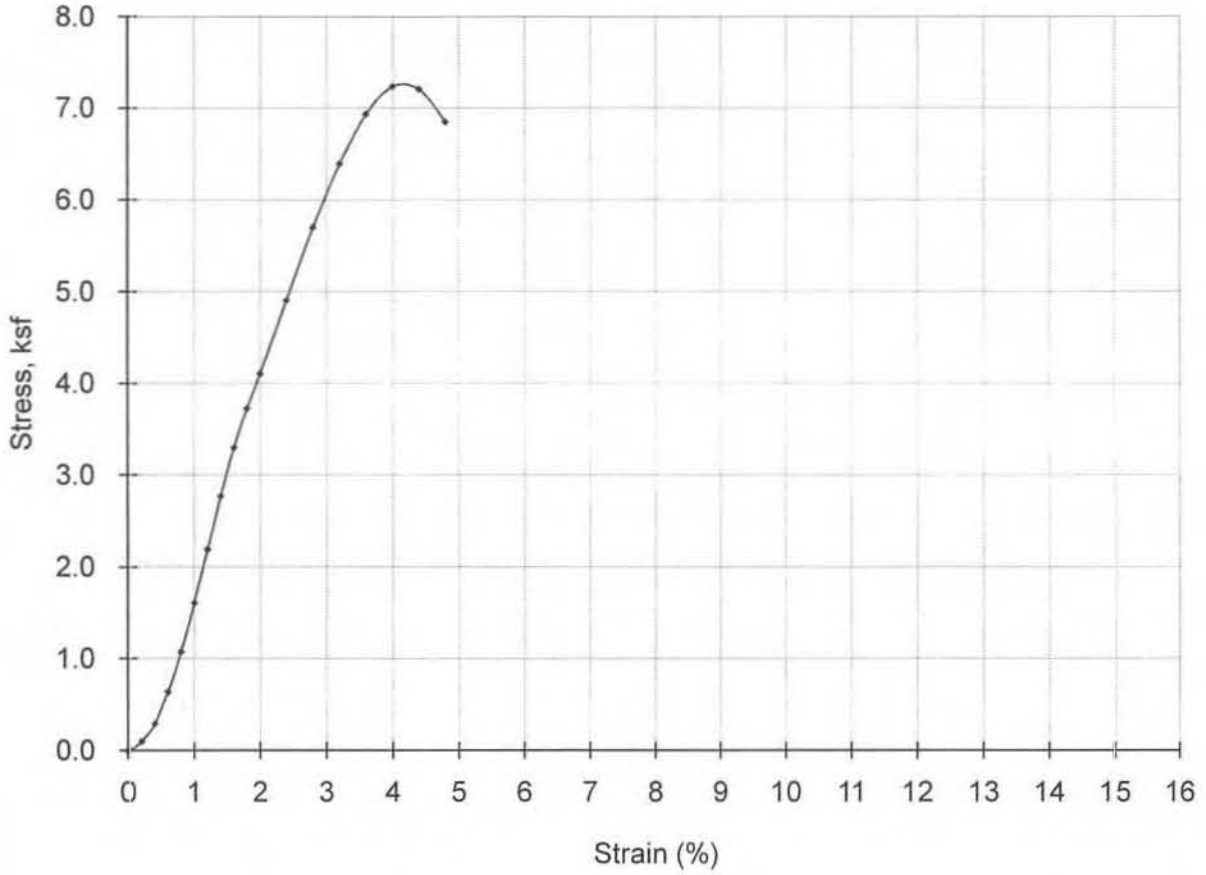
Sample No. : 1A **Maximum Strength (ksf):** 5.84

Depth (feet): 2 **Strain @ Failure (%):** 2.80

Material Description:
Hard, Lean Clay with Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.LLS	PLATE NO.: 8A

UNCONFINED COMPRESSION TEST



Boring No.: R-10-165

Sample No. : 2 **Maximum Strength (ksf):** 7.23

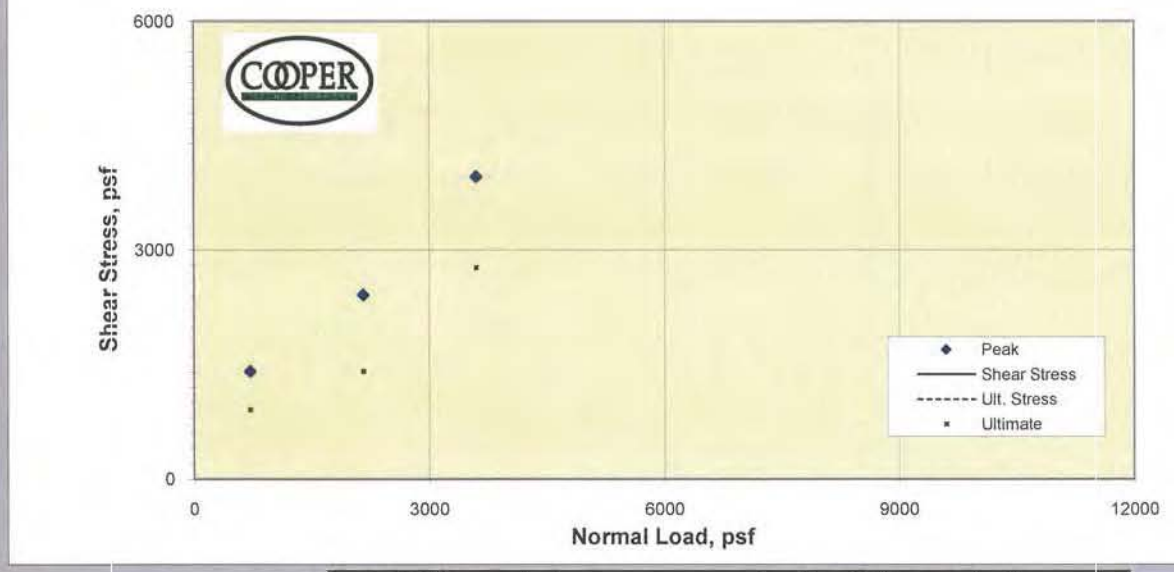
Depth (feet): 5.5 **Strain @ Failure (%):** 4.00

Material Description:
Hard, Lean Clay with Gravel

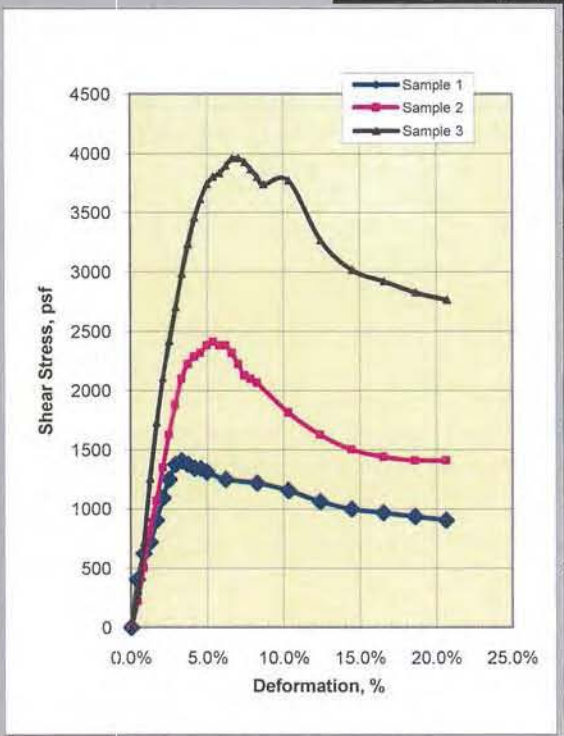
PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.LLS	PLATE NO.: 8B

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	16.3%	15.2%	15.2%	
Dry Dens., pcf	95.5	97.9	97.6	
Void Ratio	0.765	0.722	0.728	
Saturation %	57.5	57.0	56.3	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	22.6%	21.6%	21.6%	
Dry Dens., pcf	104.7	106.6	106.5	
Void Ratio	0.611	0.583	0.584	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.912	0.918	0.916	
Normal Stress, psf	720	2160	3600	
Shear Stress, psf	1409	2411	3961	
Strengths picked at	3.3%	5.4%	7.0%	
Ult. Stress, psf	908	1409	2766	
Strain Rate, %/min.	1.0	1.0	1.0	

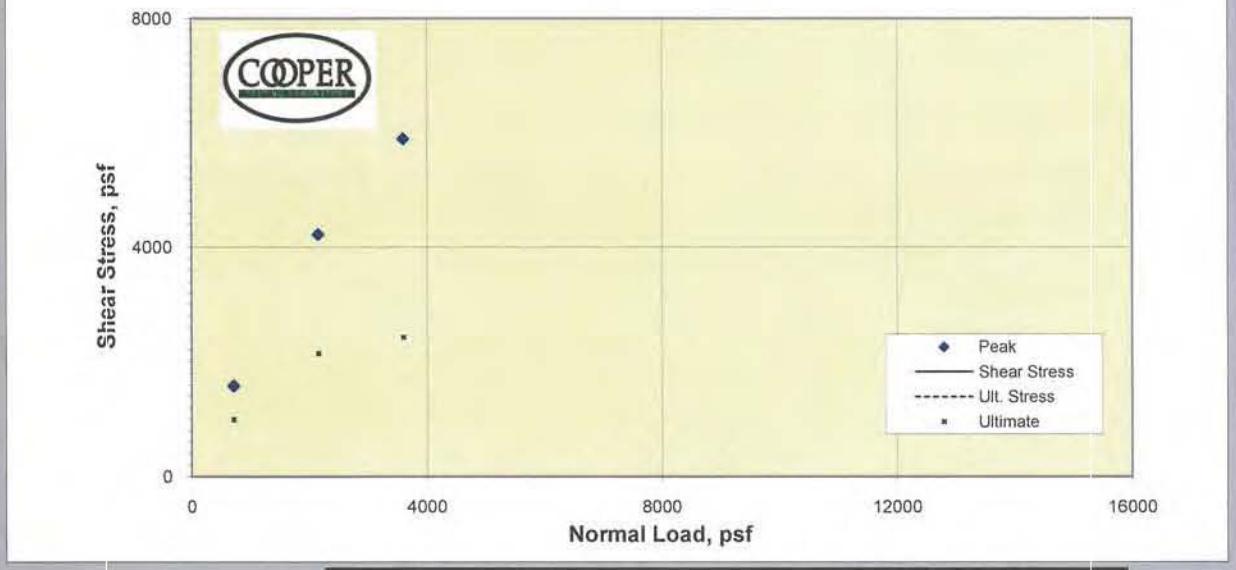
CTL #	157-283
Client:	Parikh Consultants
Project	MSN Contract B1-Landslide Study - 208140.LLS
Tested By:	MD
Reduced By:	RU
Date:	12/1/2010

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	R-10-162A		15	Olive Silty SAND (slightly plastic)
2	R-10-162A		15	Olive Silty SAND (slightly plastic)
3	R-10-162A		15	Olive Silty SAND (slightly plastic)
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

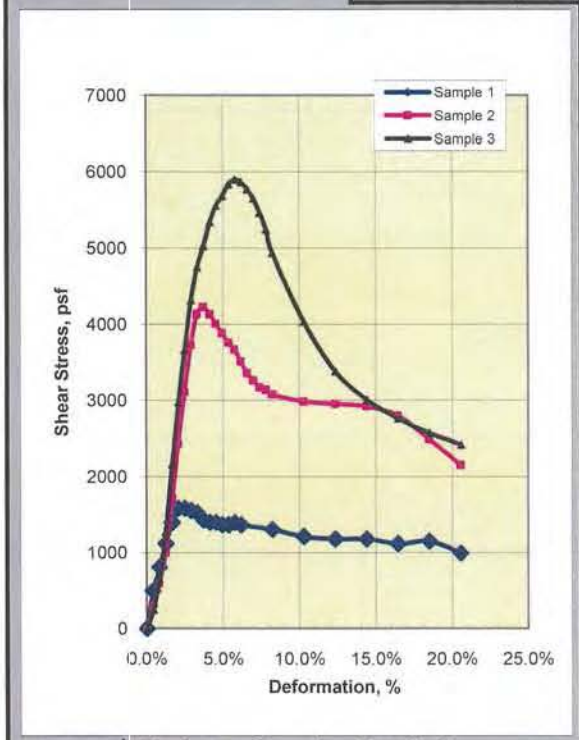
Plate No. 9A

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	22.2%	24.7%	20.8%	
Dry Dens., pcf	90.9	89.0	93.7	
Void Ratio	0.854	0.894	0.799	
Saturation %	70.2	74.7	70.3	
Diameter	2.43	2.43	2.43	
Height	1.01	1.01	1.01	
	Sample Data: At Test			
Moisture %	25.2%	26.5%	23.6%	
Dry Dens., pcf	100.3	98.4	103.0	
Void Ratio	0.682	0.715	0.638	
Saturation %	100.0	100.0	100.0	
Diameter	2.43	2.43	2.43	
Height	0.913	0.911	0.918	
Normal Stress, psf	720	2160	3600	
Shear Stress, psf	1584	4223	5899	
Strengths picked at	2.5%	3.7%	5.8%	
Ult. Stress, psf	994	2142	2422	
Strain Rate, %/min.	1.0	1.0	1.0	

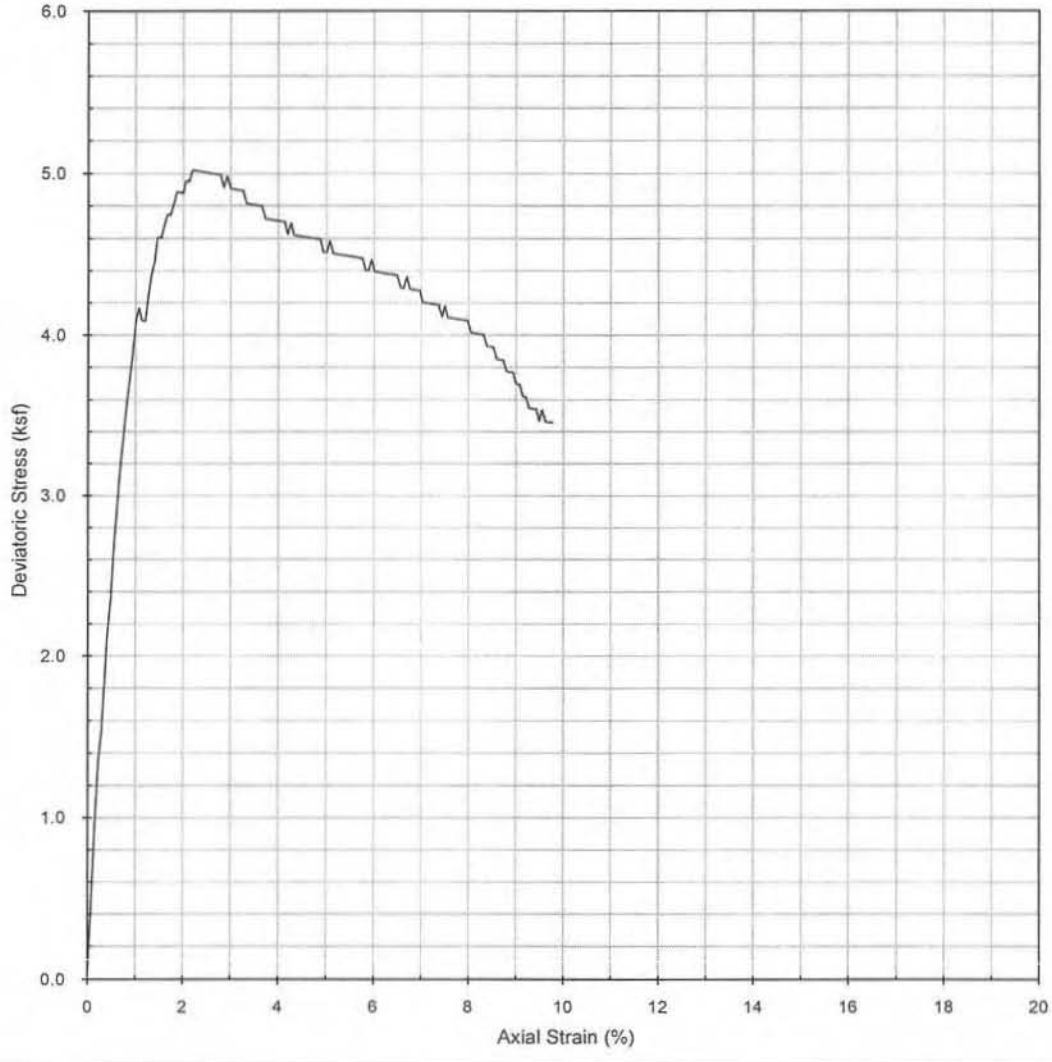
CTL #	157-283
Client:	Parikh Consultants
Project	MSN Contract B1-Landslide Study - 208140.LLS
Tested By:	MD
Reduced By:	RU
Date:	12/1/2010

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	RW-10-162		24-25	Olive Silty SAND
2	RW-10-162		24-25	Olive Silty SAND
3	RW-10-162		24-25	Olive Silty SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

Plate No. 9B

UNCONSOLIDATED UNDRAINED COMPRESSION TEST

Stress vs. Strain



Boring No.	R-10-161
Sample No.	
Elev. or Depth (ft)	11.5'-13'
Soil Description	Sandy Lean Clay, light brown

Height of Sample (inch)	5
Initial Diameter (inch)	2.416
% Moisture	26.1
Dry Density (pcf)	96.3
Cell Pressure (ksf)	0.72
Maximum Strength (ksf)	5.02
Strain @ Failure (%)	2.1

Date: 11/24/2010

File Name: UUR101161

APPENDIX C

SETTLEMENT ANALYSES

PROCEDURE FOR SETTLEMENT CALCULATIONS UNDER FILL AREAS

Settlements for all the seven fill areas noted in the report utilized the following approach. Calculations were performed based on the following assumptions:

- Based on information from field observations, range of settlements for self weight of the fill was taken as 0.5 to 0.75 percent of the height of fill.
- Compression settlements of the underlying native clay layers were judged to be immediate (elastic), and thus computed using elastic compression theory
  - Compressible (clay) layer thicknesses under each fill area were established based on the relevant boring under the fill area.
  - The compressible clay layers were divided into sublayers, generally 5 feet thick. Each sublayer was assumed to have homogenous propertied
  - Elastic modulus for each sublayer was computed as follows:
    - Shear strength of the sublayer was computed from the sampler blowcount. The shear strength was linearly interpolated between 1 and 2 ksf for SPT blow counts between 8 and 15 and between 2 and 4 ksf for blow counts between 15 and 30.
    - The past preconsolidation pressure is taken as 4 times the shear strength.
    - Effective vertical pressure is taken as 0.125x(depth to center of sublayer). Overconsolidation ratio (OCR) is the ratio of Effective Vertical Pressure to the Past Preconsolidation Pressure.
    - Elastic Modulus was based on the E/Su curves presented in Duncan and Buchignani (1976), based on OCR and Plasticity Index of the clays. The plate is attached.
  - Settlements were based on a strip loaded area under the fill, based on the height of the fill and the width of the top of fill.
  - Stresses were computed at the center of each strip, based on the a 2V:1H dispersion of the fill load
  - Elastic settlements for each sublayer was computed based on the formula:

  - Settlement $= \frac{\text{(Stress at Center of Sublayer)x(thickness of Sublayer)}}{\text{Elastic Modulus}}$

A table showing the computed settlements is presented below. Corresponding calculations are presented in the following pages. It should be noted that all the settlements are in the overconsolidated range.

Fill Area No.	Relevant Boring	Maximum Fill Height (ft)	Compressible Layer Thickness (ft)	Fill Settlement (inches)[1]	Native Soil Settlement (inches
1A	A-09-104	15	20	0.9 to 1.35	0.66
1B	A-09-105	19	8	1.15 to 1.7	0.25
2	A-09-110	30	15	1.8 to 2.7	0.52
3	A-09-114	12	5	0.7 to 1.1	0.16
4	A-09-125	11	0[1]	0.65 to 1.0	0
5	A-09-133 A-09-134	28	12	1.7 to 2.5	0.55
6	A-10-167	15	8	0.9 to 1.35	0.12
7	A-10-165	10	12	0.6 to 0.9	0.15

Notes:
(1) 0.5 to 0.75 percent of Fill Height
(2) Rock at ground surface in the relevant boring

Fill Area No. = 1A **Height of Fill =** 15 **Contact Width (B) =** 60

Boring No. A-09-104 **Contact Pressure =** 1875

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	8	8	5	0.69	346667	64	1758	0.487	0.5	2.773333	5.546667	500
8	20	37	24	3.2	1282667	74	1520	0.171	1.75	12.82667	7.329524	400
								0.66				

LL = 30, PI =14 **E = 500 Su**

Note: The top layer was described as clayey sand in the field; so, the settlement is probably overestimated

Fill Area No. = 1B **Height of Fill =** 19 **Contact Width (B) =** 60

Boring No. A-09-105 **Contact Pressure =** 2375

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	8	39	25	3.38	845000	64	2227	0.253	0.5	13.52	27.04	250
								0.253				

LL = 48, PI =31 **E = 250 Su**

Fill Area No. = 2 Height of Fill = 30 Contact Width (B) = 70

Boring No. A-09-110 Contact Pressure = 3750

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	5	36	23	3.1	1092000	72.5	3621	0.199	0.3125	12.48	39.936	350
5	10	43	28	3.7	1304333	77.5	3387	0.156	0.9375	14.90667	15.90044	350
10	15	39	25	3.4	1183000	82.5	3182	0.161	1.5625	13.52	8.6528	350
								0.52				

LL = 38, PI = 20 E = 350 Su

Fill Area No. = 3 **Height of Fill =** 12 **Contact Width (B) =** 52

Boring No. A-09-114 **Contact Pressure =** 1500

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	7	18	12	1.6	780000	55.5	1405	Sand	0.4375	6.24	14.26286	
7	12	11	7	1.0	476666.7	61.5	1268	0.160	1.1875	3.813333	3.211228	500
12	17	38	25	3.3	23936.1	66.5	1173	Sand	1.8125	13.17333	7.268046	
								0.16				

LL = 38, PI = 20 **E =500 Su**

Fill Area No. = 5 Height of Fill = 28 Contact Width (B) = 70

Boring No. A-09-133&134 Contact Pressure = 3500

Depth From	Depth To	Blow Counts MC	Blow Counts SPT	Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
0	6	36	23	3.1	780000	73	3356	0.310	0.375	12.48	33.28	250
6	12	43	28	3.7	931666.7	79	3101	0.240	1.125	14.90667	13.25037	250
								0.549				

LL = 51, PI = 28 (n Boring 133 E = 250 Su

Fill Area No. = 6 **Height of Fill =** 15 **Contact Width (B) =** 55

Boring No. A-10-167 **Contact Pressure =** 1875

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	4	33	21	2.9	1001000	57	1809	0.087	0.25	11.44	45.76	350
4	8	72	47	6.2	2184000	61	1691	0.037	0.75	24.96	33.28	350
								0.12				

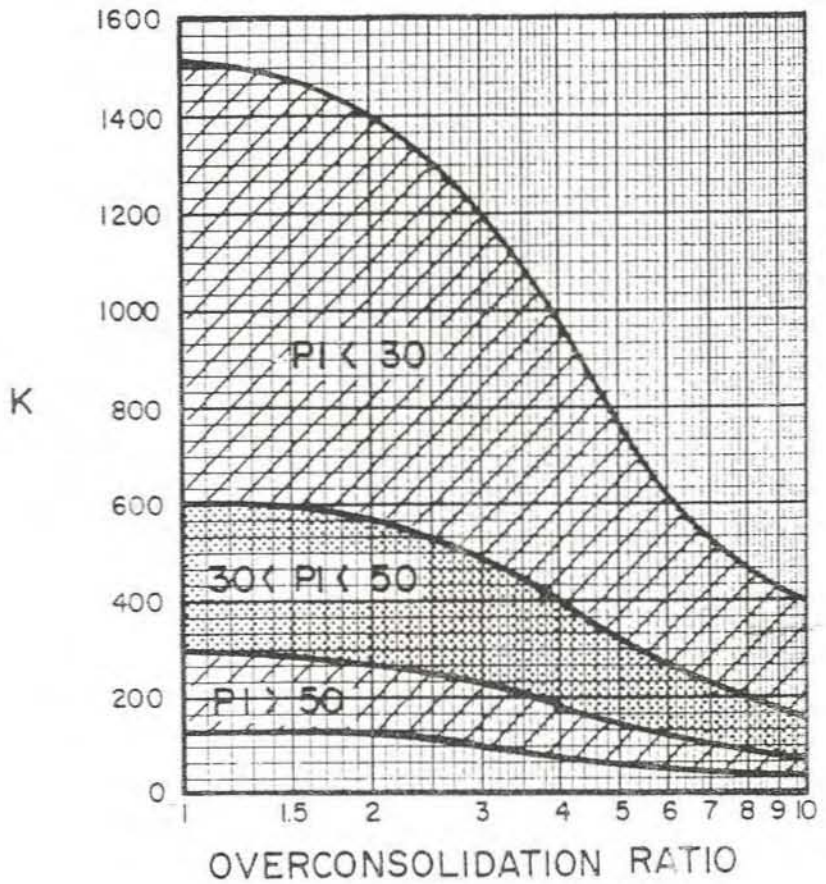
LL = 31, PI = 14 **E = 350 Su**

Fill Area No. = 7 Height of Fill = 10 Contact Width (B) = 50

Boring No. A-10-165 Contact Pressure = 1250

Depth		Blow Counts		Su (ksf)	E (psf)	B'	q (psf)	Settl. (in.)	Sigv	Pp (ksf)	OCR	E/Su
From	To	MC	SPT									
0	4	20	13	1.7	606666.7	52	1202	0.095	0.25	6.933333	27.73333	350
4	12	64	42	5.5	1941333	58	1078	0.053	1	22.18667	22.18667	350
								0.15				

LL = 31, PI = 15 E = 350 Su



$E_u = KS_u$

E_u = UNDRAINED MODULUS OF CLAY

K = FACTOR FROM CHART ABOVE

S_u = UNDRAINED SHEAR STRENGTH OF CLAY

Fig. 5 CHART FOR ESTIMATING UNDRAINED MODULUS OF CLAY

SLOPE STABILITY ANALYSES

1. **2:1 Cut Slope in Bimrock – 20 feet high**

2. **Southwest Frontage Road – Sta. 259+00 ("FR1" Line) – Wedge Analyses**

   (4 runs) – includes discussion of procedure

3. **Sta. 416+00 ("RLF" Line)**

4. **Sta. 337+40 ("RL2" Line)**

5. **Northbound On-Ramp Fill Slope: Effective and Total Stress Analyses (2 runs)**

6. **Retaining Wall No. 7 (3 runs) - includes discussion of procedure**

SLOPE STABILITY ANALYSIS PROCEDURES

Slope stability analyses were generally performed using the SLOPE/W computer program, using circular failure surfaces (a wedge analysis was performed for one case). The input includes the slope geometry, the design soil profile at the slope location, the pertinent soil properties (unit weight and density of the soil) and the water table.

For the analyses, limits for the top and toe of the circle are specified (see attached figure). The program employs a search routine to determine the circle with the minimum factor of safety within the specified limits.

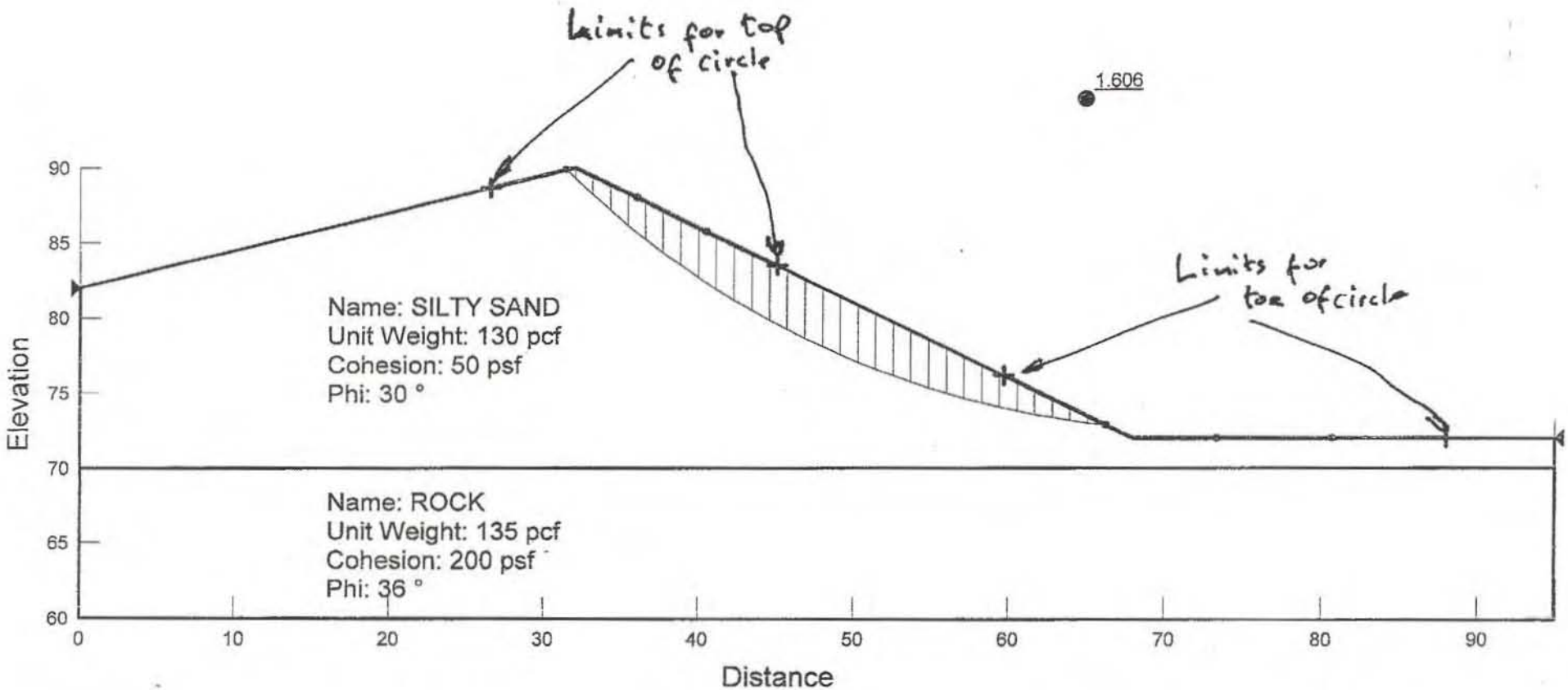
If the limits are specified appropriately, as in the attached figure, the local slope stability is automatically analyzed (along with the global stability) when soil properties for the slope are homogenous for the height of the slope. The safety factor and the analyses result that is presented is for the lowest value of circles within the specified limits.

For very small slopes (slump conditions) it is not feasible to model and analyze the slopes and therefore specific mitigation measures are discussed to minimize such slumps. These measures are presented in Sections 8.1.1 and 8.1.2 of the report.

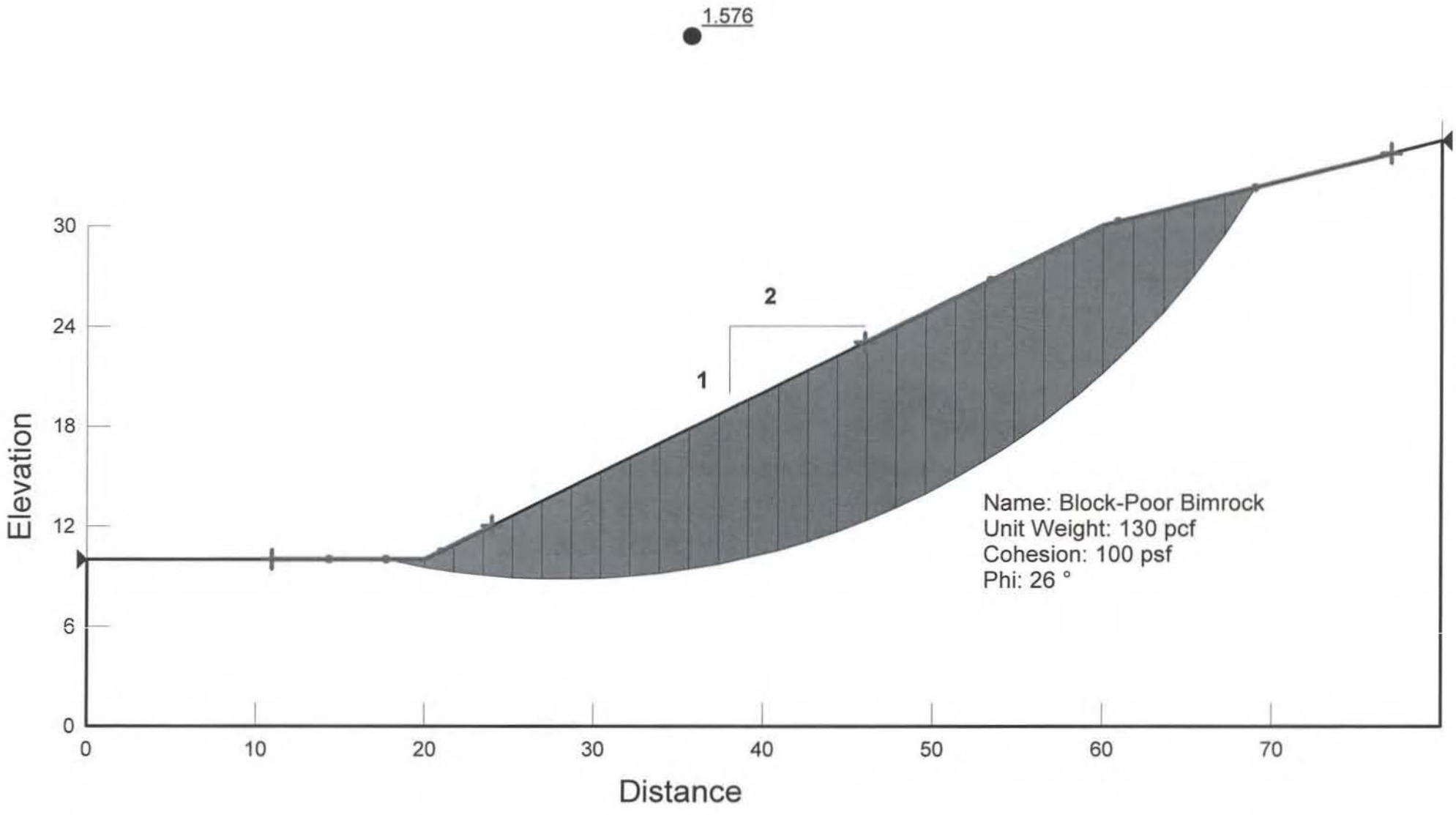
Slope stability analyses were run for both static and pseudo-static conditions. For pseudo-static conditions, a coefficient of 0.2g per Caltrans Guidelines for Structures Foundation Reports, December, 2009 was used. Additionally, the cohesion was increased by 50 percent to account for increased strength due to rapid loading.

A factor of safety of 1.5 is required for static conditions and 1.1 for seismic conditions.

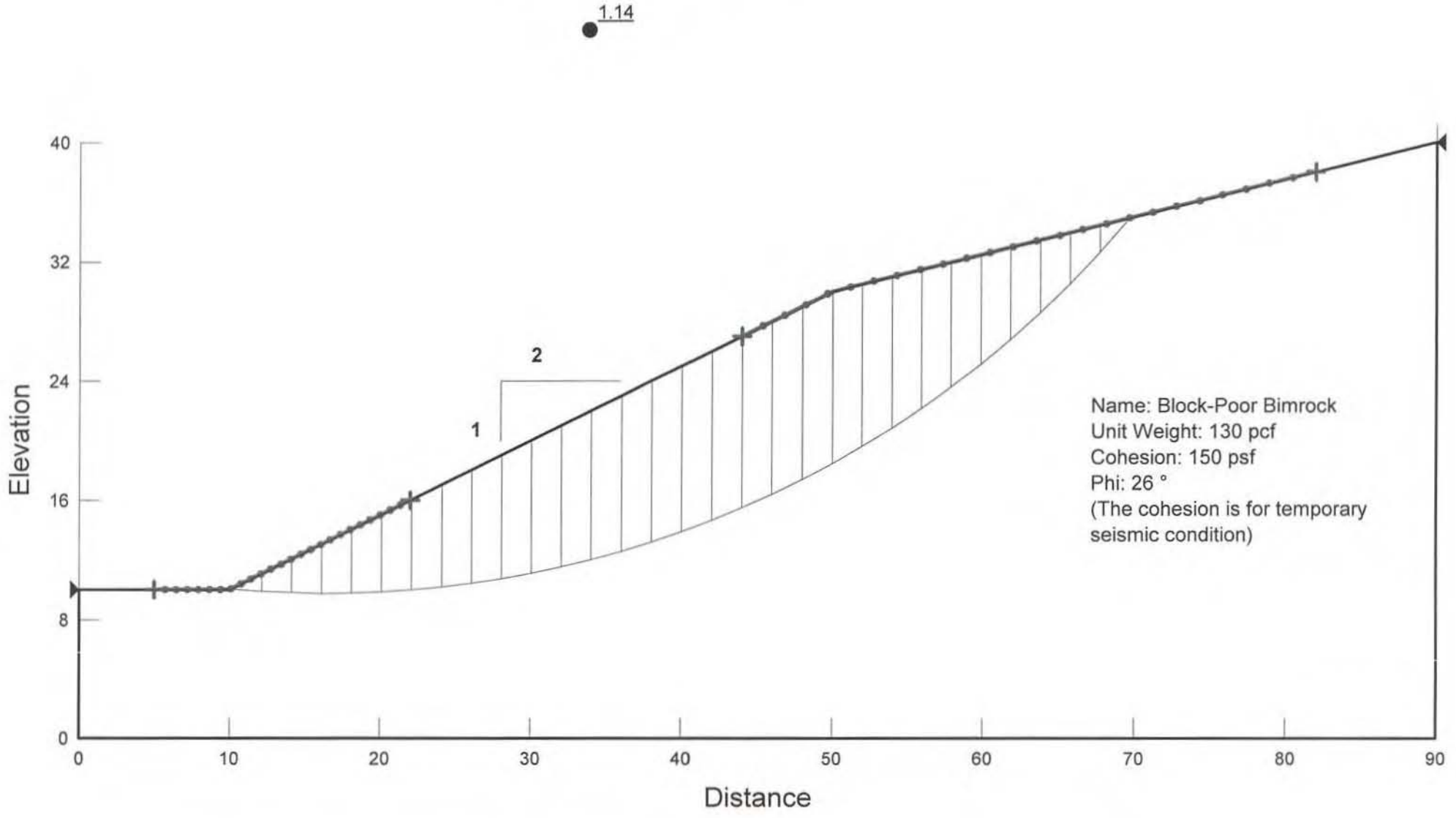
MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 337+40 "RL2 LINE"
(BASED ON BORING NO. A-09-112)



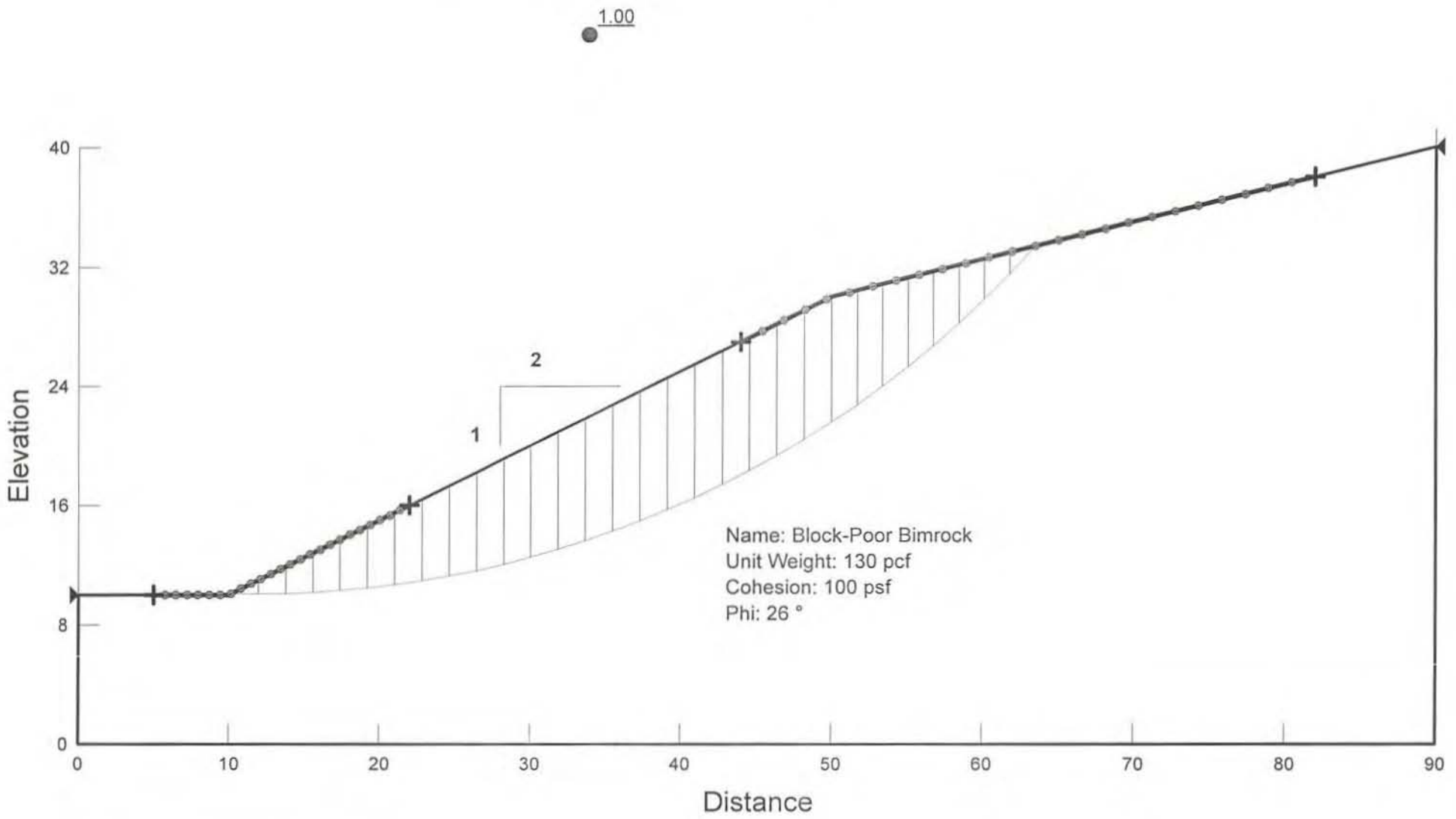
MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
CUT SLOPE IN BLOCK-POOR BIMROCK
SLOPE HEIGHT = 20 FEET



MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
CUT SLOPE IN BLOCK-POOR BIMROCK
SLOPE HEIGHT = 20 FEET
SEISMIC CONDITION - 0.2 g



MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
CUT SLOPE IN BLOCK-POOR BIMROCK
SLOPE HEIGHT = 20 FEET
SEISMIC CONDITION - 0.21 g



PROCEDURE FOR SLOPE STABILITY ANALYSIS
SOUTHWEST FRONTAGE ROAD - STA. 259+00 ("FR1" LINE)

Cross-sections for slope stability were developed for:

- Existing Conditions, e.g. prior to construction of the Frontage Road; and
- Post Construction, e.g. after construction of the Frontage Road

The cross-sections were based on borings A-10-161, 162, 162A, 163, 164 and 166.

Soils in the cross-sections consisted of:

- Landslide Debris (Qls)
- Tertiary Sandsrone (Ts)
- Stiff Sandy Clay (CL) – 2-ft thick, between Ts and fg
- Franciscan Melange (fg)

Slope stability analyses were performed using the 'wedge' method of analysis, using the SLOPE/W computer program. The failure surface was forced through the CL layer. Analyses were performed for:

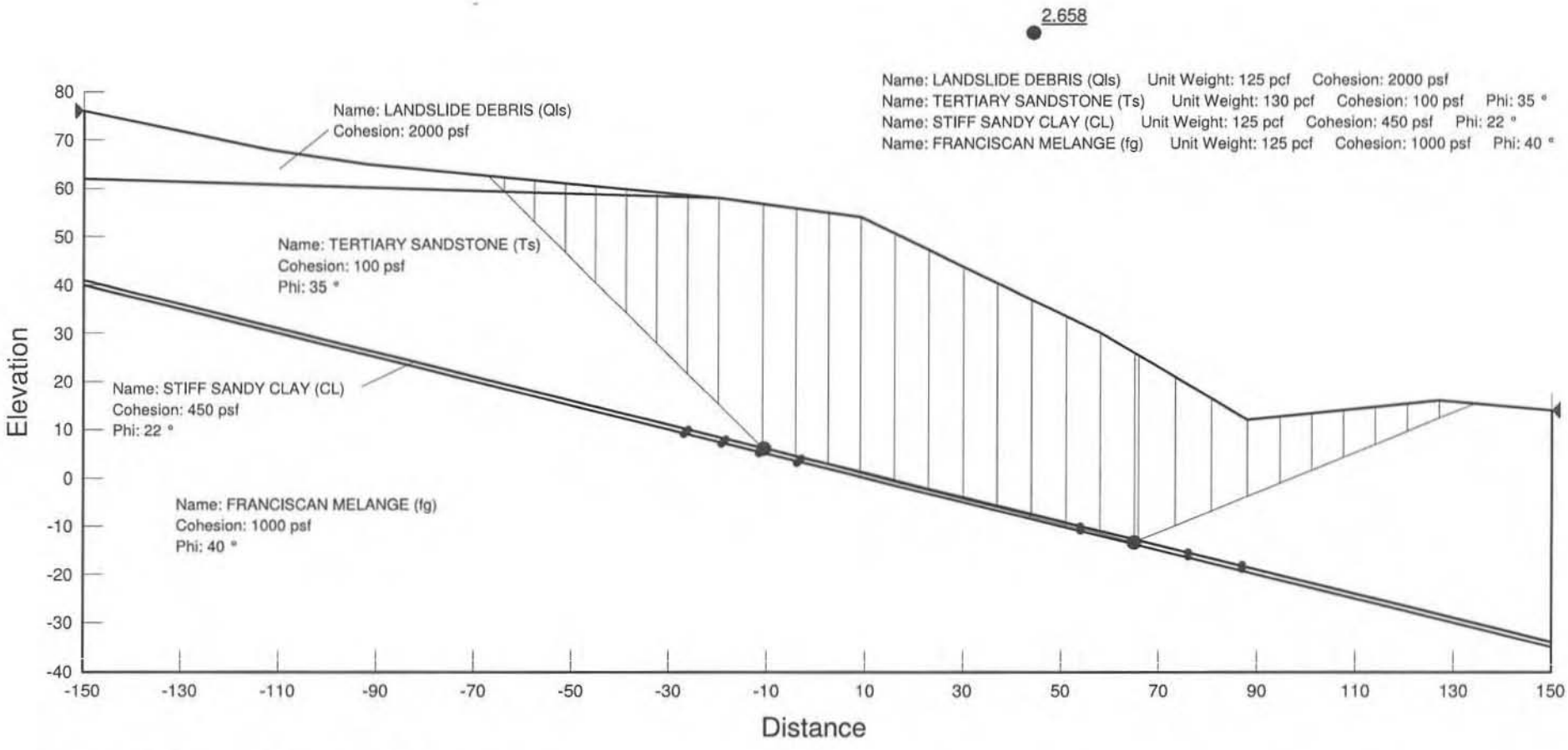
- Total stress (using Phi = 22 degrees; and cohesion = 450 psf for the CL layer); and
- Effective stress (using Phi = 30 degrees; and cohesion = 0 psf for the CL layer)

Thus, four analyses were performed:

- Existing Conditions – Total Stress Analysis
- Post Construction - Effective Stress Analysis
- Existing Conditions – Total Stress Analysis
- Post Construction – Effective Stress Analysis

The cross-sections analyzed and the results of the analyses (e.g. factors of safety) are presented in the following pages.

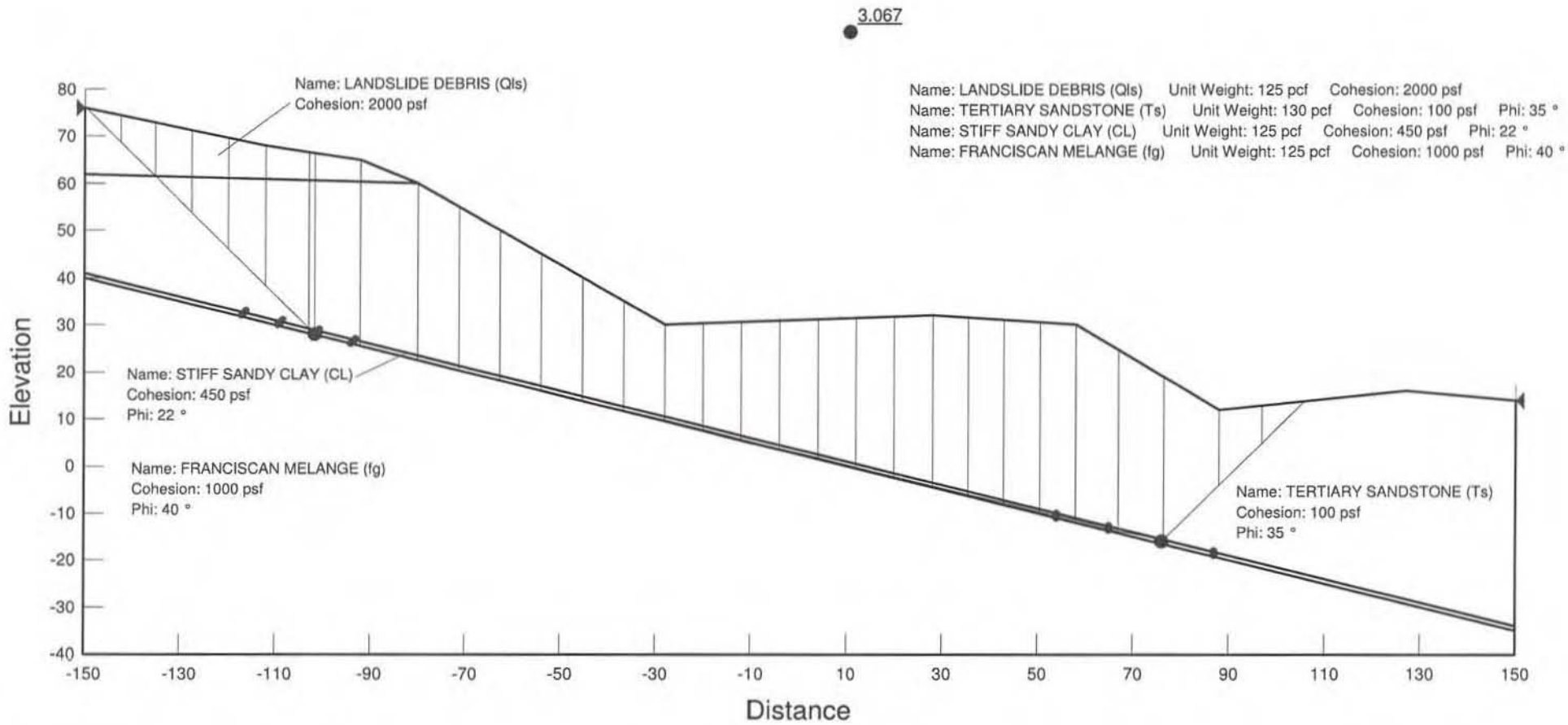
MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
SOUTHWEST FRONTAGE ROAD
STA. 259+00 ("FR1" LINE)
EXISTING CONDITIONS - TOTAL STRESS ANALYSIS



Section is based on Borings R-10-161, R-10-162, R-10-163, R-10-164, R-10-166

Section FR1 (Existing Conditions).gsz
5/1/2011 2:19:23 PM

MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
SOUTHWEST FRONTAGE ROAD
STA. 259+00 ("FR1" LINE)
POST CONSTRUCTION - TOTAL STRESS ANALYSIS

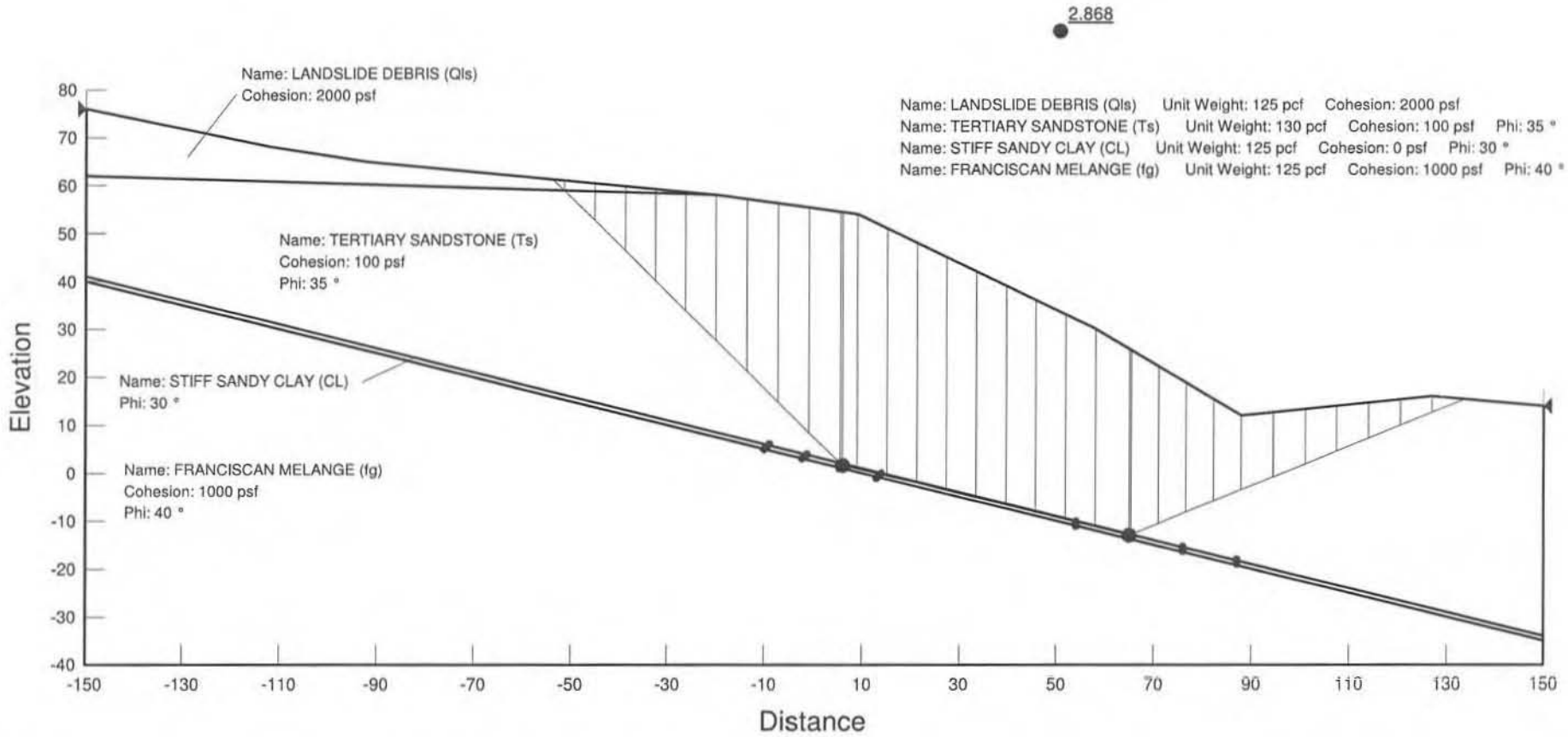


Section is based on Borings R-10-161, R-10-162, R-10-163, R-10-164, R-10-166

FR1 259+00

Section FR1 (Cut).gsz
5/1/2011 2:59:37 PM

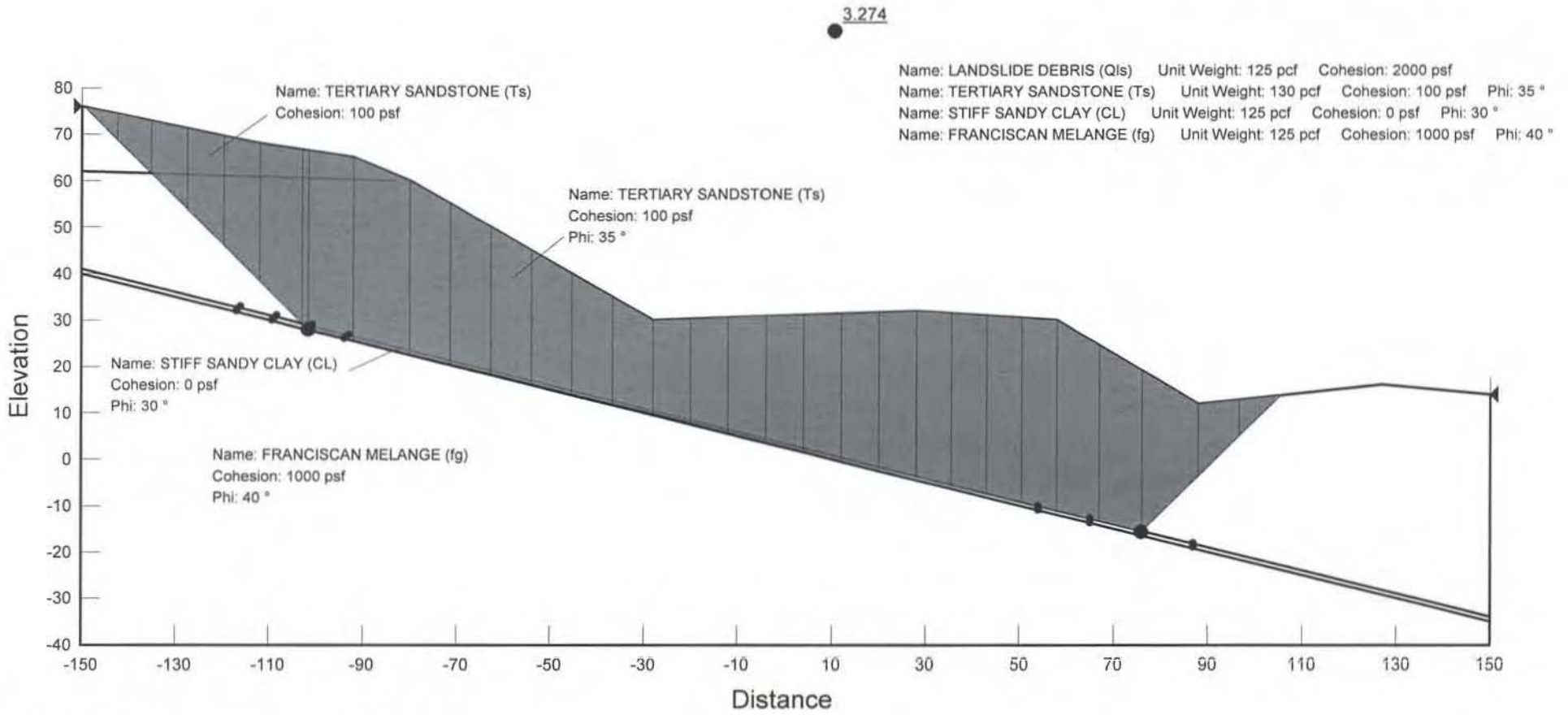
MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
SOUTHWEST FRONTAGE ROAD
STA. 259+00 ("FR1" LINE)
EXISTING CONDITIONS - EFFECTIVE STRESS ANALYSIS



Section is based on Borings R-10-161, R-10-162, R-10-163, R-10-164, R-10-166

Section FR1 (Existing Conditions)-Eff Cl.gsz
5/1/2011 3:04:31 PM

MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 259+00 ("FR1" LINE)
POST CONSTRUCTION - EFFECTIVE STRESS ANALYSIS



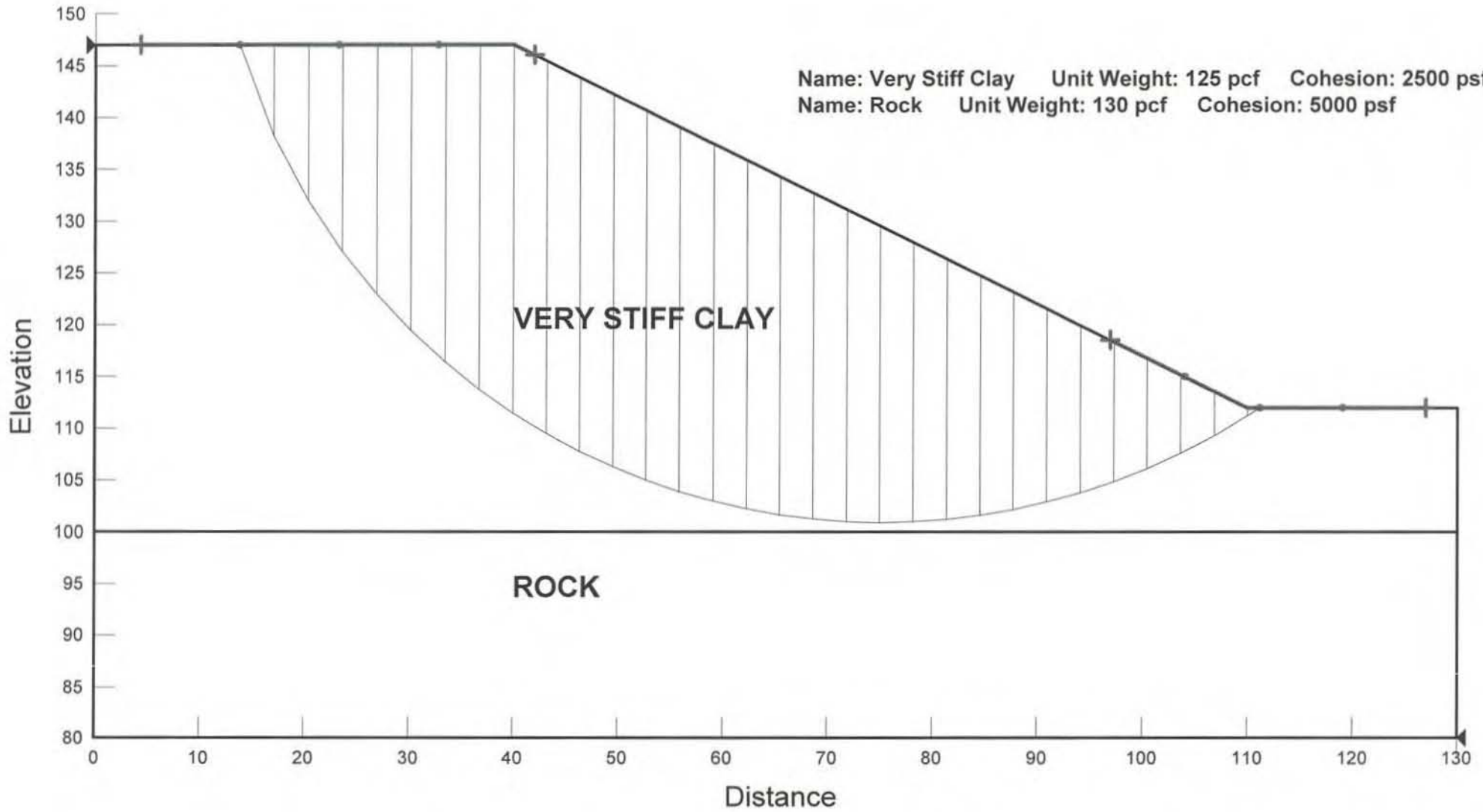
Section is based on Borings R-10-161, R-10-162, R-10-163, R-10-164, R-10-166

FR1 259+00

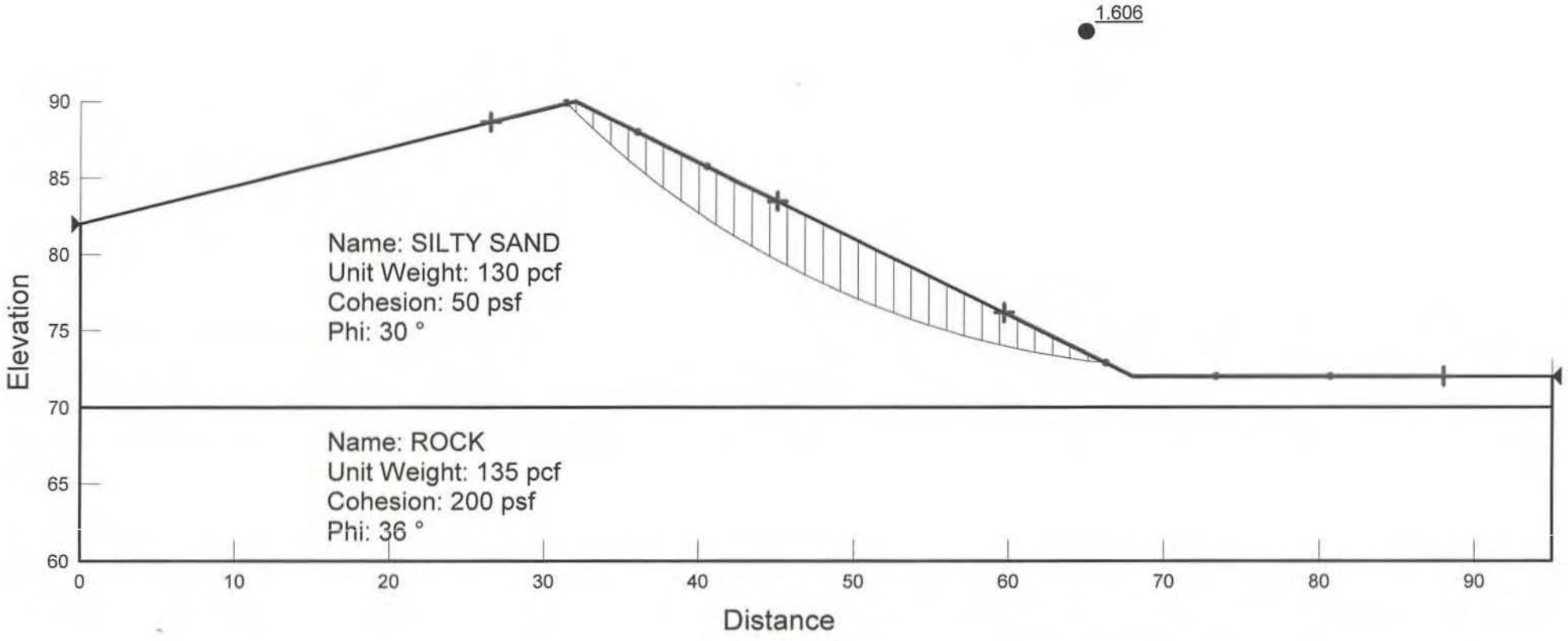
Section FR1 (Cut)-Eff Cl.gsz
5/1/2011 2:54:28 PM

REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STATION 416+00 ("RLF" LINE)

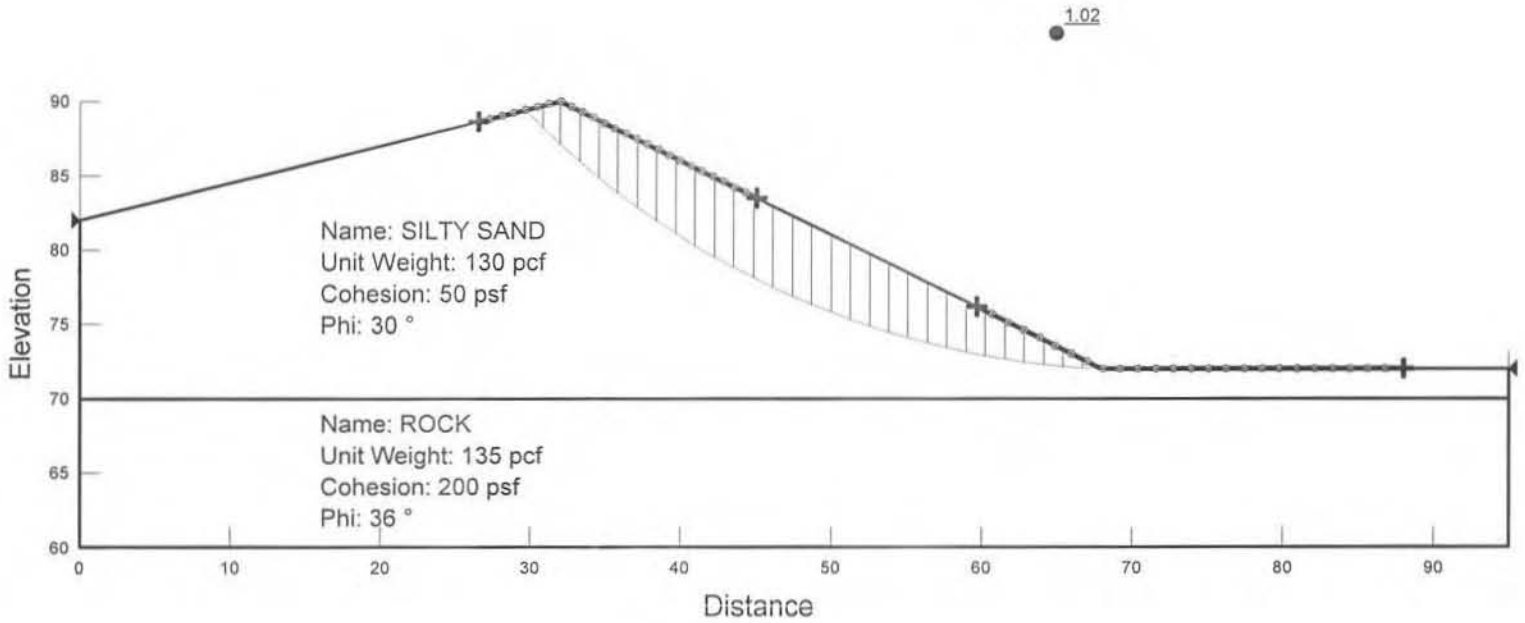
3.793



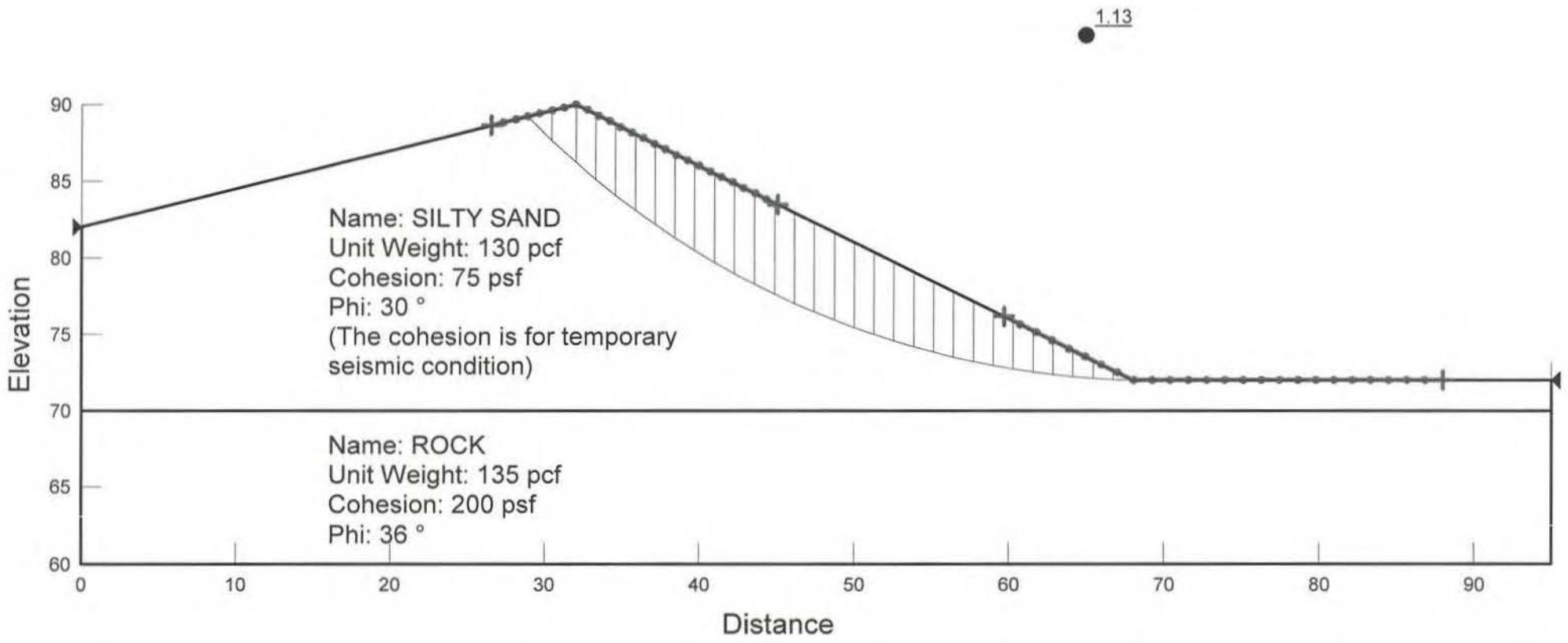
MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 337+40 "RL2 LINE"
(BASED ON BORING NO. A-09-112)



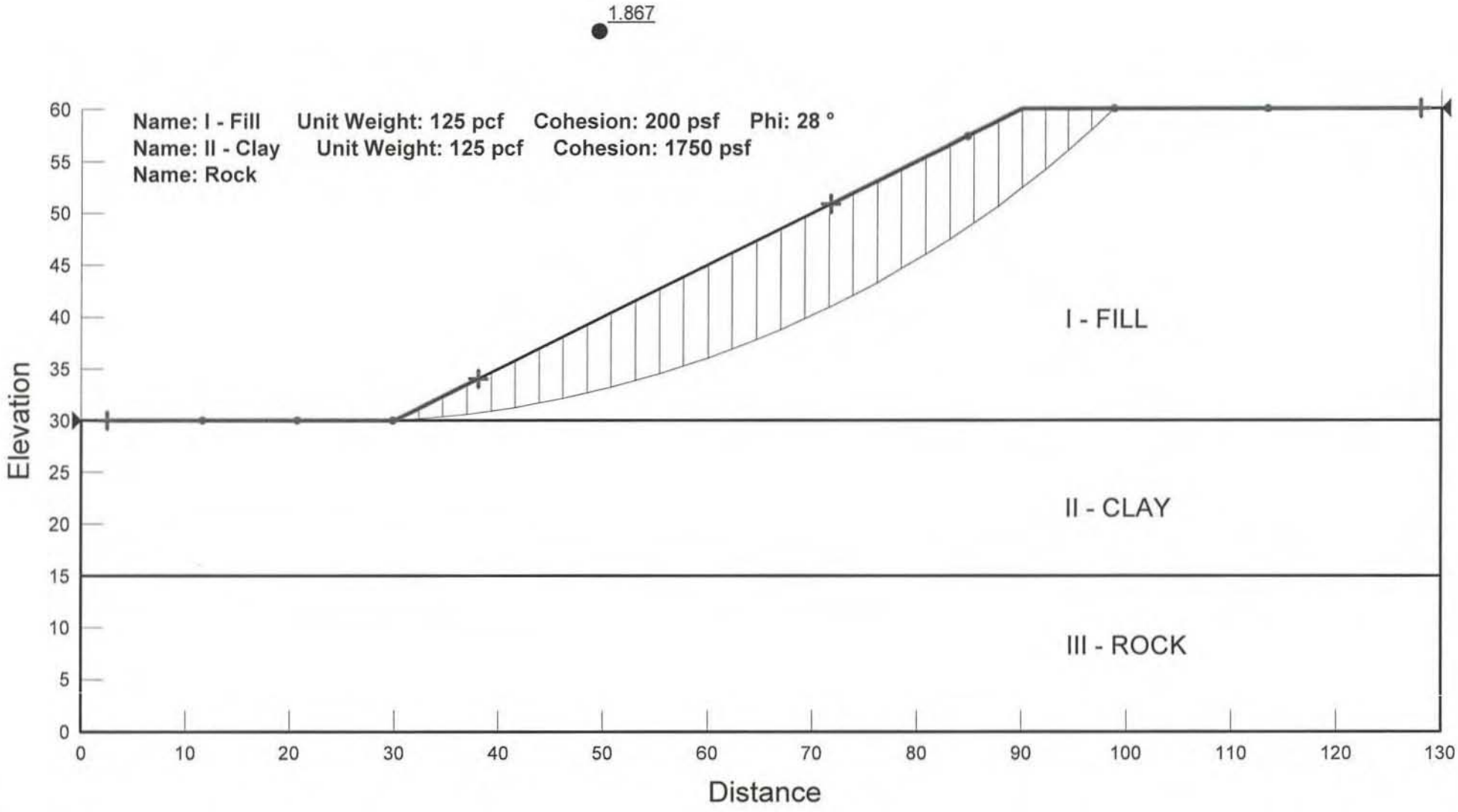
MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 337+40 "RL2 LINE"
(BASED ON BORING NO. A-09-112)
SEISMIC CONDITION - 0.21 g



MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 337+40 "RL2 LINE"
(BASED ON BORING NO. A-09-112)
SEISMIC CONDITION - 0.2 g

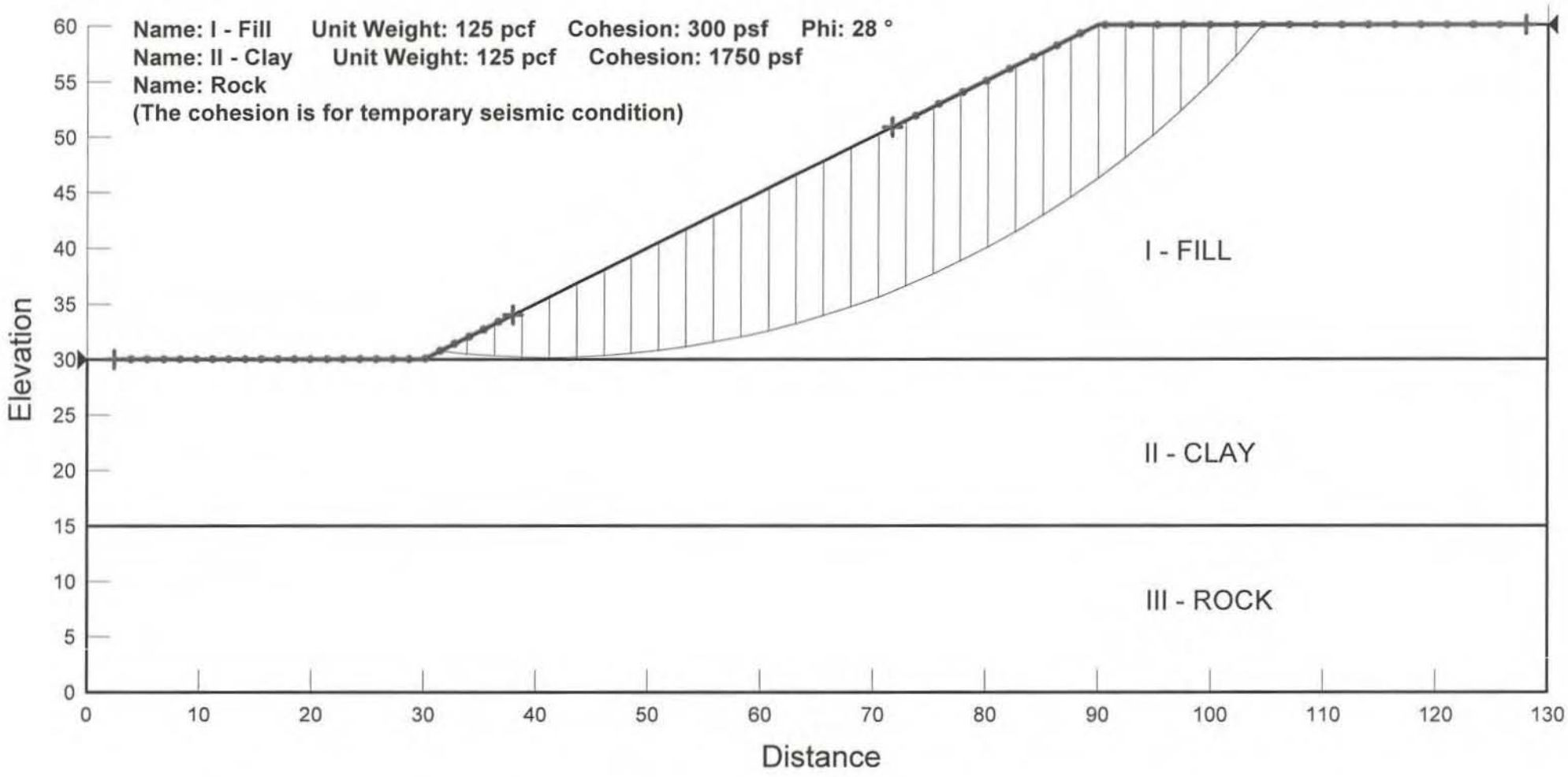


REDWOOD LANDFILL INTERCHANGE PROJECT
NORTHBOUND ON-RAMP FILL SLOPE
BASED ON BORING A-09-110



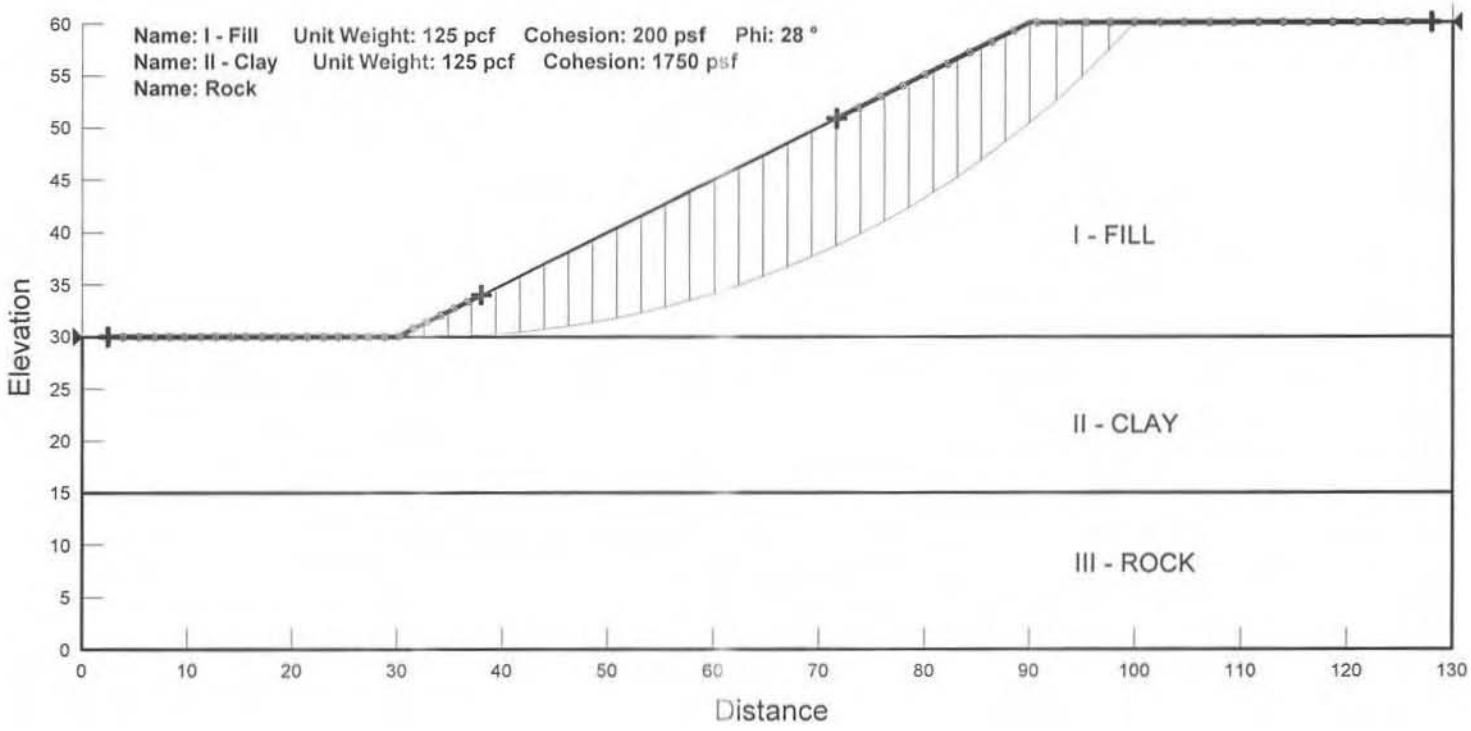
REDWOOD LANDFILL INTERCHANGE PROJECT
NORTHBOUND ON-RAMP FILL SLOPE
BASED ON BORING A-09-110
SEISMIC CONDITION - 0.2 g

1.39



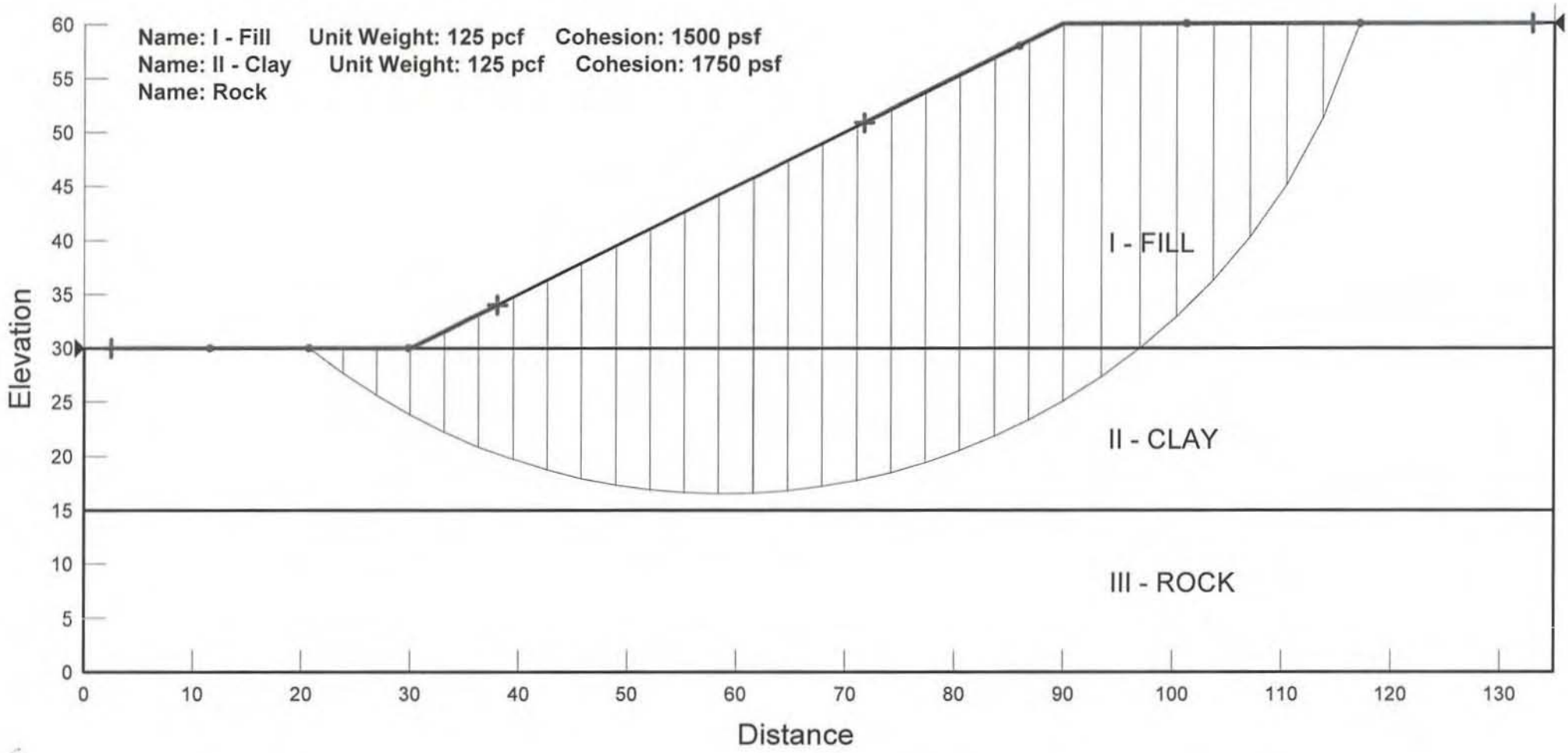
REDWOOD LANDFILL INTERCHANGE PROJECT
NORTHBOUND ON-RAMP FILL SLOPE
BASED ON BORING A-09-110
SEISMIC CONDITION - 0.21 g

1.19



REDWOOD LANDFILL INTERCHANGE PROJECT
NORTHBOUND ON-RAMP FILL SLOPE (ALT.)
BASED ON BORING A-09-110

2.849



PROCEDURE FOR SLOPE STABILITY ANALYSIS
RETAINING WALL NO. 7

The analyses were performed using the computer program SLOPE/W; conventional circular failure surfaces were used. The following procedure was employed:

a) A stability analysis was performed for the condition representing the configuration prior to occurrence of the landslide. The **"pre-slide"** cross-section was developed by our Engineering Geologist, based on geomorphology (the terrain contours and other pertinent field observations). This analysis was performed to establish a slide zone and the strength characteristics of the slide zone material for a factor of safety of 1 (e.g. incipient failure of the landslide mass)

b) A **"post-slide"** cross-section was then developed representing the presently existing configuration. The location of the slide zone and the strength characteristics of the slide zone material from "preslide condition were replicated and an analysis was performed. The analysis yielded a factor of safety of 1.429.

c) A final analysis was performed to investigate the effects of introduction of the proposed cut and retaining wall (**"existing with cut/wall"**) . The analyzed cross-section was essentially identical with the "post-slide" cross-section, except the presence of the vertical cut for the wall. The analysis yielded a factor of safety of 1.428.

Soils in the cross-sections consisted of:

- Landslide Debris;
- Slide Zone; and
- Bedrock

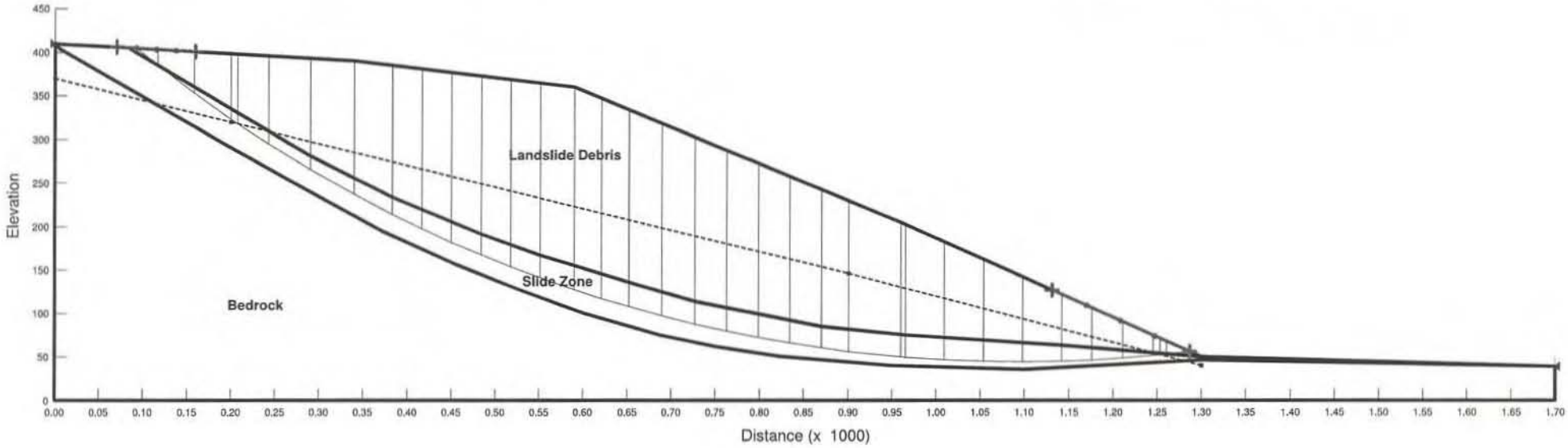
The cross-sections analyzed and the results of the analyses (e.g. factors of safety) are presented in the following pages. As may be noted, there is very little difference in the cross-sections for b) and c), relative to the slide plane. Hence, the factors of safety for the two cases are essentially identical.

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
RETAINING WALL NO. 7
INITIAL (PRE-SLIDE)

1.021

Name: Landslide Debris Unit Weight: 130 pcf Cohesion: 100 psf Phi: 26 °
Name: Slide Zone Unit Weight: 130 pcf Cohesion: 100 psf Phi: 19 °
Name: Bedrock Unit Weight: 130 pcf Cohesion: 1000 psf Phi: 40 °

NOTE:
PRESLIDE indicates the configuration prior to occurence of the landslide inferred by our Geologist based on geomorphology.

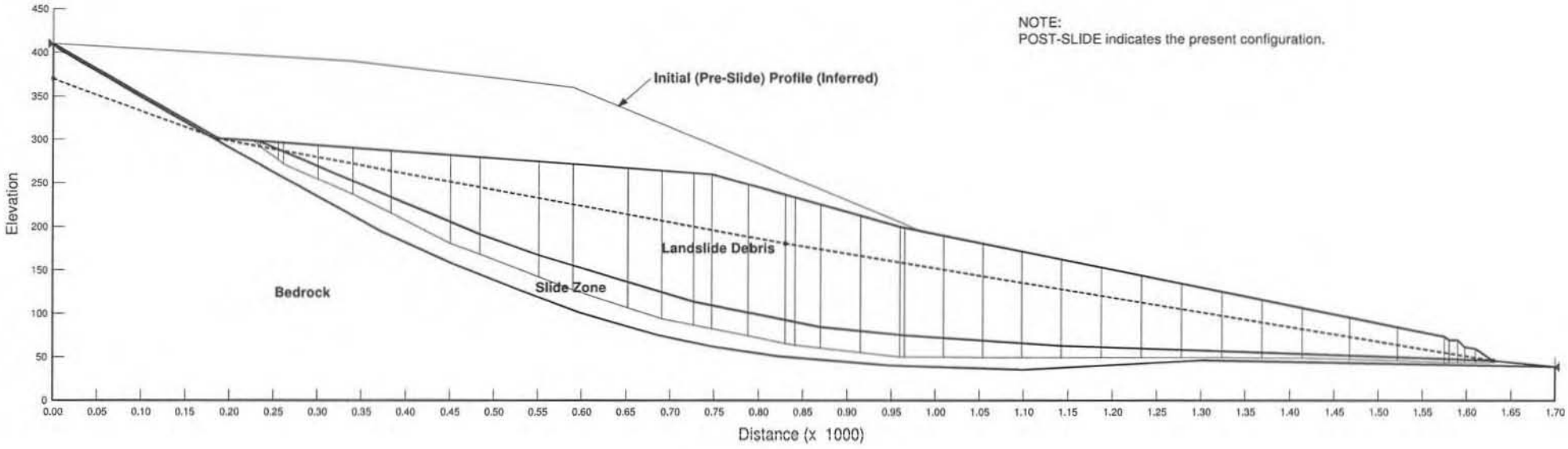


MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
RETAINING WALL NO. 7
POST-SLIDE (EXISTING)

1,429

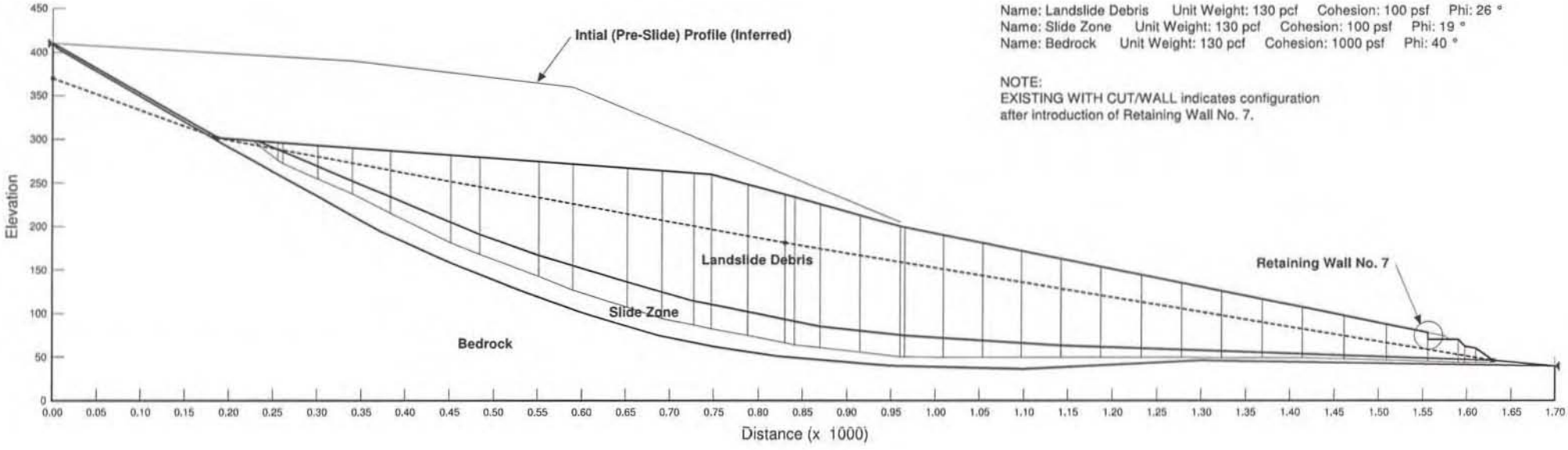
Name: Landslide Debris Unit Weight: 130 pcf Cohesion: 100 psf Phi: 26 °
Name: Slide Zone Unit Weight: 130 pcf Cohesion: 100 psf Phi: 19 °
Name: Bedrock Unit Weight: 130 pcf Cohesion: 1000 psf Phi: 40 °

NOTE:
POST-SLIDE indicates the present configuration.



MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
RETAINING WALL NO. 7
EXISTING WITH CUT/WALL

1,428



TIEBACK DESIGN

(Wall Nos. 4 & 5)

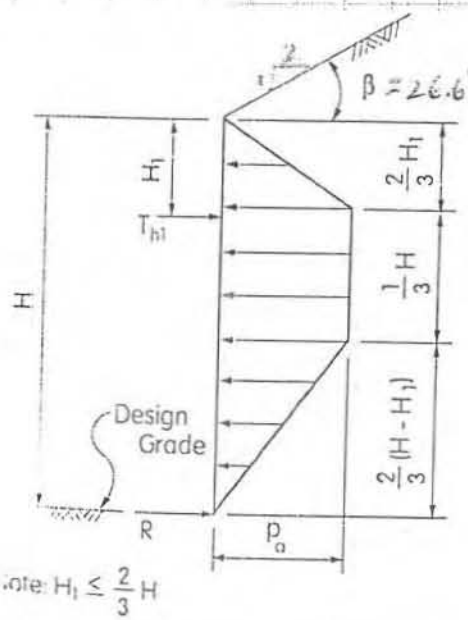
PARIKH
Practicing in the Geosciences

JOB 208140.GDR
SHEET NO ____ OF ____
CALCULATED BY PS DATE ____
CHECKED BY TJW DATE 2/10
SCALE ____

MSN - Redwood Landfill Project

Design Recommendations for Tiebacks for Wall #s 4 & 5

Lateral Earth Pressures



a) Wall with a single level of anchors

$P_a = 54\,H$ (in psf)

H = Height of Wall

H_1 = Depth to anchor

Earth Pressure Diagram

Unbonded Length = 15 feet (minimum)

Ultimate Bond Strength = 80 psi (Allowable = 40 psi (FS = 2))
(See attached)

Coefficient of Passive Pressure (K_p) = 9.0

Unit Weight = 135 pcf

Maximum Pile Arching Capability = 2.0 (effective width of passive pressure resistance = 2 × eff. width of soldier pile)

Allowable Unit Skin Friction (for Soldier Piles) = 2.0 Ksf

(Backup Calculation Follows)

RECOMMENDATIONS

COMMENTARY

3. Minerals in the rock which may "lubricate" the bond zone or reduce the grout strength.

4. Method of drilling and cleaning the drill hole

5. Drill hole diameter

6. Strength of the grout

7. Grouting procedure

The typical values shown in Table 6.1 are not intended for final design. Working bond stresses shall be established on a project-by-project basis after review of geologic data, rock cores and previous experience.

Each rock anchor shall be tested in order to verify the load carrying capacity of the anchor and to preload the tendon (see Chapter 8).

For anchors in weak or weathered rock masses, pressure grouting techniques may be used to successfully enhance grout to rock bond values.

anchor grout can be approximated by using a value of 10% of the unconfined compressive strength of the rock, up to a maximum value of 3.1 MPa (450 psi).

ROCK	AVERAGE ULTIMATE BOND STRESS-ROCK/GROUT	
	MPa	PSI
Granite & Basalt	1.7 - 3.1	250 - 450
Dolomitic Limestone	1.4 - 2.1	200 - 300
Soft Limestone	1.0 - 1.4	150 - 200
Slates & Hard Shales	0.8 - 1.4	120 - 200
Soft Shales	0.2 - 0.8	30 - 120
Sandstones	0.8 - 1.7	120 - 250
Weathered Sandstones	0.7 - 0.8	100 - 120
Chalk	0.2 - 1.1	30 - 155
Weathered Marl	0.15 - 0.25	25 - 35
Concrete	1.4 - 2.8	200 - 400

Table 6.1 Typical Average Ultimate Bond Stresses-Rock/Grout

6.7.2 Soil Anchors

6.7.2.1 General Considerations

The existing theoretical and empirical methods for predicting anchor capacity should only be used for preliminary design estimate purposes. The final anchor capacity shall be verified by field testing each anchor.

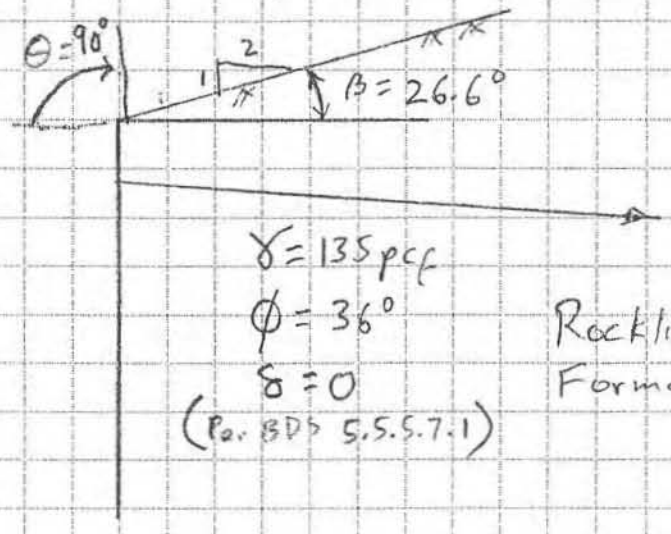
Actual bond length dimensions for specific design loads are based on installation techniques and should be determined by the specialty anchor contractor.

Normally, the bond length for soil anchors is in the range of 6-12m (20-40 ft). Bond lengths greater than 15m (50 ft) in soil may not be necessary and are not effective unless provisions are taken to allow transfer of the load to the bottom of the bond zone.

Used 80 psi

Tieback Walls for Wall Nos. 4 & 5 (Walls in Rocklike Formation)

(Based on BDS 5.5.5.7)



From BDS Section 5.5.5.3

Active Earth Pressure, $k_a = \dfrac{\sin^2(\theta+\phi')}{\Gamma\left(\sin^2\theta \sin(\theta-\delta)\right)}$

$$= \frac{\sin^2(90^\circ+36^\circ)}{\Gamma\left(\sin^3(90^\circ)\right)} = \frac{0.6545}{\Gamma(1)}$$

$$= \frac{0.6545}{\Gamma}$$

$$\Gamma = \left[1+\left(\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}\right)^{0.5}\right]^2$$

$$= \left[1+\left(\frac{\sin 36^\circ \sin(36^\circ-26.6^\circ)}{\sin 90^\circ \sin(90+26.6^\circ)}\right)^{0.5}\right]^2$$

$$= \left[1+\left(\frac{(0.5858)(0.1633)}{(1)(0.8942)}\right)^{0.5}\right]^2$$

$$= \left[1+0.3271\right]^2 = 1.761$$

$$\therefore K_a = \frac{0.6545}{1.761} = 0.372$$

$$P_a = \frac{P_{Total}}{\frac{2}{3}H}$$

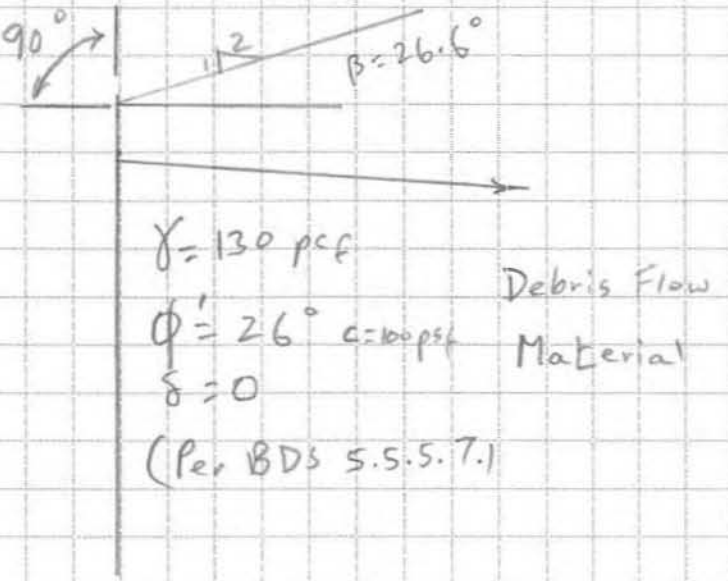
$$= \frac{1.44 P_a}{\frac{2}{3}H}$$

$$= \frac{1.44 \times \frac{1}{2}(0.372) H^2 \times 135}{\frac{2}{3}H}$$

$$= 54.24H$$

Tieback Wall for Wall No. 4 (Wall in Debris Flow Material)

(Based on BDS 5.5.5.7)



From BDS Section 5.5.5.3

Active Earth Pressure, $K_a = \dfrac{\sin^2(\theta+\phi')}{\Gamma(\sin^2\theta \sin(\theta-\delta))}$

$= \dfrac{\sin^2(90+26^\circ)}{\Gamma \sin^3(90^\circ)} = \dfrac{0.899}{\Gamma}$

$$\Gamma = \left[1+\left(\frac{\sin(\phi'+\delta)(\sin(\phi-\beta))}{\sin(\theta-\delta)\sin(\theta+\beta)}\right)^{0.5}\right]^2$$

Using $\beta = 18^\circ$ (1:3 slope, since $c = 100$ psf)

$$\Gamma = \left[1+\left(\frac{\sin 26^\circ \sin(26^\circ-18^\circ)}{\sin 90^\circ \sin(90^\circ+18^\circ)}\right)^{0.5}\right]^2$$

$$= \left[1+\left(\frac{(0.438)(0.139)}{(1)(0.951)}\right)^{0.5}\right]^2$$

$$\Gamma = \left[1 + 0.253\right]^2 = 1.57$$

$$\therefore K_a = \frac{0.899}{1.57} = 0.572$$

$$P_a = \frac{P_{Total}}{\frac{2}{3} H}$$

$$= \frac{1.44\ P_a}{\frac{2}{3} H} = \frac{1.44 \times \frac{1}{2} (0.572) \times H^2 \times 130}{\frac{2}{3} H}$$

$$= 80\ H$$

PIPE/CULVERT DESIGN

(AltPipe Output)

AltPipe

Project EA: **EA264071**
Project Engineer: **Dat Q. Nguyen**
Location: **LOTB - 145**
Description: **MSN**

Steel Pipes

DSN/U		1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxx	15b	16xx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxx	37c	40b	41c	44c	47c	48c
Pipe Diameter (in)		18	18	24	18	18	18	18	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	24	18	18	36	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Pipe Type	Coat	Minimum Thickness (in)																																											
Corrugated Steel Pipe - Helical Corrugations - 2⅔" X ½"	GAL																							0.079																						
	AL2																							0.079																						
	BC																							0.079																						
	BCI			0.079																	0.064	0.064	0.064	0.064			0.138																		
Corrugations	PA	0.052	0.052	0.052													0.064	0.064	0.064	0.064	0.052	0.052	0.052	0.052			0.079					0.064	0.064	0.064	0.064							0.064		0.064	0.064
	PS	0.052	0.052	0.052													0.064	0.064	0.064	0.064	0.052	0.052	0.052	0.052			0.079					0.064	0.064	0.064	0.064							0.064		0.064	0.064
Corrugated Steel Pipe - Annular Corrugations - 2⅔" X ½"	GAL																							0.079																						
	AL2																							0.079																						
	BC																							0.079																						
	BCI			0.079																	0.064	0.064	0.064	0.064																					
Corrugations	PA	0.064	0.064	0.064													0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064			0.079					0.064	0.064	0.064	0.064							0.064		0.064	0.064
	PS	0.064	0.064	0.064													0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064			0.079					0.064	0.064	0.064	0.064							0.064		0.064	0.064
Steel Spiral Rib Pipe - ¾" X 1" Ribs At 11½" Pitch	GAL			0.109																				0.079																						
	AL2																							0.079																						
	BC			0.109																				0.079																						

Steel Pipes

DSN/U		1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxx	15b	16xx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxx	37c	40b	41c	44c	47c	48c
Pipe Diameter (in)		18	18	24	18	18	18	18	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	24	18	18	36	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Pipe Type	Coat	Minimum Thickness (in)																																												
Steel Spiral Rib Pipe - ¾" X 1" Ribs At 8½" Pitch	BCI			0.079																				0.064																					
	PA			0.064					0.109															0.064			0.079																		
	PS			0.064					0.109															0.064			0.079																		
	GAL			0.109																				0.079																				
	AL2																							0.079																				
	BC			0.109																				0.079																				
	BCI			0.079																				0.064																				
	PA			0.064					0.109															0.064			0.079																		
	PS			0.064					0.109															0.064			0.079																		
	GAL			0.109																				0.079																				
	AL2																							0.079																				
Steel Spiral Rib Pipe - ¾" X ¾" Ribs At 7½" Pitch	BC			0.109																				0.079																				
	BCI			0.079																				0.064																				
	PA			0.064					0.109															0.064			0.079																		
	PS			0.064					0.109															0.064			0.079																		
	CSS																										0.064																		

Aluminum Pipes

DSN/U	1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxx	15b	16xx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxx	37c	40b	41c	44c	47c	48c

Pipe Diameter (in)	18	18	24	18	18	18	18	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	24	18	18	36	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Pipe Type	Minimum Thickness (in)																																											
Corrugated Aluminum Pipe - Annular Corrugations - 2⅔" X ½" Corrugations																				0.060	0.060	0.060	0.060																				0.060	0.060	0.060	0.060
Corrugated Aluminum Pipe - Helical Corrugations - 2⅔" X ½" Corrugations																				0.060	0.060	0.060	0.060																				0.060	0.060	0.060	0.060
Aluminum Spiral Rib Pipe - ¾" X 1" Ribs At 11½" Pitch																							0.060																					
Aluminum Spiral Rib Pipe - ¾" X ¾" Ribs At 7½" Pitch																							0.060																					

Plastic Pipes

DSN/U	1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxx	15b	16xx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxx	37c	40b	41c	44c	47c	48c
Pipe Diameter (in)	18	18	24	18	18	18	18	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	24	18	18	36	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Pipe Type	Availability																																											
PVC Corrugated	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
PVC Ribbed	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable

Plastic Pipes

DSN/U	1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxx	15b	16xx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxx	37c	40b	41c	44c	47c	48c
Pipe Diameter (in)	18	18	24	18	18	18	18	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	24	18	18	36	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Pipe Type	Availability																																											
HDPE Corrugated - Type S	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Ribbed	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Corrugated - Type C	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable	Allowable

Reinforced Concrete Pipes

DSN/U	1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxxx	15b	16xxx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxxx	37c	40b	41c	44c	47c	48c
Pipe Diameter (in)	18	18	24	18	18	18	18	24	18	18	18	18	18	18	18	18	18	18	18	18	18	18	24	18	18	36	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Steel Cover (in)	0.75	0.75	1	0.75	0.75	0.75	0.75	1	0.75	0.75	0.75	0.75				0.75	0.75	0.75	0.75	0.75	0.75	0.75	1			1					0.75	0.75	0.75	0.75	0.75	0.75				0.75	0.75	0.75	0.75	0.75
Sacks of Cement	5	5	5	5	5	5	5	5	5	5	5	5				5	5	5	5	5	5	5	5			5					5	5	5	5	5	5				5	5	5	5	5
Percentage Water	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1				11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1			11.1					11.1	11.1	11.1	11.1	11.1	11.1				11.1	11.1	11.1	11.1	11.1

Reinforced Concrete Pipes

Minimum Cementitious Material Content

(lbs/C.Y.)

Minimum Cover (in)	Maximum Water-Cementitious Material Ratio	
	0.35	0.40
1.00	470	470
1.25	470	470
1.50	470	470

Other Information

DSN/U	1j	1b	1h	2b	2d	5e	5h	5c	7f	8e	9b	9d	9xxx(278+52)	9n	10d	11b	13b	14c	14xxxx	15b	16xxx	16b	16e	16k	16i	18c	19f	22b	24e	26e	23b	23d	29m	33c	31k	31h	34e	34xxxx	37c	40b	41c	44c	47c	48c
Soil pH	7.53	7.53	7.53	6.78	6.78	6.78	6.78	6.78	6.09	6.09	6.09	6.09	1.19	1.19	1.19	6.76	6.76	6.76	6.76	7.47	7.47	7.47	7.47	3.72	3.72	6.71	3.72	3.72	3.72	3.72	5.18	5.18	5.18	5.18	6.48	6.48	4.1	4.1	4.23	6.73	5.97	6.15	5.58	5.58
Minimum Soil Resistivity (ohm-cm)	910	910	910	540	540	540	540	540	970	970	970	970	3220	3220	3220	1340	1340	1340	1340	2010	2010	2010	2010	2680	2680	1150	2680	2680	2680	2680	5360	5360	5360	5360	1310	1310	7500	7500	2680	1050	3480	1880	4020	4020
Sulfate Concentration (ppm)	47.7	47.7	47.7	109.7	109.7	109.7	109.7	109.7	37.5	37.5	37.5	37.5	20.7	20.7	20.7	25.6	25.6	25.6	25.6	24.2	24.2	24.2	24.2	18.2	18.2	27.6	18.2	18.2	18.2	18.2	1.9	1.9	1.9	1.9	28.1	28.1	4.1	4.1	6.4	23.2	11	4.9	4.4	4.4
Chloride Concentration (ppm)	51.6	51.6	51.6	137.2	137.2	137.2	137.2	137.2	42.9	42.9	42.9	42.9	16.9	16.9	16.9	18.2	18.2	18.2	18.2	20.8	20.8	20.8	20.8	31.8	31.8	63.2	31.8	31.8	31.8	31.8	13.4	13.4	13.4	13.4	28.3	28.3	8	8	57.1	56.1	17.2	19.5	9.7	9.7
Abrasion Level	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2–5 Year Flow Velocity (ft/sec)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Design Service Life (years)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Height of Cover (ft)	4.33	5.45	2.57	4.98	2.03	5.26	2.01	2.38	4.75	5.96	4.95	2.0	2	3.53	4.97	3.4	3.4	2	4.73	3	2.62	2.21	2.21	2.0	3.03	14.59	5.17	9.84	10	11.33	3.9	5.34	4.19	15.72	6	12	2.32	5.79	10	5	5	2.41	4.79	8.5

6.09

PAVEMENT DESIGN

Project: MSWN - Redwood Landfill Project
Job No.: 208140
Flexible pavement Backcalculation - East Frontage Road

R-value (soil) = 5
R-value (AB) = 78 (Class 3)
R-value (AS) = 50 (Class 4)

	TI =	10.0	10.5	
Total	GE req (mm) =	926.3	972.6	
Full Depth AC:	dd SF (mm) =	30.0	30.0	
GE req(AC)	+ SF (mm) =	956.3	1002.6	
(table 633.1)	**t(AC) (mm) =**	**405.0**	**420.0**	
Depth (AC & AB):	q(AC) (mm) =	214.5	225.2	
	Add SF (mm) =	60.0	60.0	
GE req(AC)	+ SF (mm) =	274.5	285.2	
(table 633.1)	**t(AC) (mm) =**	**165.0**	**165.0**	
(table 633.1)	t(AC) (mm) =	301.0	301.0	
GE req(AB)	(mm) =	625.3	671.6	
(table 633.1)	**t(AB) (mm) =**	**570.0**	**615.0**	

Note: User must input all values in yellow and then reference
t the final values in gray

Project: MSN - Redwood Landfill
Job No: 208140.GDR
Mainline - LCB

R-value (Soil) = 5
R-value (AS) = 50 (Class 4)

TI =	12.5	13.5	
Total GE req (ft) =	3.80	4.10	
Full Depth AC:			
Add SF (ft) =	0.10	0.10	
GE req(AC) + SF (ft) =	3.90	4.20	
(table 633.1) **t(AC) (ft)** =	**1.70**	**1.80**	
Depth (AC & LCB):			
GE req(AC+LCB) (ft) =	3.80	4.10	
40% of GE req (AC+LCB) (ft) =	1.52	1.64	
Add SF (ft) =	0.20	0.20	
GE req(AC) + SF (ft) =	1.72	1.84	
(table 633.1) **t(AC) (ft)** =	**0.95**	**1.00**	
(table 633.1) GE t(AC) (ft) =	1.81	1.87	
GE req(LCB) (ft) =	1.99	2.23	
(table 633.1) **t(LCB) (ft)** =	**1.80**	**2.00**	
Depth (AC, LCB & AS):			
GE req(AC+LCB) (ft) =	2.00	2.16	
40% of GE req (AC+LCB) (ft) =	0.80	0.86	
Add SF (ft) =	0.20	0.20	
GE req(AC) + SF (ft) =	1.00	1.06	
(table 633.1) **t(AC) (ft)** =	**0.60**	**0.65**	
(table 633.1) GE t(AC) (ft) =	0.98	1.05	
GE req(LCB) (ft) =	1.02	1.11	
Add SF (ft) =	0.2	0.2	
GE req(LCB) + SF (ft) =	1.22	1.31	
(table 633.1) **t(LCB) (ft)** =	**0.65**	**0.70**	
GE t(LCB) (ft) =	1.24	1.33	
GE t (AC+LCB) (ft) =	2.22	2.38	
GE req(AS) (ft) =	1.58	1.72	
(table 633.1) **t(AS) (ft)** =	**1.60**	**1.75**	

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of AC section, 0.1 ft satety factor is taken whereas for AC with AB and As 0.20 ft factor of safery is added.

Project: MSN Redwood LandfillProject (R=10)
Job No.: 208140.GDR
Ramps and Bikelane

R-value (soil) = 10
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 2)

	TI =	6.50
Total GE req =		1.87
Full Depth AC:	Add SF =	0.10
	GE req(HMA-A) + SF =	1.97
(table 633.1)	**t(HMA-A)=**	**0.80**
Depth (AC & AB):	GE req(HMA-A) =	0.46
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.66
(table 633.1)	**t(HMA-A)=**	**0.30**
(table 633.1)	GE t(HMA-A)=	0.64
	GE req(AB) =	1.23
(table 633.1)	**t(AB)=**	**1.15**
		1.45
Depth (AC, AB& AS):	GE req(HMA-A) =	0.46
Add SF =		0.20
	GE req(HMA-A) + SF =	0.66
(table 633.1)	**t(HMA-A)=**	**0.30**
(table 633.1)	GE t(HMA-A)=	0.64
	GE req(HMA-A+AB) =	1.04
GE req(AB) =		0.40
Add SF =		0.20
	GE req(AB) + SF =	0.60
(table 633.1)	**t(AB)=**	**0.55**
	GE t(AB)=	0.61
	GE t (HMA-A+AB)	1.25
	GE req(AS) =	0.62
(table 633.1)	**t(AS)=**	**0.65**
		1.50

R-value (soil) = 10
R-value (AB) = 78
R-value (AS) = 50

	TI =	10.00
Total GE req =		2.88
	Add SF =	0.10
	GE req(HMA-A) + SF =	2.98
	t(HMA-A)=	**1.30**
	GE req(HMA-A) =	0.70
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.90
	t(HMA-A)=	**0.50**
	GE t(HMA-A)=	0.90
	GE req(AB) =	1.98
	t(AB)=	**1.80**
		2.30
	GE req(HMA-A) =	0.70
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.90
	t(HMA-A)=	**0.50**
	GE t(HMA-A)=	0.90
	GE req(HMA-A+AB) =	1.60
	GE req(AB) =	0.70
	Add SF =	0.20
	GE req(AB) + SF =	0.90
	t(AB)=	**0.85**
	GE t(AB)=	0.94
	GE t (HMA-A+AB)	1.84
	GE req(AS) =	1.04
	t(AS)=	**1.05**
		2.40

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of HMA-A section, 0.1 ft satety factor is taken whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

Project: MSN Redwood LandfillProject
Job No.: 208140.GDR
Ramps and Bikelane on Fill

R-value (soil) = 15
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 4)

	TI =	6.50
Total GE req =		1.77
Full Depth AC:	Add SF =	0.10
	GE req(HMA-A) + SF =	1.87
(table 633.1)	**t(HMA-A)=**	**0.80**
Depth (AC & AB):	GE req(HMA-A) =	0.46
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.66
(table 633.1)	**t(HMA-A)=**	**0.30**
(table 633.1)	GE t(HMA-A)=	0.64
	GE req(AB) =	1.13
(table 633.1)	**t(AB)=**	**1.25**
		1.55
Depth (AC, AB& AS):	GE req(HMA-A) =	0.46
Add SF =		0.20
	GE req(HMA-A) + SF =	0.66
(table 633.1)	**t(HMA-A)=**	**0.30**
(table 633.1)	GE t(HMA-A)=	0.64
	GE req(HMA-A+AB) =	1.04
GE req(AB) =		0.40
Add SF =		0.20
	GE req(AB) + SF =	0.60
(table 633.1)	**t(AB)=**	**0.55**
	GE t(AB)=	0.61
	GE t (HMA-A+AB)	1.25
	GE req(AS) =	0.52
(table 633.1)	**t(AS)=**	**0.55**
		1.40

R-value (soil) = 15
R-value (AB) = 78
R-value (AS) = 50

	TI =	10.00
Total GE req =		2.72
	Add SF =	0.10
	GE req(HMA-A) + SF =	2.82
	t(HMA-A)=	**1.30**
	GE req(HMA-A) =	3.20
	Add SF =	0.20
	GE req(HMA-A) + SF =	3.40
	t(HMA-A)=	**0.50**
	GE t(HMA-A)=	0.90
	GE req(AB) =	1.82
	t(AB)=	**1.65**
		2.15
	GE req(HMA-A) =	3.20
	Add SF =	0.20
	GE req(HMA-A) + SF =	3.40
	t(HMA-A)=	**0.50**
	GE t(HMA-A)=	0.90
	GE req(HMA-A+AB) =	1.60
	GE req(AB) =	0.70
	Add SF =	0.20
	GE req(AB) + SF =	0.90
	t(AB)=	**0.85**
	GE t(AB)=	0.94
	GE t (HMA-A+AB)	1.84
	GE req(AS) =	0.88
	t(AS)=	**0.90**
		2.25

Note: User must input all values in yellow and then reference
chapter 600 to get the final values in gray
For full depth of HMA-A section, 0.1 ft satety factor is taken
whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

Project: MSN Redwood LandfillProject
Job No.: 208140.GDR
Ramps and Bikelane

R-value (soil) = 5
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 2)

	TI =	6.50
Total GE req =		1.98
Full Depth AC:	Add SF =	0.10
	GE req(HMA-A) + SF =	2.08
(table 633.1)	**t(HMA-A)=**	**0.85**
Depth (AC & AB):	GE req(HMA-A) =	0.46
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.66
(table 633.1)	**t(HMA-A)=**	**0.30**
(table 633.1)	GE t(HMA-A)=	0.64
	GE req(AB) =	1.34
(table 633.1)	**t(AB)=**	**1.25**
		1.55
Depth (AC, AB& AS):	GE req(HMA-A) =	0.46
Add SF =		0.20
	GE req(HMA-A) + SF =	0.66
(table 633.1)	**t(HMA-A)=**	**0.30**
(table 633.1)	GE t(HMA-A)=	0.64
	GE req(HMA-A+AB) =	1.04
GE req(AB) =		0.40
Add SF =		0.20
	GE req(AB) + SF =	0.60
(table 633.1)	**t(AB)=**	**0.55**
	GE t(AB)=	0.61
	GE t (HMA-A+AB)	1.25
	GE req(AS) =	0.73
(table 633.1)	**t(AS)=**	**0.75**
		1.60

R-value (soil) = 5
R-value (AB) = 78
R-value (AS) = 50

	TI =	10.00
	Total GE req =	3.04
	Add SF =	0.10
	GE req(HMA-A) + SF =	3.14
	t(HMA-A)=	**1.30**
	GE req(HMA-A) =	0.70
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.90
	t(HMA-A)=	**0.50**
	GE t(HMA-A)=	0.90
	GE req(AB) =	2.14
	t(AB)=	**1.95**
		2.45
	GE req(HMA-A) =	0.70
	Add SF =	0.20
	GE req(HMA-A) + SF =	0.90
	t(HMA-A)=	**0.50**
	GE t(HMA-A)=	0.90
	GE req(HMA-A+AB) =	1.60
	GE req(AB) =	0.70
	Add SF =	0.20
	GE req(AB) + SF =	0.90
	t(AB)=	**0.85**
	GE t(AB)=	0.94
	GE t (HMA-A+AB)	1.84
	GE req(AS) =	1.20
	t(AS)=	**1.20**
		2.55

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of HMA-A section, 0.1 ft satety factor is taken whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

APPENDIX D

APPENDIX D

SITE GEOLOGY – INTERPRATIONS AND MAPPING

D.1 PREVIOUS GEOLOGIC MAPPING

Dickerson (1922) originally mapped the Petaluma, Santa Rosa, and Point Reyes 15' quadrangles, focusing exclusively on Tertiary and Quaternary rocks. Aside from the volcanic rocks of Burdell Mountain, most Tertiary rocks were not distinguished as separate units in Dickerson's (1922) study. The Novato Conglomerate (now known to be Cretaceous) was mapped as a member of the "Pliocene" Sonoma Volcanics. (In 1922, the beginning of the Pliocene was considered to be ~10 million years before present.)

Weaver's (1949) map of the Petaluma Quadrangle is one of nine 15-minute geologic quadrangle maps in his report of the geology north of San Francisco Bay. Weaver informally named the Novato Conglomerate and tentatively assigned it a Cretaceous(?) age. Weaver assigned all Mesozoic rocks, excluding the Novato Conglomerate, to the "Franciscan group", then considered to be entirely of Late Jurrassic age. Weaver identified volcanic rocks in the vicinity of Burdell Mountain as "Pliocene" Sonoma volcanics.

Weaver's (1934) reconnaissance-level studies in the vicinity of Burdell Mountain led to the first generalized map of the area. He was the first to identify the Burdell Mountain fault trace, which he mapped for a distance of about 20 km, from San Francisco Bay northwestward to the northeastern flank of Burdell Mountain, similar to how the fault is depicted on recently published maps.

Rose (1955; 1958) described the petrology of the volcanics of Burdell Mountain area (designated Sonoma Volcanics) and the stratigraphy of the Franciscan (Complex), and Great Valley (Group) (e.g., Knoxville Formation and Novato Conglomerate). Rose (1955) was also the first to describe the Tertiary strata that underlie the volcanic rocks at Burdell Mountain, which he correlated to the Merced Formation.

Rice (1973 and 1975) produced the most complete and detailed maps of the Burdell Mountain and Novato area. Although Rice's (1973) report primarily focused on landslide features and related hazards, he also included detailed studies of the rock units and geologic structure of the

area. Rice mapped large areas on all sides of Burdell Mountain as "Quaternary landslides". Small areas of intact bedrock exposed in the landslide scarps and drainages were not mapped by Rice. Many of these exposures are critical for understanding the stratigraphic relations and geologic structure at Burdell Mountain.

Blake's *et al* (2000) map that encompasses the Burdell Mountain area is the USGS 1:125,000-scale Geologic map of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California. The map and database are largely compilations that, for the Burdell Mountain and Novato area, include or are based on the previous mapping described above.

Wagner's (2002) map shows landslides scarps located approximately 470 feet north of the locations on Rice's 1975 map and the toes of the landslides "trimmed" southward. We brought this apparent error to the attention of the California Geological Survey; they informed us that they intended to correct the error when they published the regional map of the Napa 30 x 60 degree map in 2010.

Ford's (2007) map shows two traces of the Burdell Mountain fault slightly differently than did previous geologic maps. Landslide scarps mapped northeast of the fault are located 470 feet north of the locations shown on Rice's 1975 map (just like Wagner's 2002 map, which Ford worked on).

The most recently published geologic map of the area was compiled by Wagner and Gutierrez (2010). The map is presented as Plate 3A in the main body of the report. They shifted the landslides southward so that their headscarps returned to the locations originally mapped by Rice (1975); however, they did not restore the northward extent of the toes of those slides as Rice had mapped them. The two traces of the Burdell Mountain fault are shown at the same locations mapped by Ford (2007).

All of the available geologic maps are more or less in agreement that bedrock northeast of the Burdell Mountain fault is Franciscan Complex and mélange, while bedrock southwest of the fault is Burdell Mountain Volcanics (andesite) on top of Tertiary Sandstone and Franciscan Complex which have been involved in large-scale landsliding to various degrees.

Our interpretation of the site geology, based on the latest published bap and our engineering geologist's examination of air photos and detailed topographic contours, is presented in Plates D-1 through D-7. Detailed discussions of the pertinent rock units for the project site as indicated in

the plates are presented in Section D.2 under appropriate era. An explanation of the map symbols is presented on Plate D.

D.2 STRATIGRAPHY

Bedrock units of project area consist of the Jurassic and Cretaceous Franciscan Complex and melange, Tertiary sedimentary rocks, and Miocene volcanic rocks of the Burdell Mountain volcanic field which unconformably overlie the other units. The boundaries of underlying bedrock units are difficult to define precisely due to poor exposures and some similar lithologies. Surficial deposits in the Burdell Mountain area are dominated by Quaternary landslide deposits that blanket both the east and west flanks of Burdell Mountain. Landslide deposits, along with colluvium, alluvium, and vegetation commonly obscure underlying stratigraphic relationships. On Burdell Mountain itself, exposures of intact andesite flows are almost entirely restricted to the mountain top, within steep, narrow drainages, or in exposures along landslide scarps.

D.2.1 Jurassic and Cretaceous Units

The Franciscan Complex in the northern Coast Ranges has been divided into the northwest-trending Coastal, Central, and Eastern tectonic belts. (Irwin, 1960) In Marin County, the Franciscan is mostly composed of relatively coherent gently northeast-dipping thrust sheets of the Eastern Metamorphic and Central Mélange belts that range in age from Early Jurrassic to Late Cretaceous. (Blake *et al.*, 1984)

The Eastern Metamorphic belt generally consists of schistose or phyllitic metagraywacke, metachert, and metabasalt. These rocks commonly contain abundant blueschist-facies minerals such as lawsonite, jadeite, pyroxene, and metamorphic aragonite. (Blake *et al.*, 1984) The Central Mélange belt is lithologically heterogenous and consists of a complex structural assemblage of graywacke, metagraywacke, radiolarian chert, metachert, gabbro, serpentinite, and medium to high-grade blueschist, eclogite and amphibolite in a highly-sheared shaley matrix. In the vicinity of Burdell Mountain, the Franciscan Complex includes rocks assigned to both the Eastern Metamorphic belts and Central Melange.

In the San Francisco Bay Area, serpentinite occurs within the Franciscan Complex and the Great Valley Group as accreted, exotic fragments of oceanic crust (ophiolite) and often marks the base of thrust zones or tectonic boundaries. (Warhaftig, 1989) Serpentinite generally forms tabular and elongate bodies along shear zones in the Burdell Mountain area.

The Great Valley Group consists of a thick accumulation of latest Jurassic to early Paleocene marine clastic sedimentary rocks that were deposited in an extensive, elongate, north-trending forearc basin, originally located between the Sierran magmatic arc and the Franciscan subduction complex. The Great Valley Group was deposited within a complex depositional system ranging from fluvial-deltaic in the east to deep-sea fan and basin plain in the west. (Bailey *et al.*, 1964) In contrast to the Eastern Metamorphic and Central Mélange belts of the Franciscan Complex, the Great Valley Group strata are unmetamorphosed and relatively unaffected by deformation associated with subduction and accretion.

Franciscan Complex schist, phyllite, and semischist (KJfsch)

Schistose rocks of the Franciscan Complex in the Burdell Mountain area have been assigned to the Eastern Metamorphic belt (i.e., the Yolla Bolly terrane of Bailey *et al.* [1964]). These rocks form two subparallel, northwest-trending belts located northeast and southwest of Burdell Mountain. All rocks of this unit have blueschist facies, high-pressure low-temperature alteration. (Wakabayashi, 1992) Rocks include meta-sandstone ranging from very low grade and weakly foliated to moderate low-and moderate-grade phyllite and schist, shale, chert, basalt, minor greenstone, and rare blocks of amphibolite and blueschist, which are found as isolated bodies found within or near serpentinite.

Near Burdell Mountain, the Franciscan Complex schist is generally a slope former. The predominate geomorphic feature of this unit is a northwest-striking ridge which is bounded to the southwest by the Burdell Mountain fault west of Highway 101. The unit is generally exposed on steep slopes and ridges and is responsible for the most extensive landslides, which range from hummocky surficial deposits to mega-scale rotational slump blocks.

Franciscan Complex mélange (KJfm)

Franciscan Complex rocks of the Central Melange belt are found in the Burdell Mountain area in thin, elongate, fault-bounded blocks along the Burdell Mountain fault zone. The unit is bounded between two sub-parallel strands of the Burdell Mountain fault zone and is juxtaposed against Franciscan Complex schist (KJfsch) to the northeast and Burdell Mountain volcanic rocks (Tbv) to the southwest.

At Burdell Mountain, the Franciscan Complex mélange (KJfm) consists almost entirely of sandstone with only minor outcrops of chert and greenstone. The sandstone is primarily light-brown to greenish-gray lithic wacke (informally known as greywacke) that is fine to coarse

grained, moderately indurated, and it is thickly bedded to massive. The sandstone is exposed mostly in areas of low relief and in drainages, but in some areas it forms steep slopes where it has been protected upslope by more resistant rocks or it has been uplifted or folded near fault contacts. Remnants of Burdell Mountain volcanics along this ridge suggest that these more resistant rocks have preserved the morphology of the ridge. However, the proximity of two sub-parallel shear zones, and near vertical fractures with similar orientations to the shear zones within the sandstone, suggest that the relief may be fault related.

Landsliding is far less widespread within the Franciscan mélange (KJfm) than within the Franciscan schist (KJfsch) in the map area. This is interpreted to be due to the higher concentration of relatively resistant and massive sandstone rather than sheared rock that comprises the mélange in other areas in the region.

Serpentinized Ultramafic Rocks (sp)

Serpentinite associated with the Franciscan Complex and possibly with the Coast Range ophiolite (Warhaftig, 1989) forms elongate bodies along the northeast, southwest and south flanks of Burdell Mountain. It is commonly associated with fault contacts between rocks of differing lithologies and metamorphic facies. Most conspicuously, serpentinite can be traced continuously along the Burdell Mountain fault zone for several kilometers. Rocks mapped as serpentinite consist of partially to entirely serpentinized peridotite, with minor vestiges of gabbro and pyroxenite occuring locally. Silica-carbonate, a hydrothermal alteration product of serpentinite, is also found locally along fault zones, and it occurs in bold, jagged, variegated exposures with distinct green, yellow, and white colors. The rocks stand out conspicuously as linear resisistant outcrops along the easternmost trace of the Burdell Mountain fault zone south of San Antonio Road and extensively along the top of the narrow ridge that is parallel to the Burdell Mountain ridge. In the map area, the silica carbonate is largely composed of quartz or opal and calcium carbonate (and perhaps other carbonate minerals) and is a very hard, fine-grained, black, green, and white silicified rock containing intersecting veinlets of carbonate which are sometimes stained with limonite. It commonly has fault-parallel shear fabric, slickensides, and gentle to open folds that are approximately 1-10 cm in amplitude with fault-parallel hingelines.

D.2.2 Tertiary Units

Tertiary rocks at Burdell Mountain consist of sedimentary rocks of probable early to middle Miocene age and middle Miocene Burdell Mountain volcanic rocks that both lie unconformably

over rocks of the Franciscan Complex.

Rocks of the Burdell Mountain volcanic field are found only west of the Burdell Mountain fault zone and are primarily andesite (Tbv).

Tertiary Sandstone (Ts)

A relatively thin sequence of Tertiary sedimentary rocks lie stratigraphically between underlying rocks of the Franciscan Complex and overlying Burdell Mountain volcanics. The unit reaches a maximum thickness of approximately 40 m along the west flank of Burdell Mountain, but appears to pinch out stratigraphically between over and underlying units. Strata within this unit consist primarily of buff weathered sandstone with minor siltstone, pebble conglomerate, and coquina.

The composition of the sandstone is subarkose. It is light gray and tan to nearly white, with localized yellow and brown oxidation and pale green weathering. The sandstone is generally fine grained, with well-sorted, sub-angular to rounded grains, thick bedded to massive and locally planar, and is moderately fractured, friable to moderately hard, locally fossiliferous and diatomaceous, and tuffaceous along the upper part of the unit. The siltstone has similar color and weathering properties as the sandstone, although the siltstone is more thinly bedded and friable. Channelized and matrix-supported pebble conglomerate makes up a very minor part of the map unit. The clasts consist of sub-angular to well-rounded black shale, red and black chert, and quartzite, all less than 10 mm in diameter.

Burdell Mountain Andesite (Tbv)

Andesitic rocks (Tbv) make up the vast majority of the Burdell Mountain volcanics. They consist primarily of lava flows that cover an area of about 12 km^2 and are approximately 200 m thick. Along with the underlying Miocene sandstone, these volcanic flows form a gently northeast-dipping homocline that caps the northwest-trending summit ridge of Burdell Mountain and is truncated by the Burdell Mountain fault zone to the east. Smaller areas of andesitic volcanics are also found as a ridge capping unit ~2 km southeast of the southern part of Burdell Mountain and as a relatively down-dropped, fault-bounded block between two strands of the Burdell Mountain fault zone in the southeast part of the map area. The unit consists of a series of gently east-dipping lava flows that primarily rest on the Tertiary sandstone, but locally overlie faulted and folded Franciscan Complex rocks.

Twelve separate lava flows have been recognized in the southern part of the mountain: ten pyroxene andesite flows, one basalt and one biotite dacite flow locally overlying a basal tuff (this study). The andesites are porphyritic with small (1-3 mm) subhedral to euhedral phenocrysts of hypersthene, augite, and zoned plagioclase embedded in a hemi-crystalline groundmass consisting mainly of plagioclase and glass. Individual flows are 6 to 25-m-thick and consist of a massive zone underlain and overlain by non-vesicular and poorly-jointed flow breccia. The rock is moderately to deeply weathered and commonly stained red by hematite. Montronite and opal are common coatings and partial fillings of vesicles.

The age of the andesite is constrained by $^{40}Ar/^{39}Ar$ analyses of plagioclasts that yielded cooling/crystallization ages of approximately 11 million years.

D.2.3 Quaternary Units

In the project area, Quaternary deposits consist primarily of landslide deposits along the flanks of Burdell Mountain, alluvium found primarily in the lowlands overlying rocks of the Francisican Complex, and muddy sediments along the margin of San Pablo Bay. Surficial deposits are divided into units based on the type of deposit and (in the case of landslide deposits) the relative age of the deposits. The units are: mega-landslide deposit (Qlsv), landslide deposit (Qls), colluviums (Qc) including debris flow deposits (Qdf), alluvium (Qa), and bay mud (Qhbm). The surficial units were primarily mapped on aerial photographs.

Mega-landslide deposits (Qlsv)

Large-scale landslides (i.e., mega-landslides) at Burdell Mountain have drawn the interest of previous workers. In particular, Rice (1975) provided descriptions of the landslides and some of the Quaternary deposits on and near Burdell Mountain in his hazards report for Marin County and the Novato area. Ages of the older mega-landslides are unknown.

Both the northeast and southwest slopes of Burdell Mountain ridge consist of large, arcuate landslide scarps of up to 1 km across rooted near contact with the volcanic rocks and the underlying Tertiary strata and Franciscan Complex. These apparently ancient blocks of more resistant volcanic rock of up to 1 km^2 form several knobs and other areas of high relief around the base of Burdell Mountain and several large (0.5 km^2) terraces particularly high on the southwest flank of the mountain.

On the southwest slope, the large landslides are generally rotational slump-block type that have

arcuate head scarps and appear to be more deeply rooted, suggesting that slide planes cut across foliation and bedding of the Burdell Mountain volcanics and the Tertiary Sandstone strata respectively. The ages of the mega-landslides are unknown but they appear to be related to the uplift and faulting of the mountain itself, which dates back to the initiation of the East Bay fault system in the middle Miocene, although it is possibly that the preserved landslide features are Quaternary in age.

Landslide deposits (Qls)

Landslides denoted Qls include debris flow, mudflow, and block slump landslides mostly within Franciscan Complex. These are distinguished from older and larger mega-landslides by their relatively young (Holocene?) appearance, their size and slide plane depth. In general, these deposits are less than 300 feet across and/or have slide planes shallower than 30 feet. Landslide boundaries are based on surficial mapping techniques and are approximate.

Alluvium (Qa)

Due to relatively high relief and rugged terrain in the Burdell Mountain area, Quaternary alluvium is generally restricted to the large drainages, lowlands, and valleys. Quaternary alluvium is mapped primarily in the very western portion of the map area in the headwaters of San Antonio Creek and Bowman Canyon and along Highway 101 in lowlands along the eastern transition of the Burdell Mountain and the San Pablo Bay.

The alluvium consists of Pleistocene to Holocene gently sloping to horizontal, fan, terrace, and basin deposits. Generally, the alluvium is composed of sandy-clayey gravel with sub-angular to well-rounded pebbles and cobbles with a few boulders of Burdell Mountain volcanic and Franciscan Complex rocks.

Bay Mud (Qhbm)

The eastern portion of the map area is dominated by bay mud consisting of Quaternary silt, clay, peat, and fine sand deposited at or near sea level in San Pablo Bay. The flat plains of the eastern part of the Petaluma River and Novato Quadrangles east of Burdell Mountain are former marine marshlands (Rice, 1975). Bay Mud deposits are mostly several feet below mean sea level, and were regularly inundated by high tides. Tidewater from San Pablo Bay was excluded from the marshlands by a system of dikes constructed in the early 1900's (Rice, 1975). Soft Bay Mud rests on unconsolidated but compacted older stream channel and colluvial deposits.

D.3 REFERENCES

Atwater, T., 1970, Implications of plate tectonics for the Cenozoic tectonic evolution of western North America: Geological Society of America Bulletin, v. 81, p. 2513-3536.

Atwater, T., 1989, Plate tectonic history of the northeast Pacific and western North America: The Geology of North America, Vol. IV, Geological Society of America, Boulder, CO. p. 21-72.

Bailey, E.H., Irwin, W. P., Jones, D. L., 1964, Franciscan and related rocks and their significance in the geology of western California: California Division of Mines and Geology Bulletin 183, p.177.

Blake, M.C. Jr.; Bartow, J.A.; Frizzell, V.A. Jr.; Schlocker, J.; Sorg, D.; Wentworth, C.M.; and Wright, R.H.; 1974; Preliminary Geologic Map of Marin and San Francisco Counties and Parts of Alameda, Contra Costa and Sonoma Counties, California; U.S.Geological Survey, Miscellaneous Field Studies Map MF 574.

Blake, M.C., Jr., Howell, D.G., and Jayko, A.S.; 1984; Tectonostratigraphic terranes of the San Francisco Bay Region, in Blake, M.C., Jr., eds., Franciscan geology of northern California: Pacific Section of Economic Paleontologists and Mineralogists, v. 43, p. 5-22.

Blake, M.C. Jr., Graymer, R. W., and Jones, D. L.; 2000; Geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California, 1:125,000. U.S. Geological Survey, MF-2337.

Dickerson, R.E.; 1922; Tertiary and Quaternary history of the Petaluma, Point Reyes, and Santa Rosa quadrangles: California Academy of Science Proceedings, series 4, v. 11, n. 19, p. 527-601.

Dickinson, W.R., and Snyder, W.S.; 1979a; Geometry of subducted slabs related to the San Andreas transform: Journal of Geology, v.87, p. 609-627.

Dickinson, W.R., and Snyder, W. S.; 1979b; Geometry of triple junctions related to the San Andreas transform: Journal of Geophysics. Res., 84(B2), p. 561-572.

Ford, E.W.; 2003; Mesozoic and Tertiary Stratigraphy of the Burdell Mountain Area and Implicaitons for Slip along the East Bay fault System, Marin County California; Field Trip Guidebook; Northern California Geological Society

Ford, E.W.; 2007; Burdell Mountain Stratigraphy and Implications for Long-term Slip along the East Bay Fault System, California; M.S. Thesis at San Francisco State University.

Fox, K.F.; 1983; Tectonic setting of late Miocene, Pliocene, and Pleistocene rocks in part of the Coast Ranges north of San Francisco, California: U.S. Geological Survey, Professional Paper 1239, p. 33.

Fox, K.F. Jr., Fleck, R. J., Curtis, G. H., and Meyer, C. E.; 1985; Implications of the

northwestwardly younger age of the volcanic rocks of west central California: Geological Society of America Bulletin, v. 96, p. 647-654.

Grahman, S.A., Stanley, R.G., Bent, J.V., and Carter, J.B.; 1989; Oligocene and Miocene paleogeography of central California and displacement along the San Andreas fault system, Geological Society of America Bulletin, v. 101, p. 711-730.

Huffman, O.F.; 1972; Lateral displacement of upper Miocene rocks and the Neogene history of offset along the San Andreas fault in central California: Geological Society of America Bulletin, v. 83: p. 2913-2946.

Irwin, W.P.; 1960; Geologic reconnaissance of the northern Coast Ranges and Klamath Mountains, California: California Division of Mines and Geology Bulletin 179, p. 79.

Jones, D.L.; 1994; Neogene transpressive evolution of the California Coast Ranges: Tectonics, v. 13, n. 2, p. 561-574.

Mankinen, E.A.; 1972; Paleomagnetism and potassium-argon ages of the Sonoma volcanics, California: Geological Society of America Bulletin. v. 83, p. 2063-2072.

McLaughlin, R.J., Sliter, W. V., Sorg, D. H., Russell, P. C., Sarna-Wojcicki, A. M.; 1996; Large-scale right–slip displacement on the East San Francisco Bay region fault system, California: Implications for location of late Miocene to Pliocene Pacific plate boundary. Tectonics, v. 15, 18 p.

Medly, E.W.; 2008; Engineering the Geological Chaos of Franciscan and other BIMrocks; American Rock Mechanics Association, 08-316

Page, B.M., Thompson, G.A., and Coleman, R.G.; 1998; Late Cenozoic tectonics of the central and southern Coast Ranges of California Geological Society of America Bulletin. v. 110, p. 846-876.

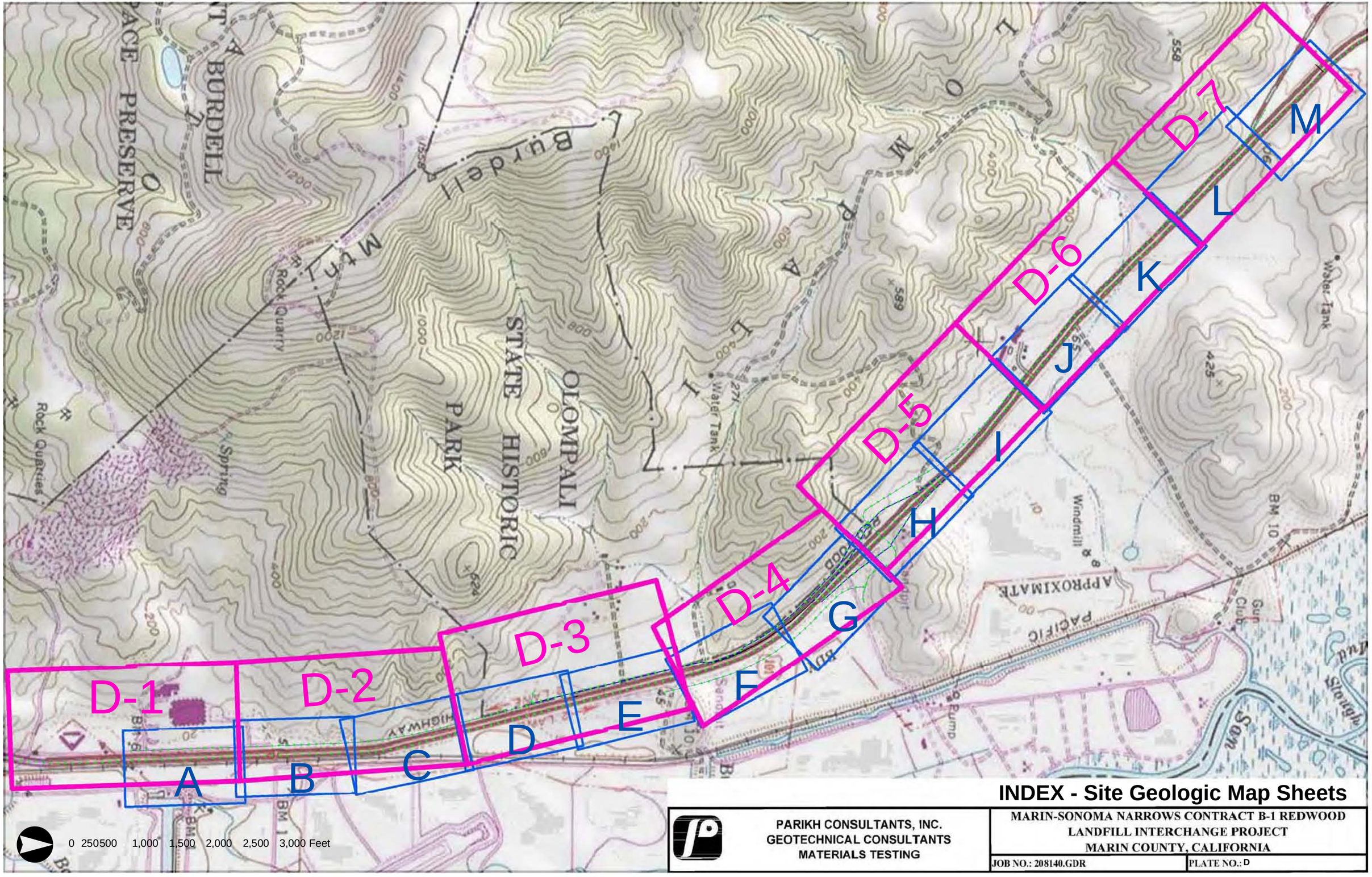
Rice, S.J.; 1973; Geology and Geologic Hazards of the Novato Area, Marin County, California. Scale 1:12,000. California division of Mines and Geology, Preliminary Report 21, 47 p.

Rice, S.J.; 1975; Geology for Planning Novato Area, Marin County, California: California Division of Mines and Geology Open-File Report 76-1, Plate 1 East - Geology, Eastern Part of the Novato Area, scale 1:12,000.

Rose, R.L.; 1958; Pre-Tertiary stratigraphy near Petaluma, California: Geological Society of America Bulletin. v. 69, p. 2.

Wagner, D.L., Rice, S.J., Bezore, S.P., Randolph-Loar, C.E., Allen, J.E. and Witter, R.C.; 2002; Geologic map of the Petaluma River 7.5' Quadrangle, Marin and Sonoma counties, California: A digital database: California Geological Survey website, http://www.conservation.ca.gov/-cgs/rghm/rgm/preliminary_geologic_maps.htm

Wakabayashi, J.; 1992; Nappes, tectonics of oblique plate convergence and metamorphic evolution related to 140 million years of continuous subduction, Franciscan Complex,

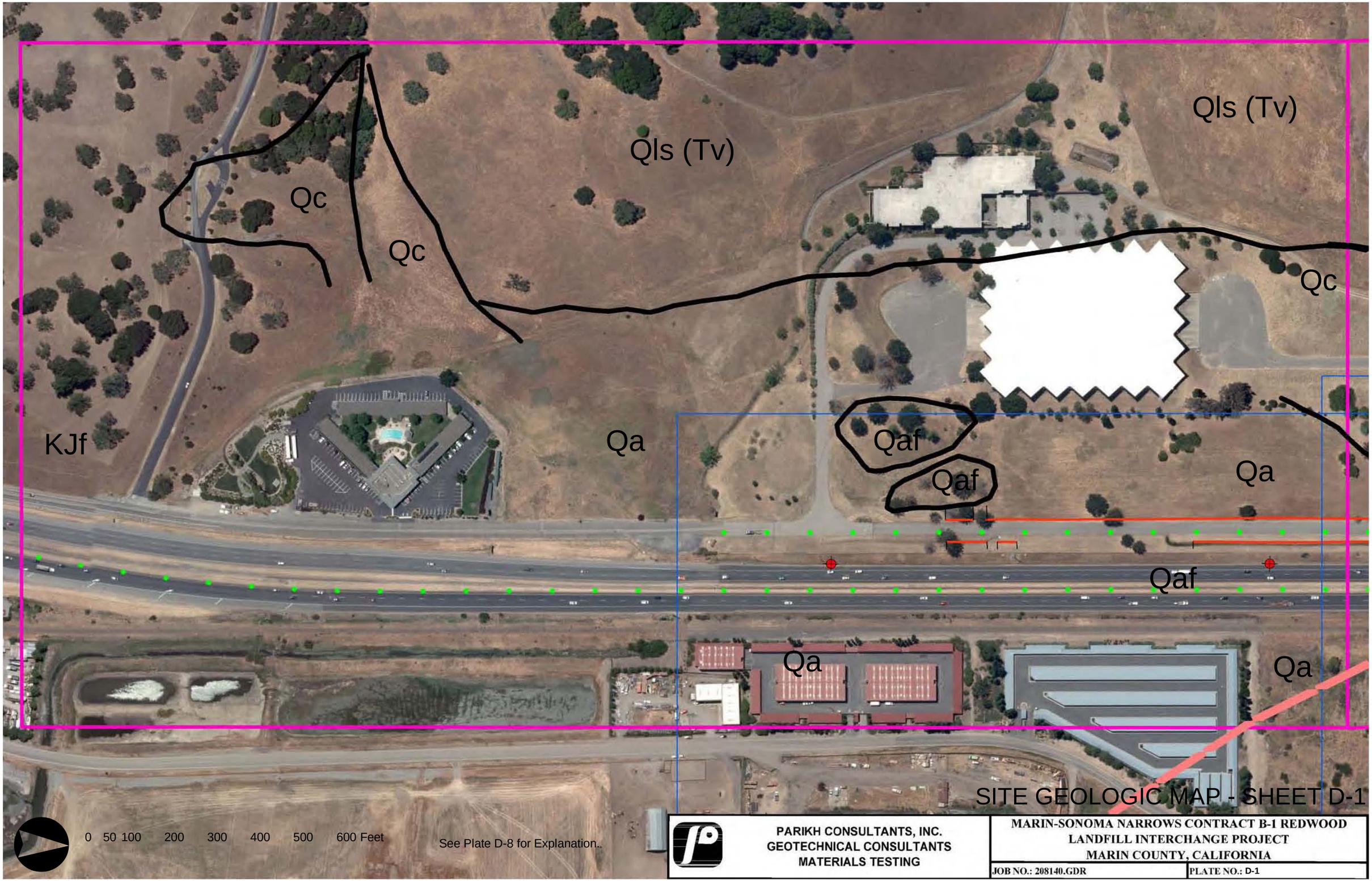


INDEX - Site Geologic Map Sheets

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D

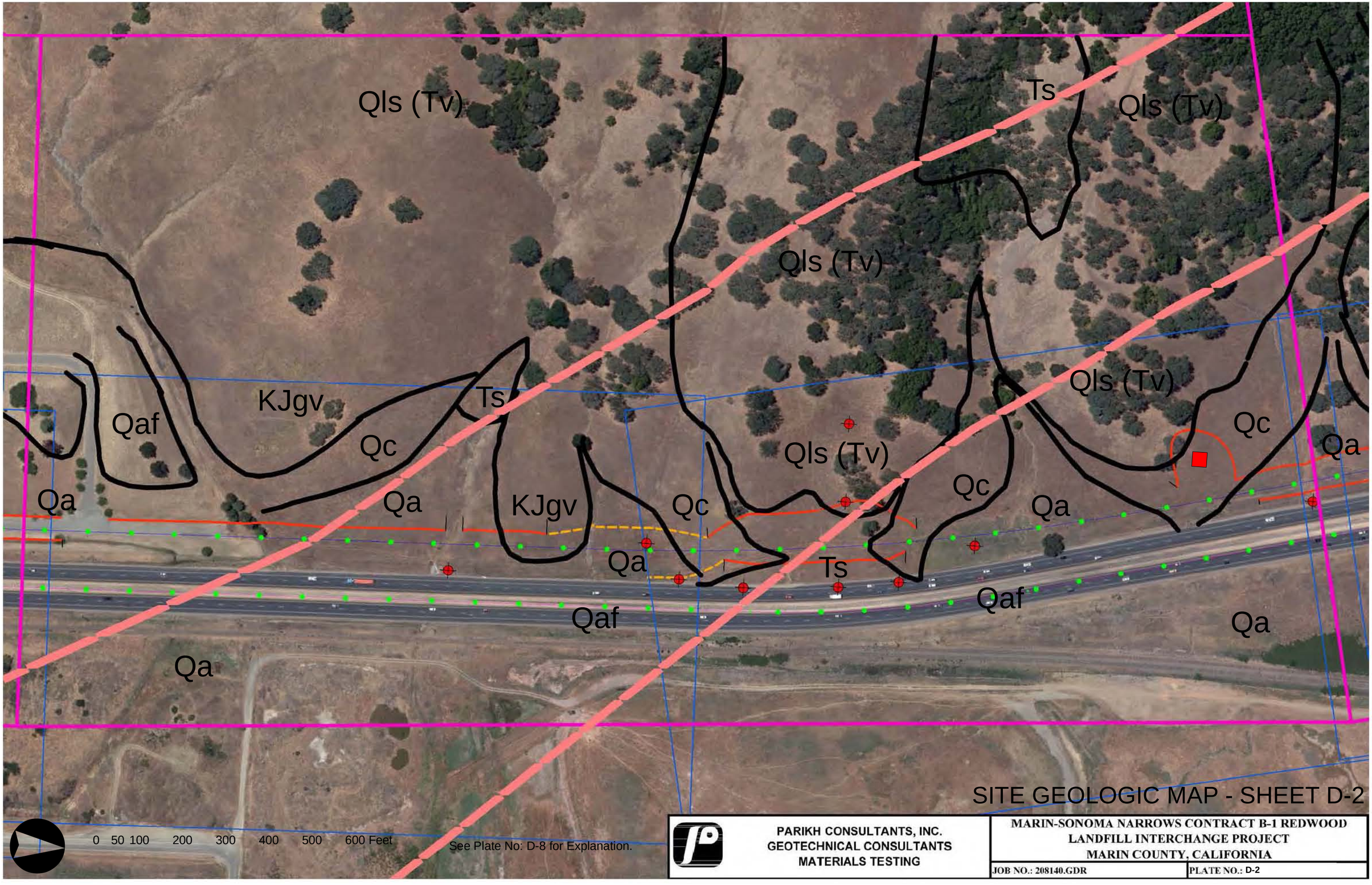


SITE GEOLOGIC MAP - SHEET D-1

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-1



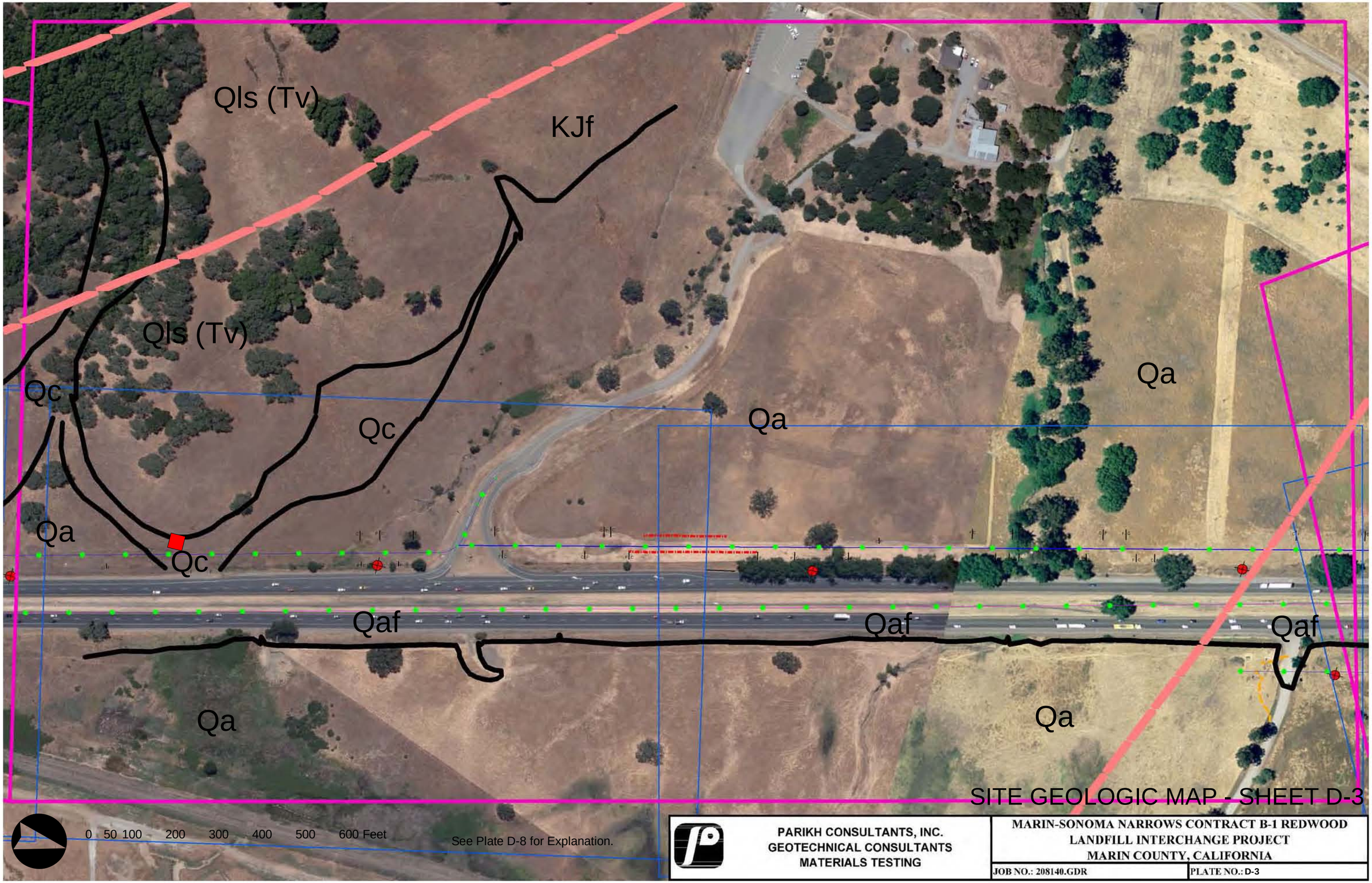
See Plate No: D-8 for Explanation.

SITE GEOLOGIC MAP - SHEET D-2

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-2



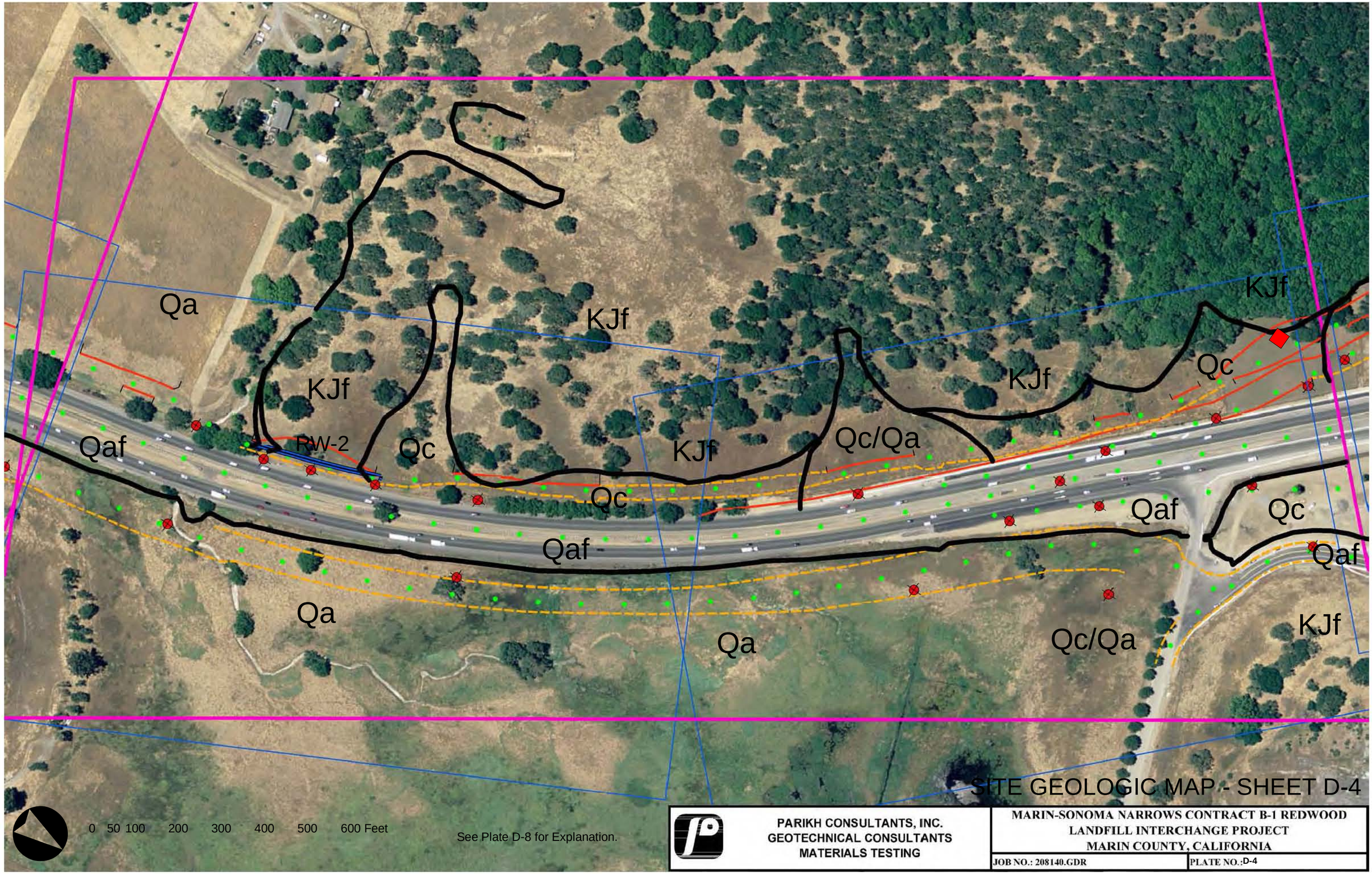
See Plate D-8 for Explanation.

SITE GEOLOGIC MAP - SHEET D-3

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-3



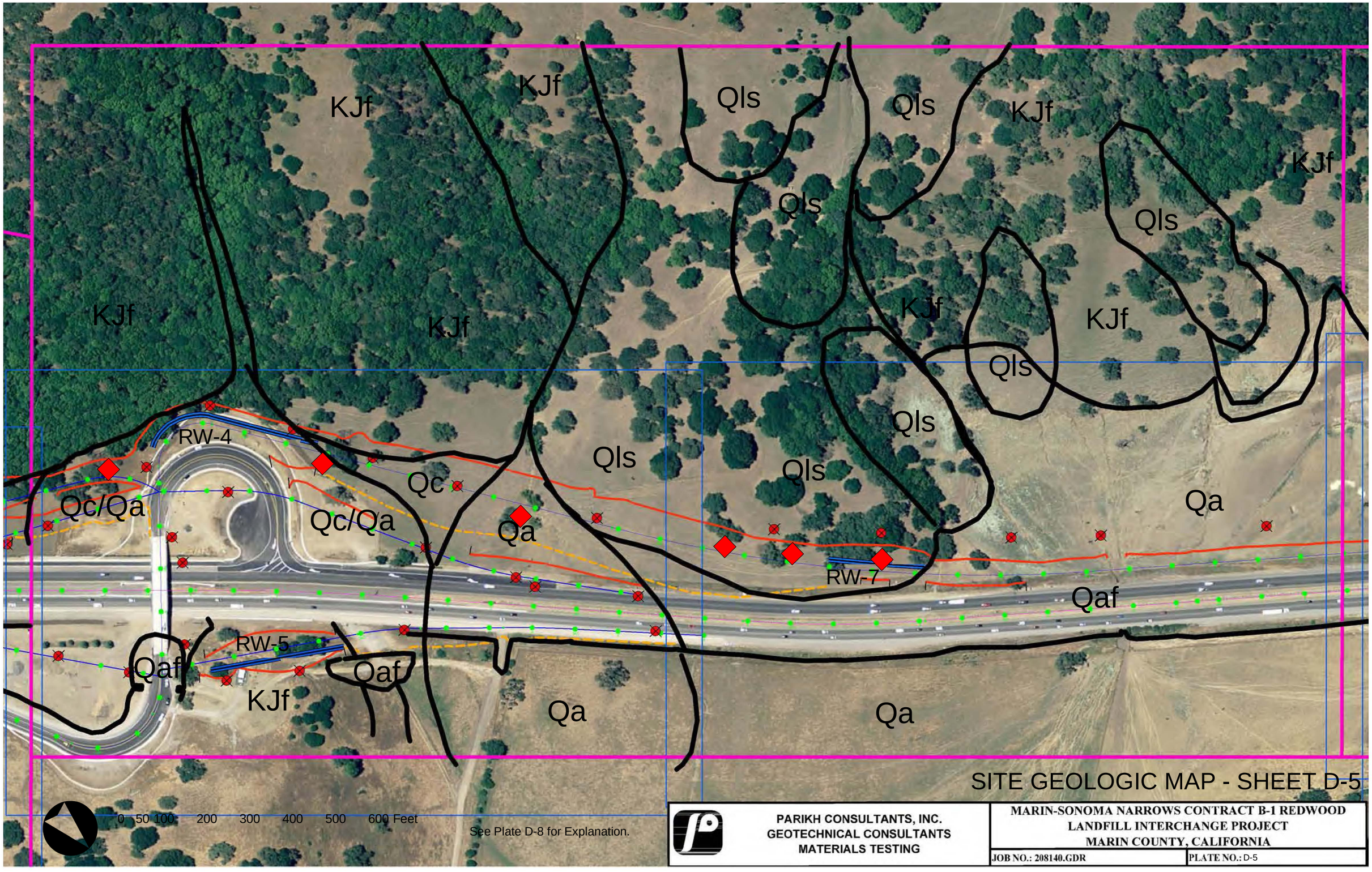
See Plate D-8 for Explanation.

SITE GEOLOGIC MAP - SHEET D-4

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-4



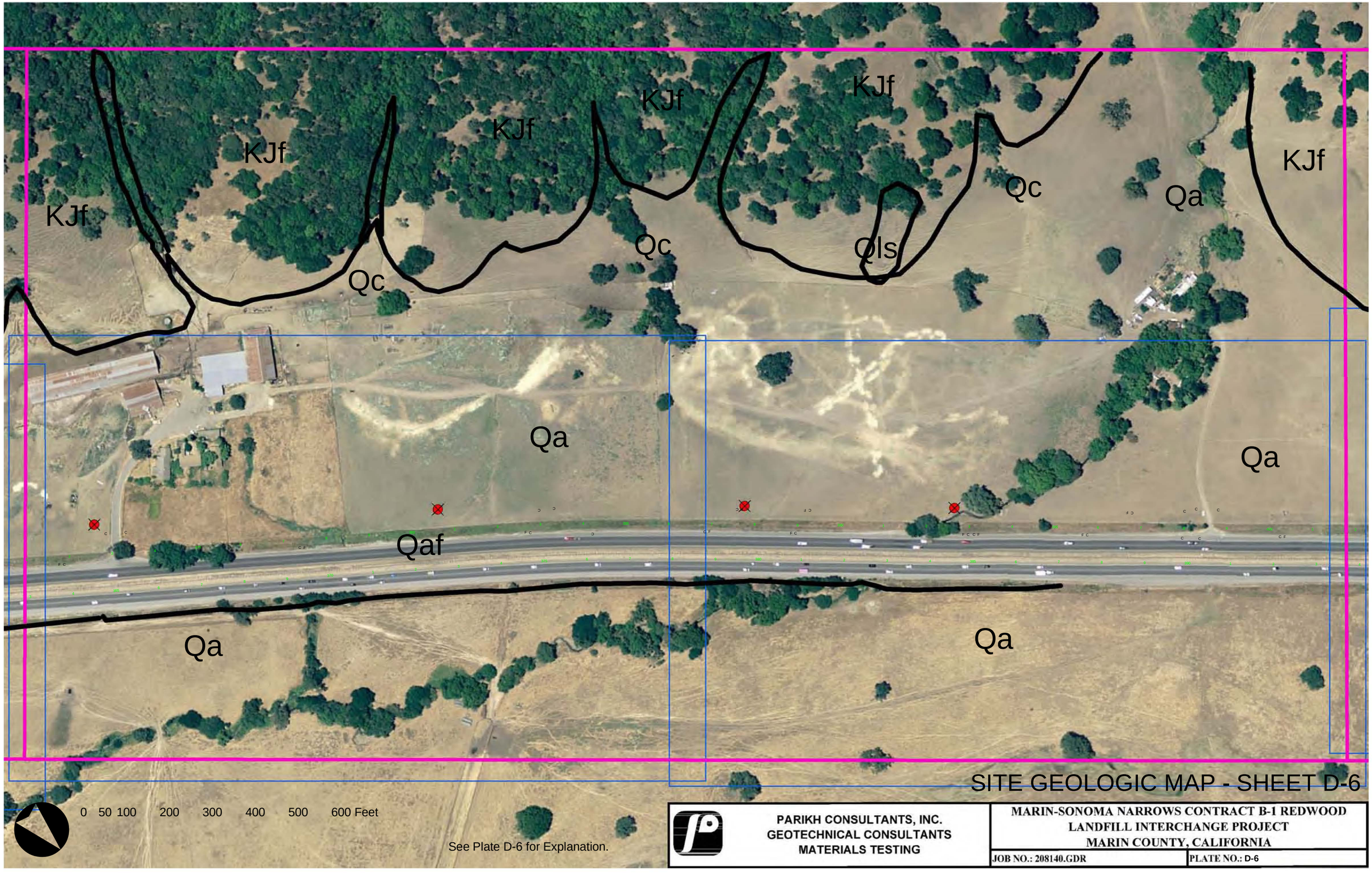
See Plate D-8 for Explanation.

SITE GEOLOGIC MAP - SHEET D-5

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-5



0 50 100 200 300 400 500 600 Feet

See Plate D-6 for Explanation.

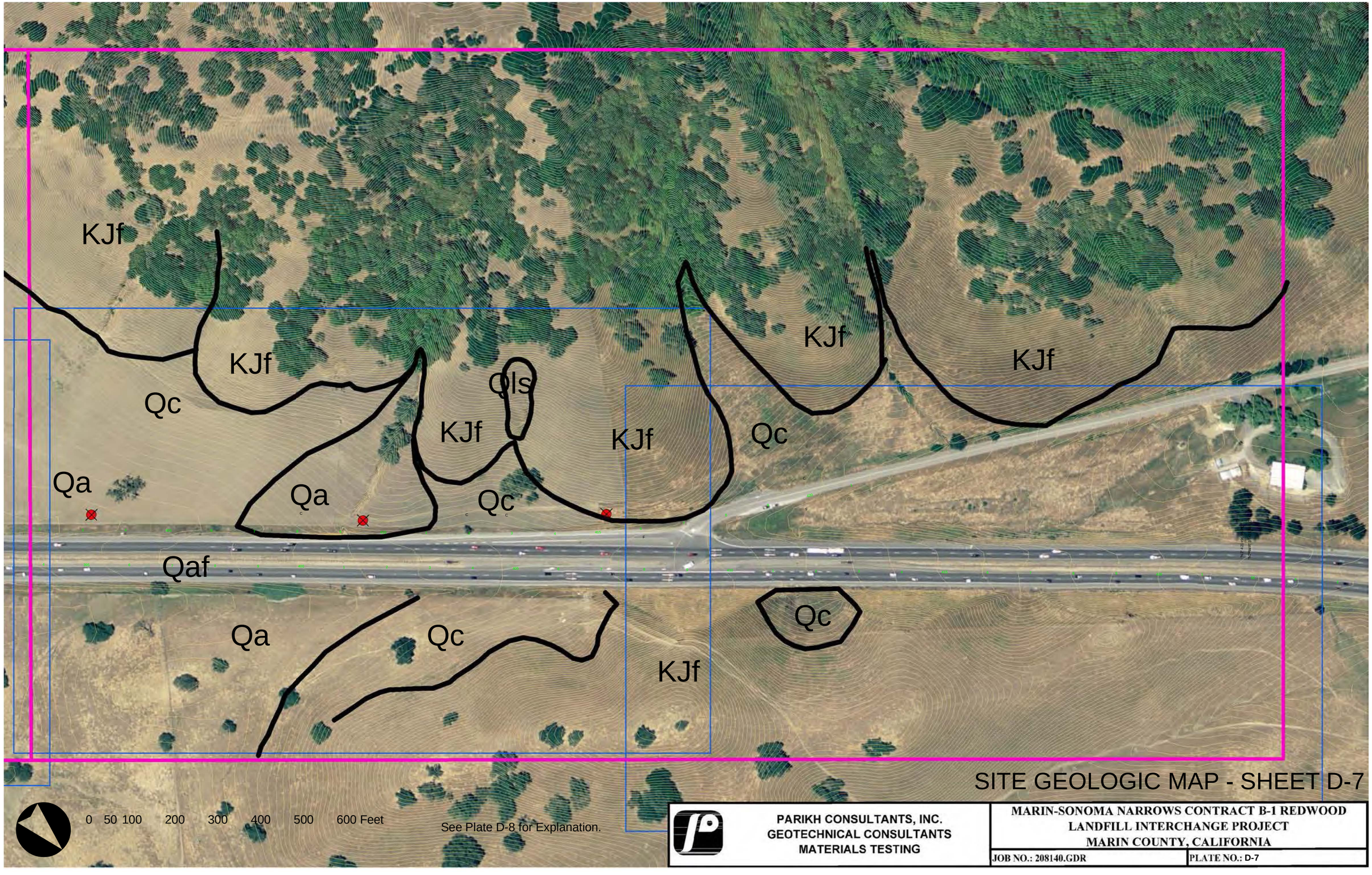
SITE GEOLOGIC MAP - SHEET D-6

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR

PLATE NO.: D-6



SITE GEOLOGIC MAP - SHEET D-7

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-7

EXPLANATION FOR SITE GEOLOGIC MAPS

- Burdell Mt. Fault (Ford; 2007)

- contact (inferred)

Qaf - artificial fill

Qc - colluvium
(including debris flow deposits)

Qa - alluvium

Qls - landslides

Qls (Tv) - large landslides composed of Burdell Mountain Volcanics

Tv - Burdell Mountain Volcanics (andesite)

Ts - Tertiary Sandstone

KJgv - Great Valley Sequence

KJf - Franciscan Complex melange
(including graywacke sandstone, shale, chert, and serpentinite)

- Top of Proposed Cut Slope

- Toe of Proposed Fill Slope

- Proposed Retaining Wall

- Project Alignment

- Boring location

- Test Pit location

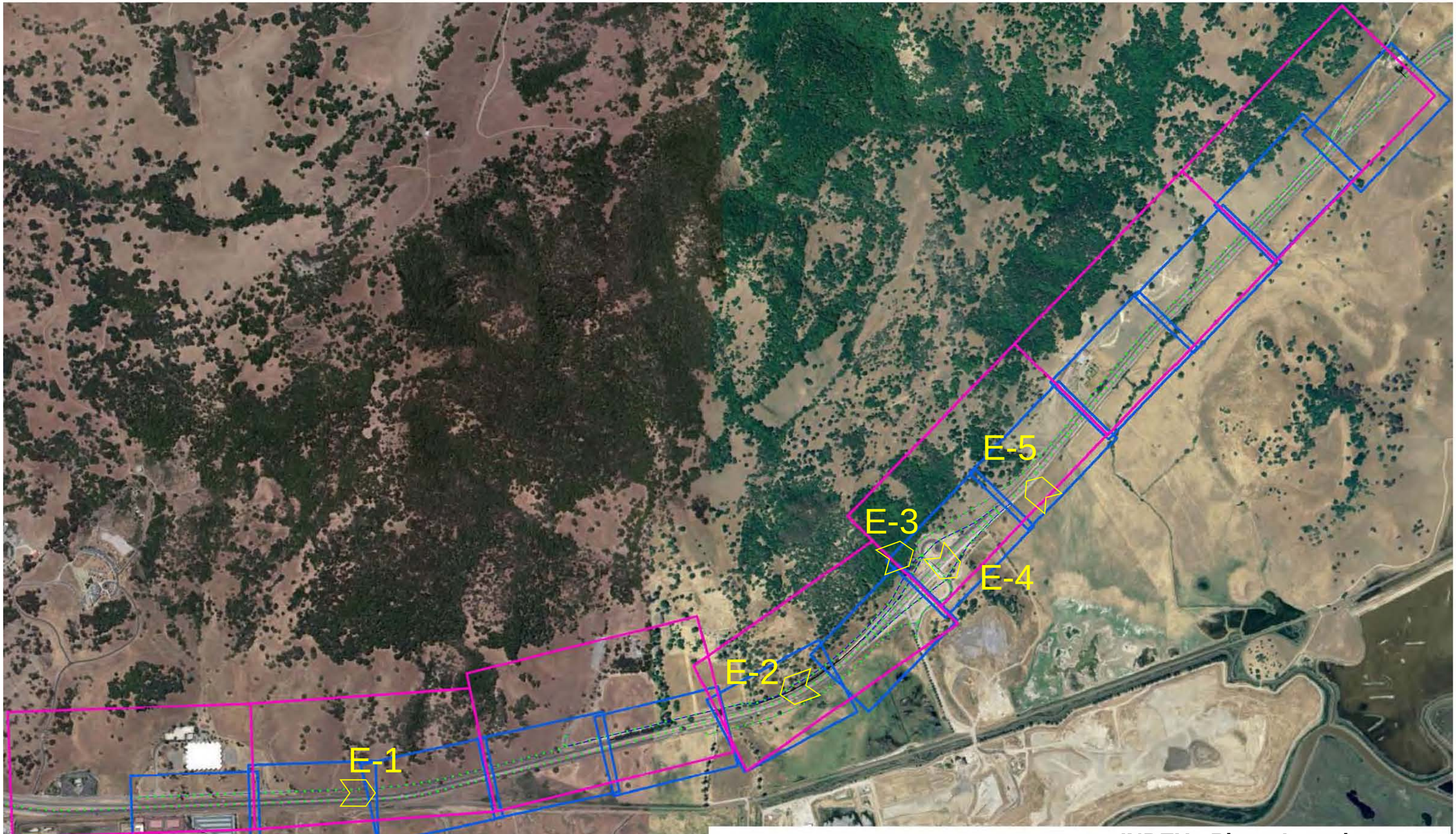
- shear zone

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: D-8

APPENDIX E



INDEX - Photo Locations

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: E

PHOTO #1

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: E-1

PHOTO #2

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: E-2

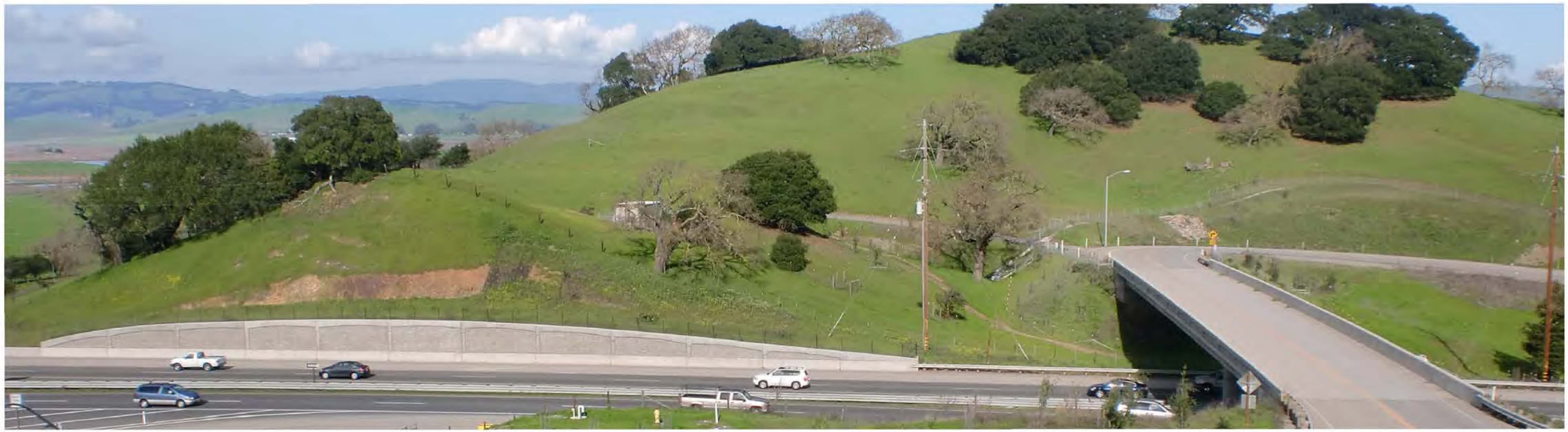
Proposed
Retaining Wall #4

PHOTO #3

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: E-3



Chert exposed in
Existing Cut Slope
@ Station 338+00

PHOTO #4

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.GDR | PLATE NO.: E-4

Erosion and slumping of
Existing Cut Slope
@ Station 360+00

PHOTO #5

	PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD LANDFILL INTERCHANGE PROJECT MARIN COUNTY, CALIFORNIA
		JOB NO.: 208140.GDR — PLATE NO.: E-5

APPENDIX F

NOTES:

1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
2. SURVEY MONUMENT AND SETTLEMENT PLATFORM LOCATIONS SHOWN FOR SETTLEMENT MONITORING ARE APPROXIMATE AND SHALL BE FIELD LOCATED BY THE ENGINEER. SEE Q SHEETS FOR TABLE LOCATIONS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.
3. PRIOR TO EARTHWORK OPERATIONS IN AREAS IDENTIFIED AS ROADWAY EXCAVATION (UNSUITABLE MATERIAL) AND AS DIRECTED BY THE ENGINEER, CONTRACTOR SHALL OVEREXCAVATE A MINIMUM OF 2' (UNLESS OTHERWISE NOTED OR DIRECTED BY THE ENGINEER), PLACE SUBGRADE ENHANCEMENT GEOTEXTILE, AND BACKFILL WITH EMBANKMENT MATERIAL. LIMITS AND LOCATIONS OF ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SHALL BE VERIFIED BY THE ENGINEER. FOR ADDITIONAL INFORMATION, SEE TYPICAL SECTIONS AND SPECIFICATIONS.
4. PRIOR TO EARTHWORK OPERATIONS IN AREAS IDENTIFIED AS ROADWAY EXCAVATION (AMA) AND AS DIRECTED BY THE ENGINEER, CONTRACTOR SHALL OVEREXCAVATE 3 FEET OF MATERIAL, HAUL AND STOCKPILE. AS DIRECTED BY THE ENGINEER, CONTRACTOR SHALL MOVE AND PLACE STOCKPILED ROADWAY EXCAVATION (AMA) MATERIAL BENEATH 3 FEET MINIMUM OF EMBANKMENT MATERIAL. OVEREXCAVATED AREA SHALL BE BACKFILLED WITH EMBANKMENT MATERIAL. LIMITS AND LOCATIONS OF ROADWAY EXCAVATION (AMA) SHALL BE VERIFIED BY THE ENGINEER. FOR ADDITIONAL INFO, SEE SPECS. STOCKPILED MATERIAL SHALL BE COVERED.

LEGEND:

- CITY OR COUNTY R/W
- C|F CUT/FILL LINE
- FENCE
- SURVEY MONUMENT (TYPE A) (FOR SETTLEMENT MONITORING) (SEE NOTE 2)
- SETTLEMENT PLATFORM (FOR SETTLEMENT MONITORING) (SEE NOTE 2)
- ROADWAY EXCAVATION (UNSUITABLE MATERIAL) (SEE NOTE 3)
- ROADWAY EXCAVATION (AMA) (SEE NOTE 4)

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

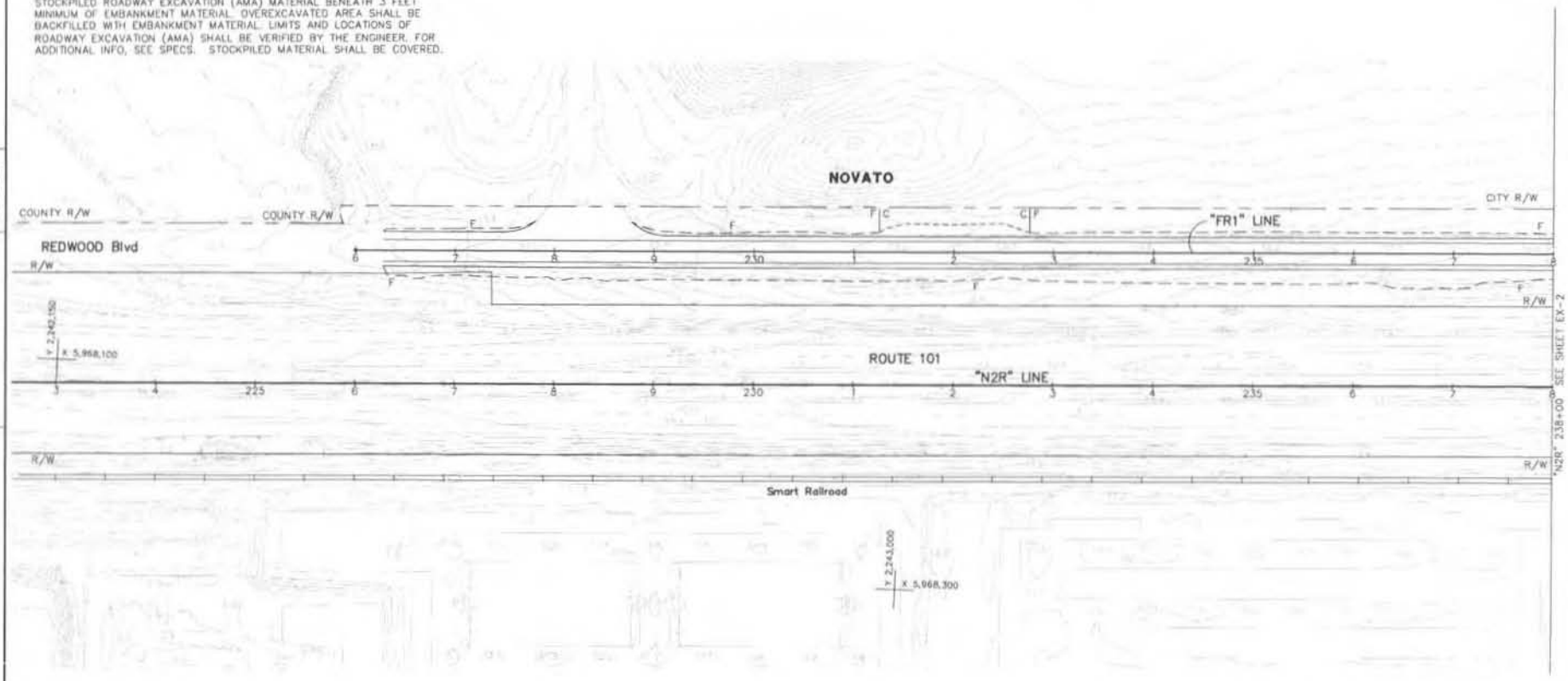
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
#670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



SCALE: 1" = 50'

EX-1

BORDER LAST REVISED 7/2/2010	USERNAME => $USER DGN FILE => $PROJECT	RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3	UNIT 0716	PROJECT NUMBER & PHASE	04000007331

USE REVISION — DATE PLOTTED => Oct 13 2011
TIME PLOTTED => 4:40 pm

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR — NATALINA V. BERNARD

CALCULATED-DESIGNED BY — CHECKED BY

REVISED BY — DATE REVISED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

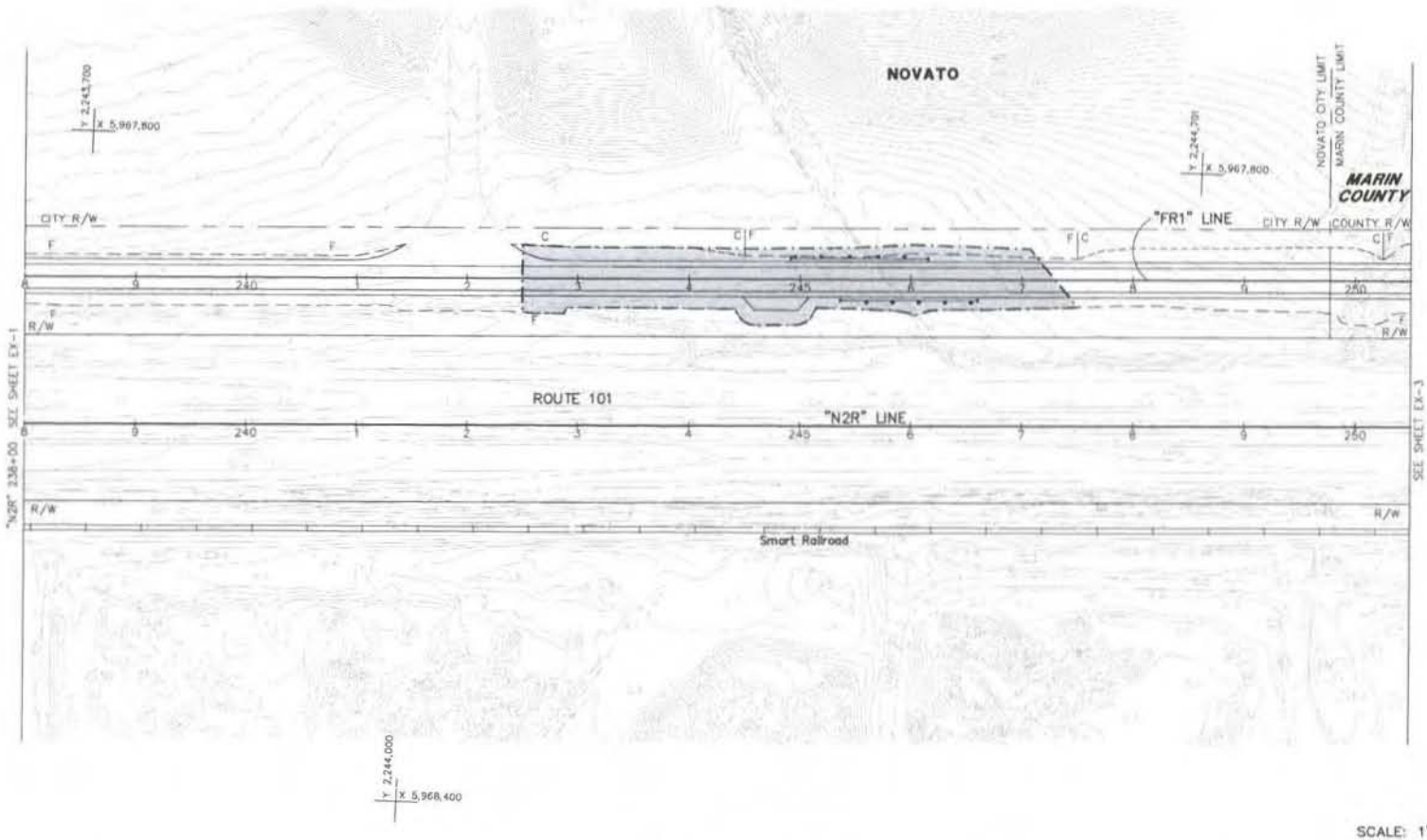
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-2

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

LAST REVISED: DATE PLOTTED => 04/13/2011 TIME PLOTTED => 4:41 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => \$USER DGN FILE => \$REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

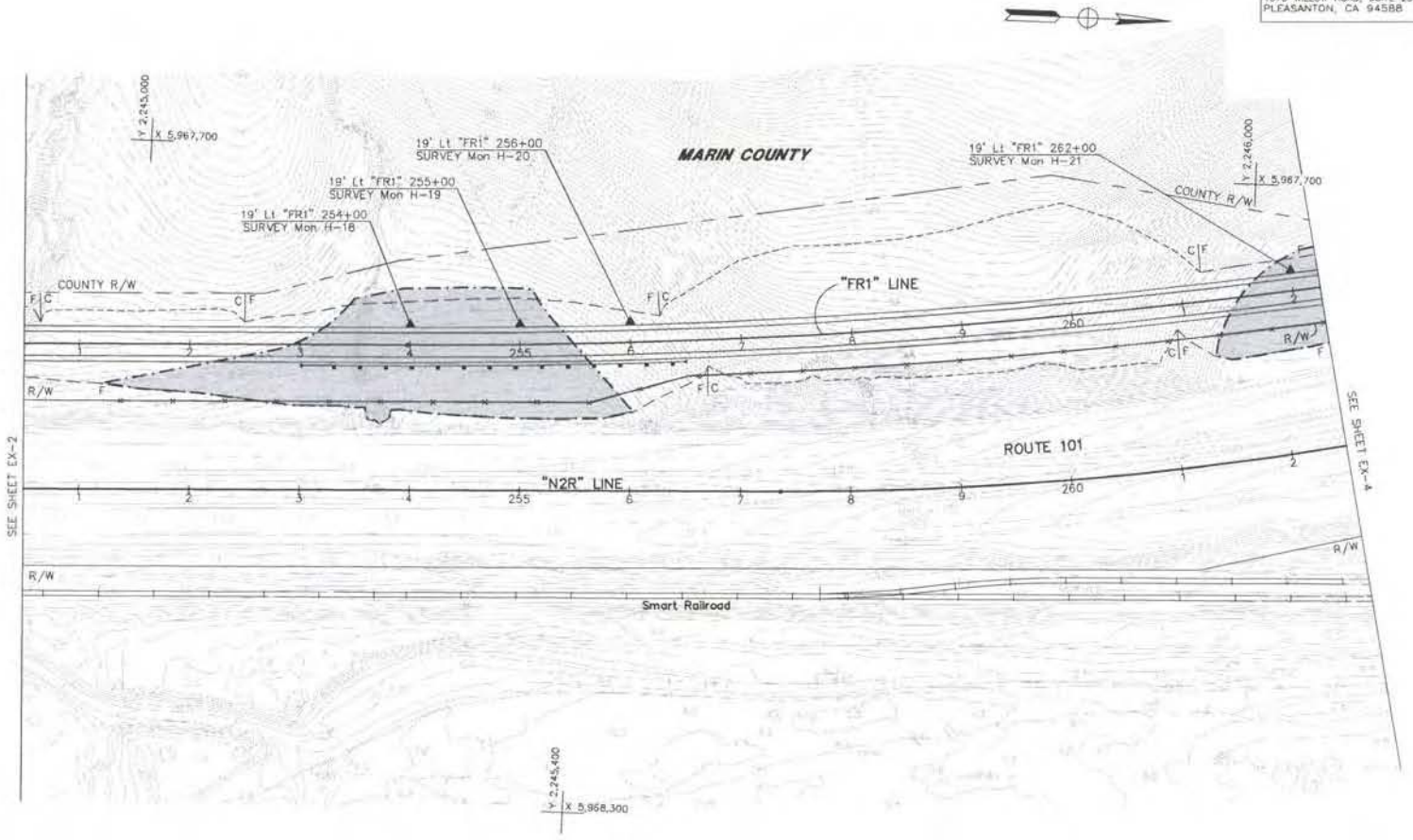
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901



SCALE: 1" = 50'

EX-3

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

ORIGINAL SHEET SIZE 22" x 34"
DATE PLOTTED => Oct 13 2011
TIME PLOTTED => 4:42 pm

BORDER LAST REVISED 7/2/2010
USERNAME => $USER
DGN FILE => $PREQUEST
RELATIVE BORDER SCALE IS IN INCHES
UNIT 0716
PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

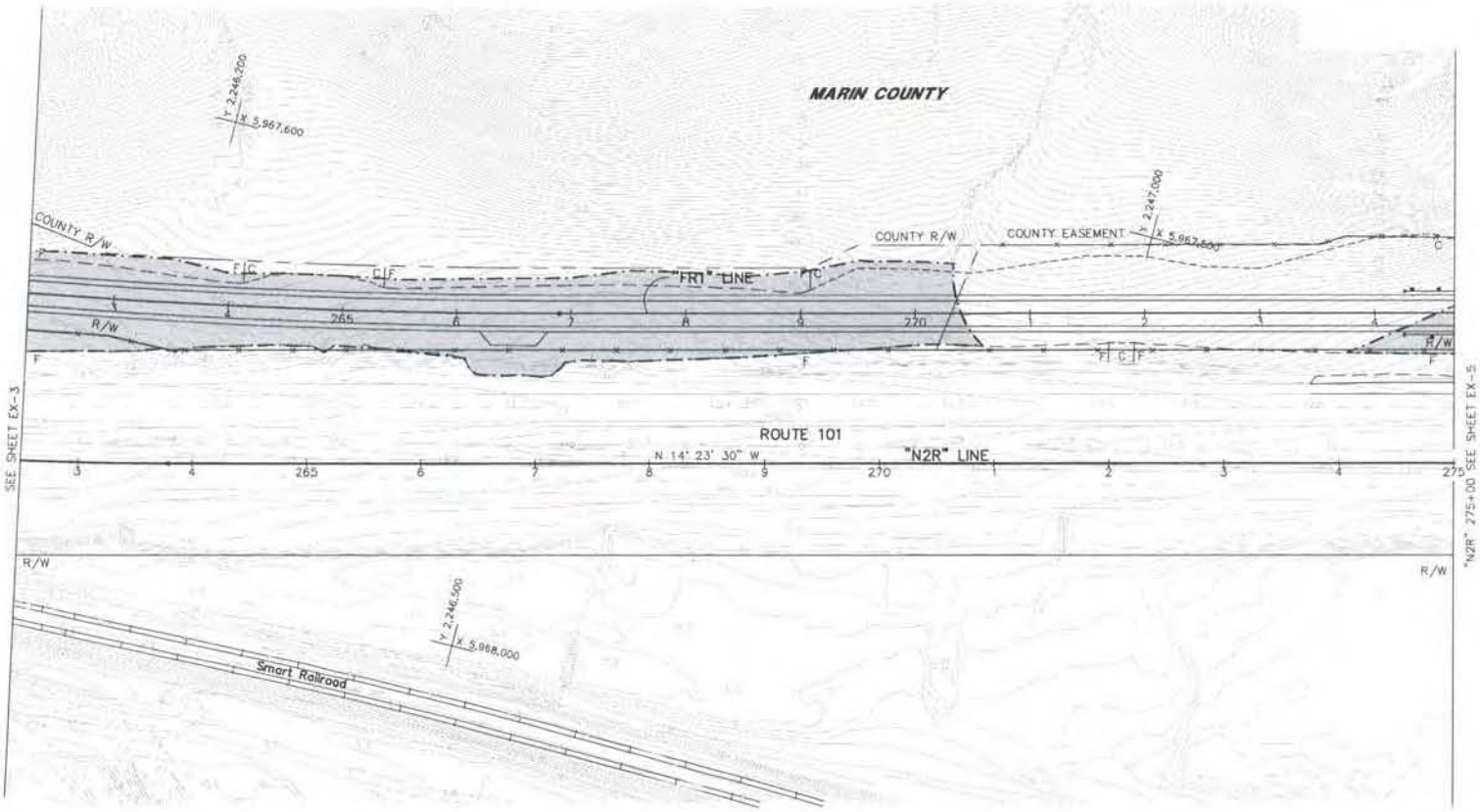
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-4

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY | DATE REVISED

LAST REVISION — DATE PLOTTED => 04-13-2011 — TIME PLOTTED => 4:43 pm

BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $PROJECT

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

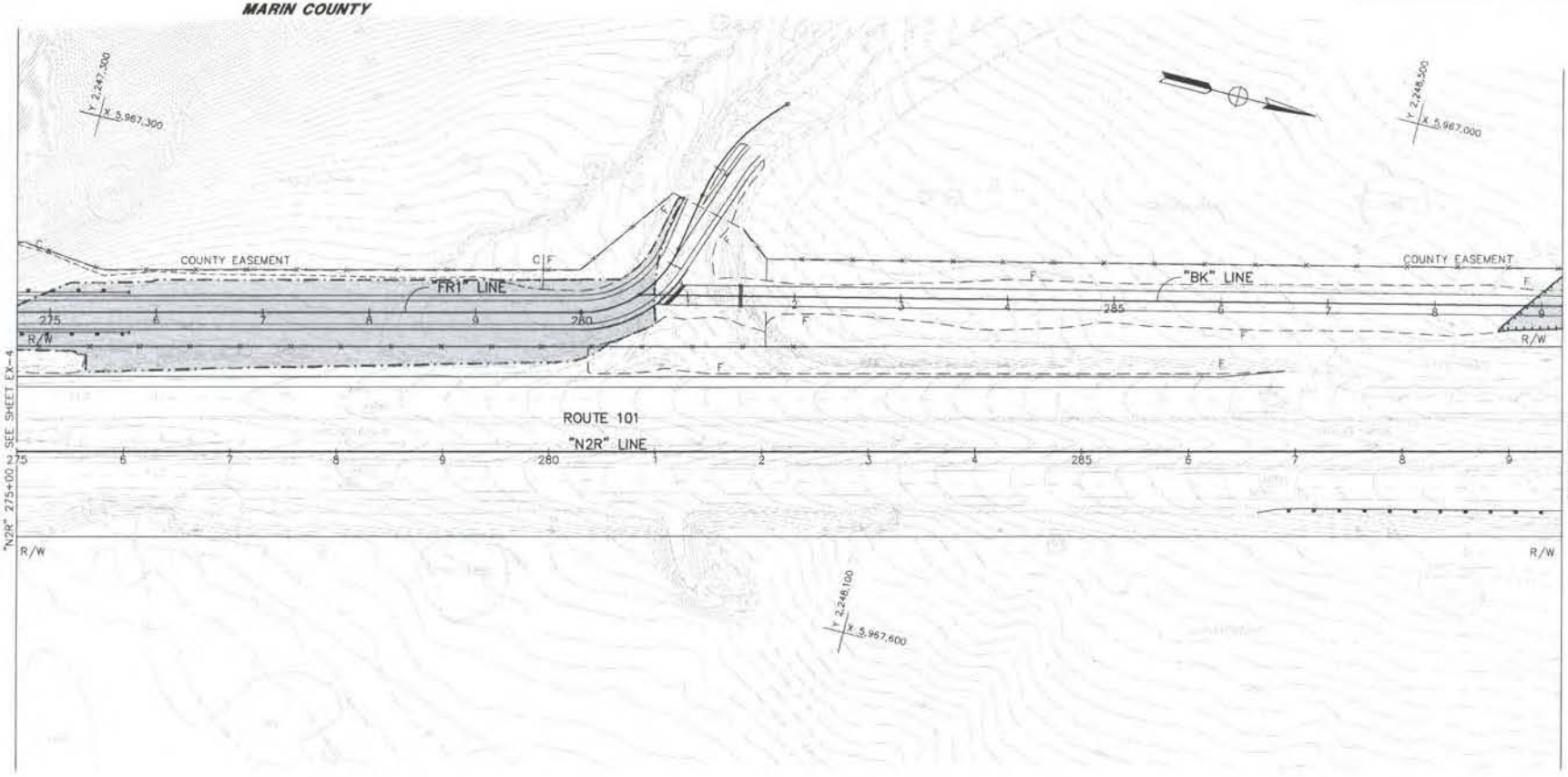
REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

OLOMPALI STATE
HISTORIC PARK

MARIN COUNTY



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-5

REVISED BY | DATE REVISED
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

DATE PLOTTED => Oct 13, 2011
TIME PLOTTED => 4:44 pm
LAST REVISION 10-3-11

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

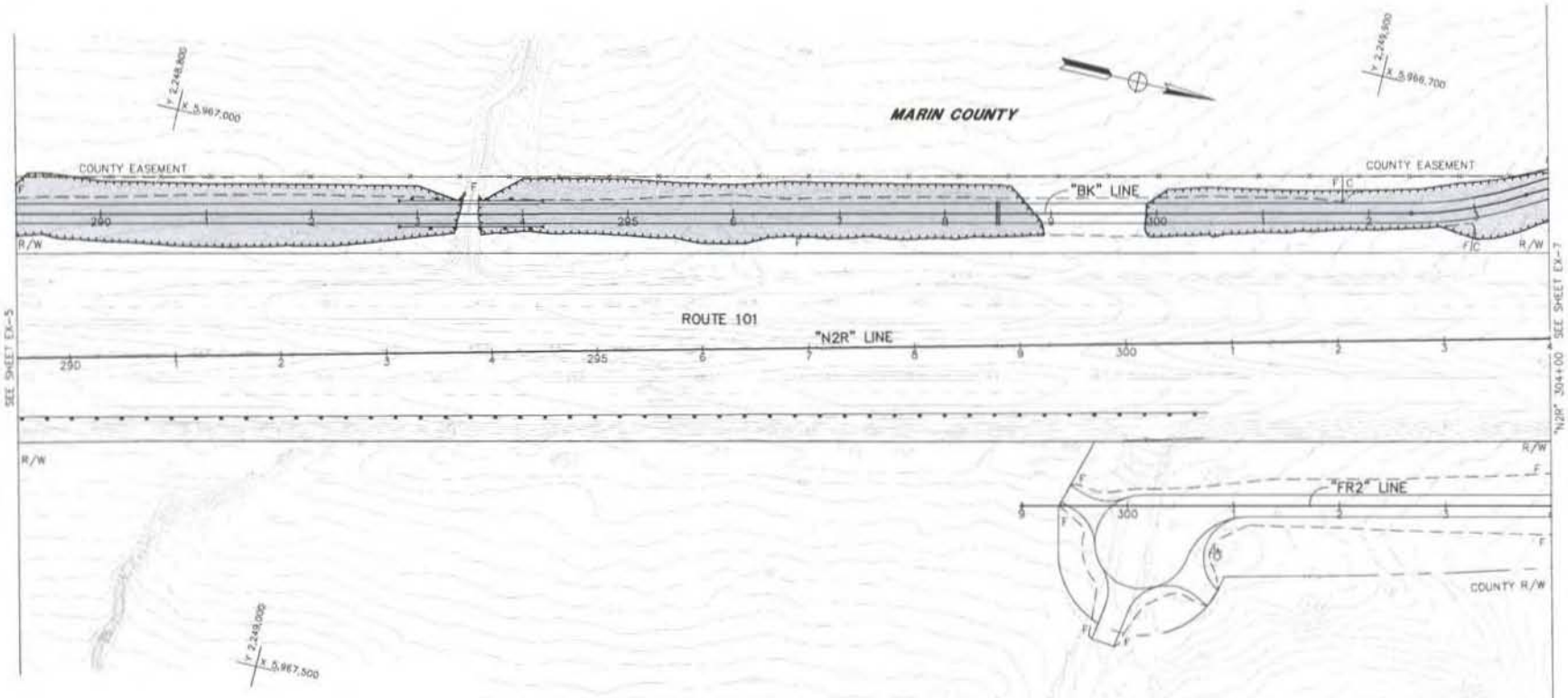
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



SCALE: 1" = 50'

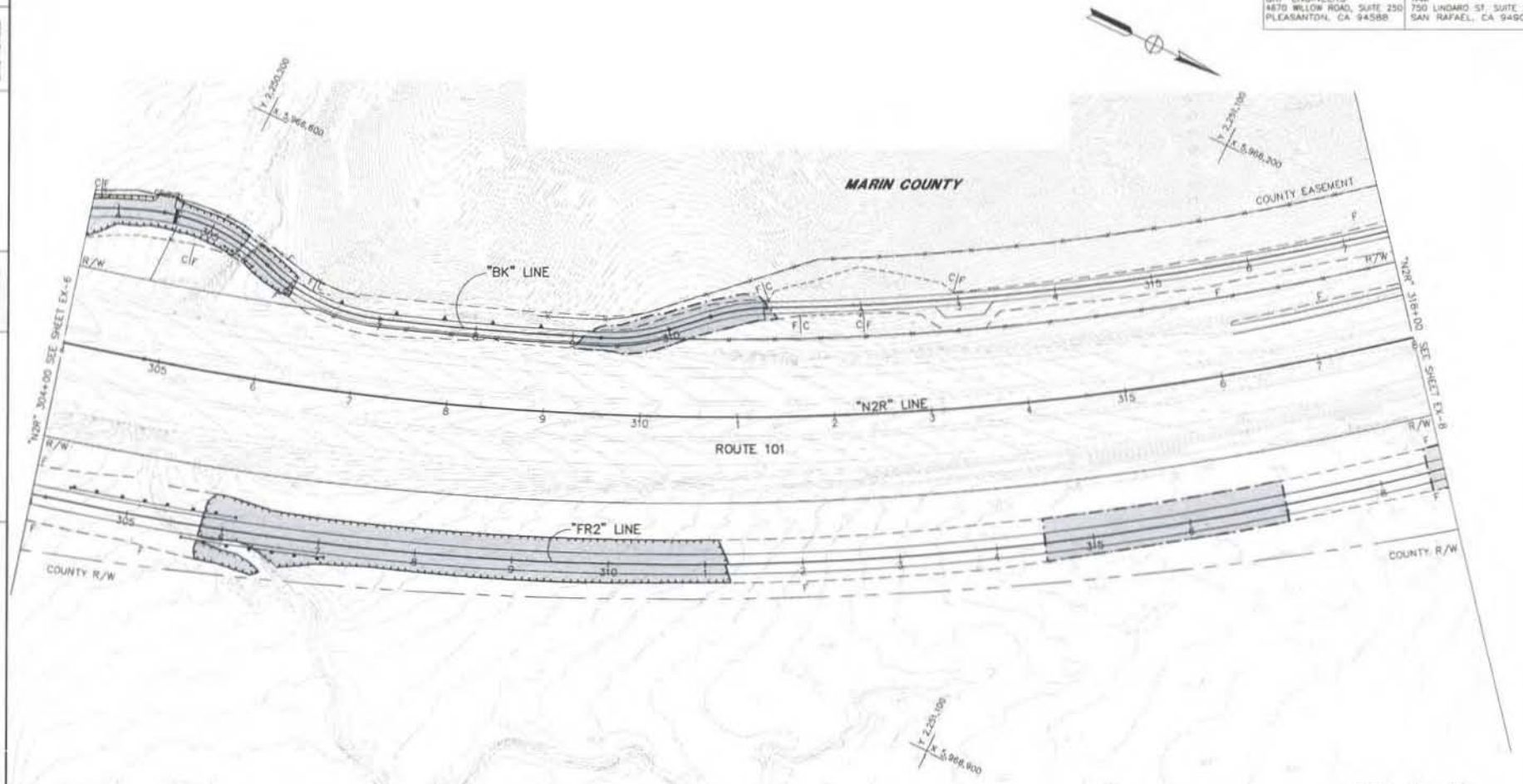
FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-6

REVISED BY: | DATE REVISED:
CALCULATED-DESIGNED BY: | CHECKED BY:
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

USER BEGIN | DATE PLOTTED => 04.13.2011 | TIME PLOTTED => 4:48 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE: IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED/DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

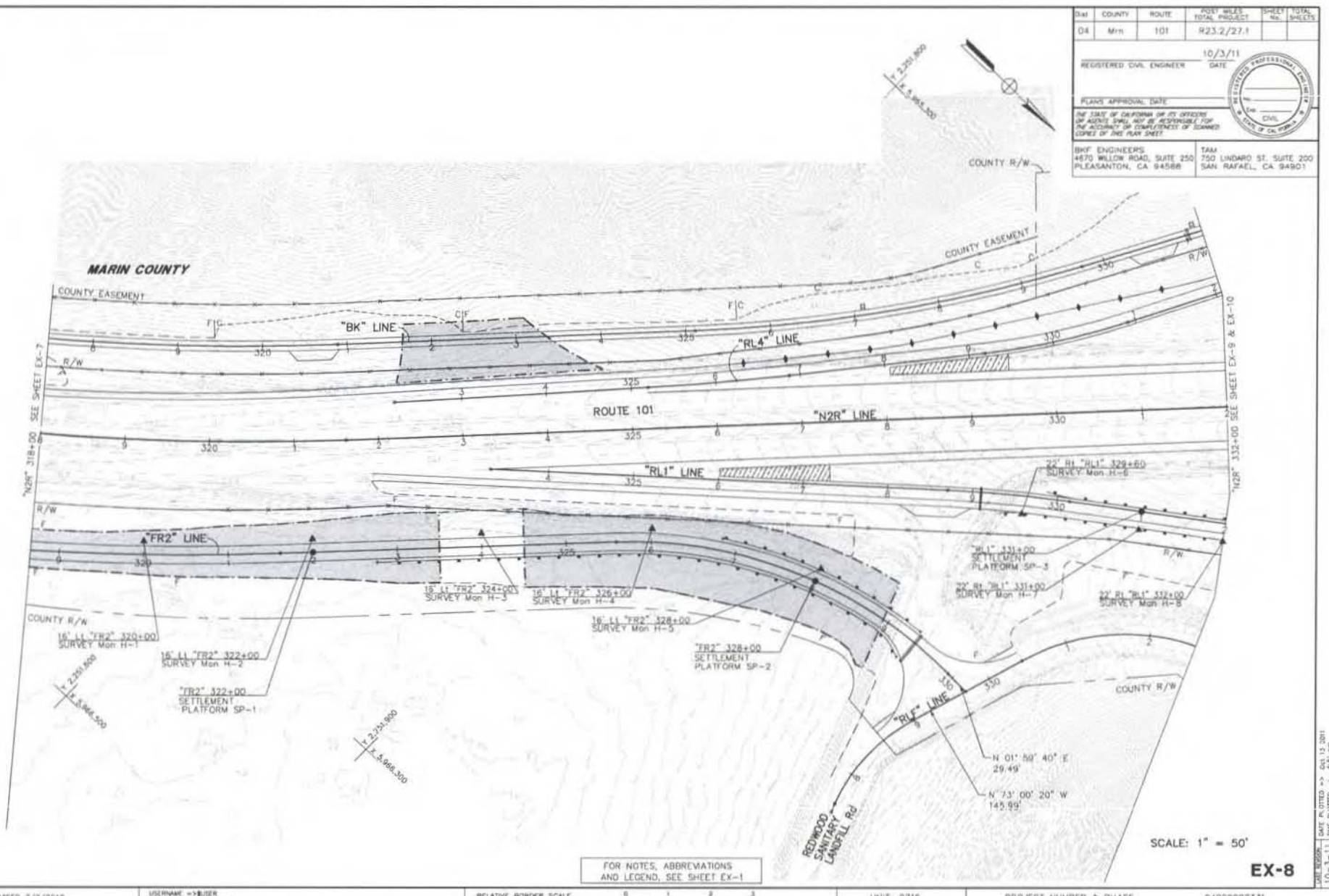
Caltrans

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-7

LAST REVISION: DATE PLOTTED => Oct 13, 2011 — TIME PLOTTED => 4:48 pm — 10-3-11

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER, DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

USER NAME = >$USER
DGN FILE = >$REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 0400000731

BORDER LAST REVISED 7/2/2010

LAST REVISION — DATE PLOTTED => OCT 13 2011
TIME PLOTTED => 4:51 pm
10-3-11

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

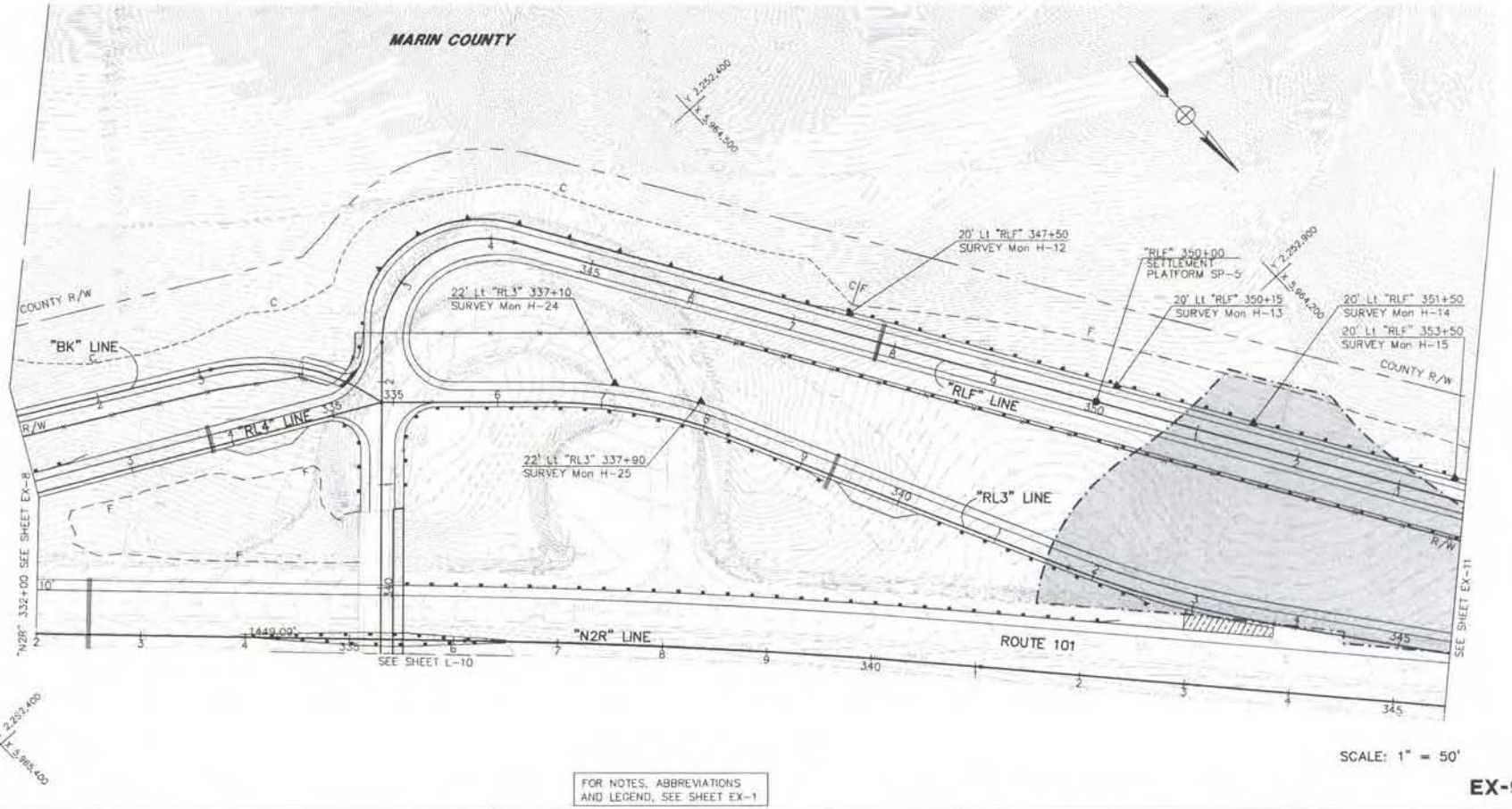
REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

Caltrans



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-9

LAST REVISION — DATE PLOTTED => Oct 13 2011
10-3-11 — TIME PLOTTED => 4:52 pm

BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 0400000733 1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — No. — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

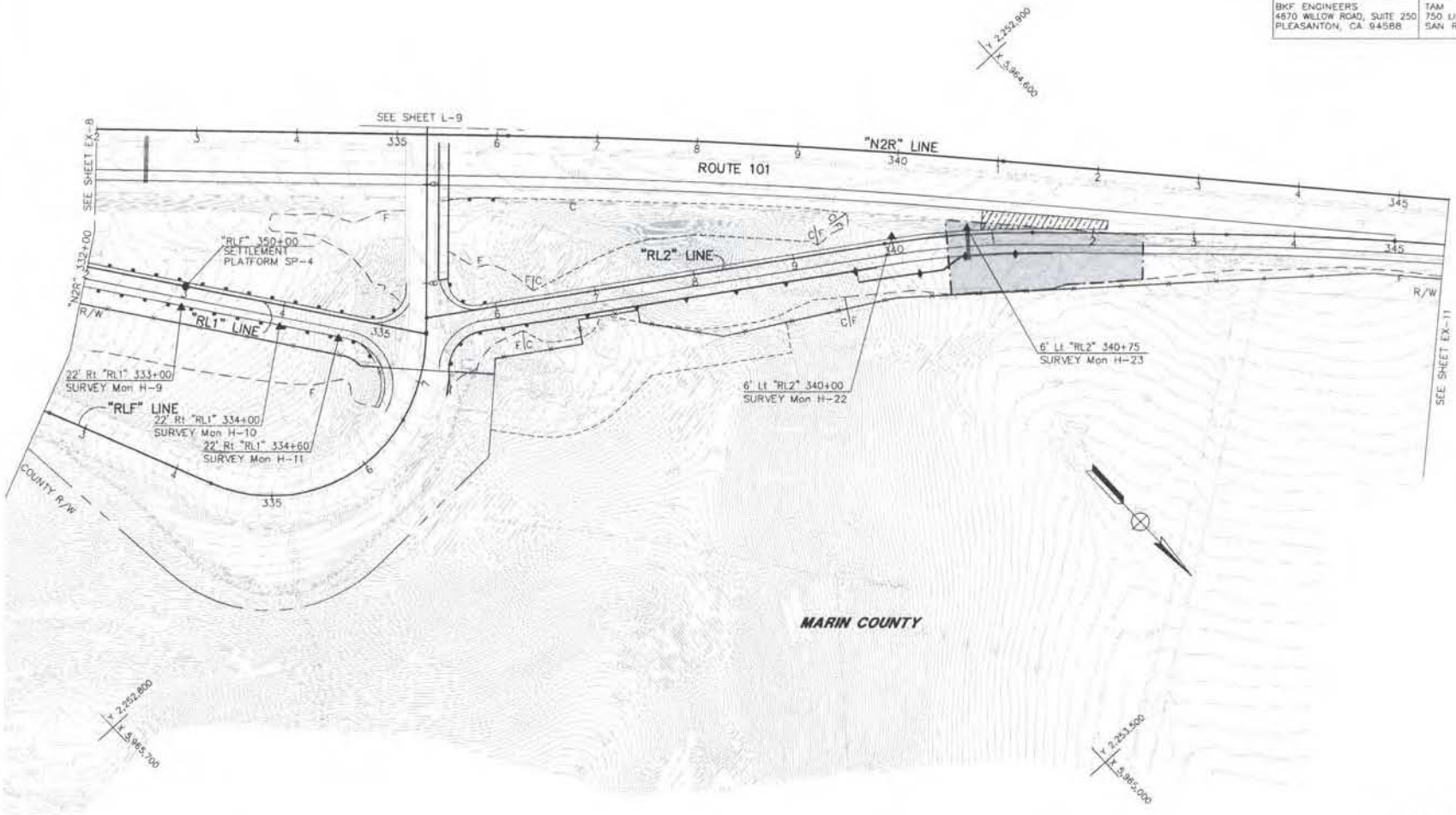
TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-10

LAST REVISION — DATE PLOTTED => Oct 13 2011
10-3-11 — TIME PLOTTED => 4:53 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $PREQUES | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

Caltrans

Y 2,253,100
X 5,964,000

"RLF" 354+00
SETTLEMENT
PLATFORM SP-6

20' Lt "RLF" 355+00
SURVEY Mon H-16

20' Lt "RLF" 357+00
SURVEY Mon H-17

COUNTY R/W

MARIN COUNTY

SEE SHEET EX-9 & EX-10

"RL3" LINE

"RL2" LINE

ROUTE 101

"N2R" LINE

"RLF" LINE

SEE SHEET EX-12

"N2R" 360+00

Y 2,253,800
X 5,964,200

SCALE: 1" = 50'

EX-11

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

LAST BORDER: DATE PLOTTED => 04-13-2011
10-3-11 TIME PLOTTED => 4:34 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $PROJECT | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

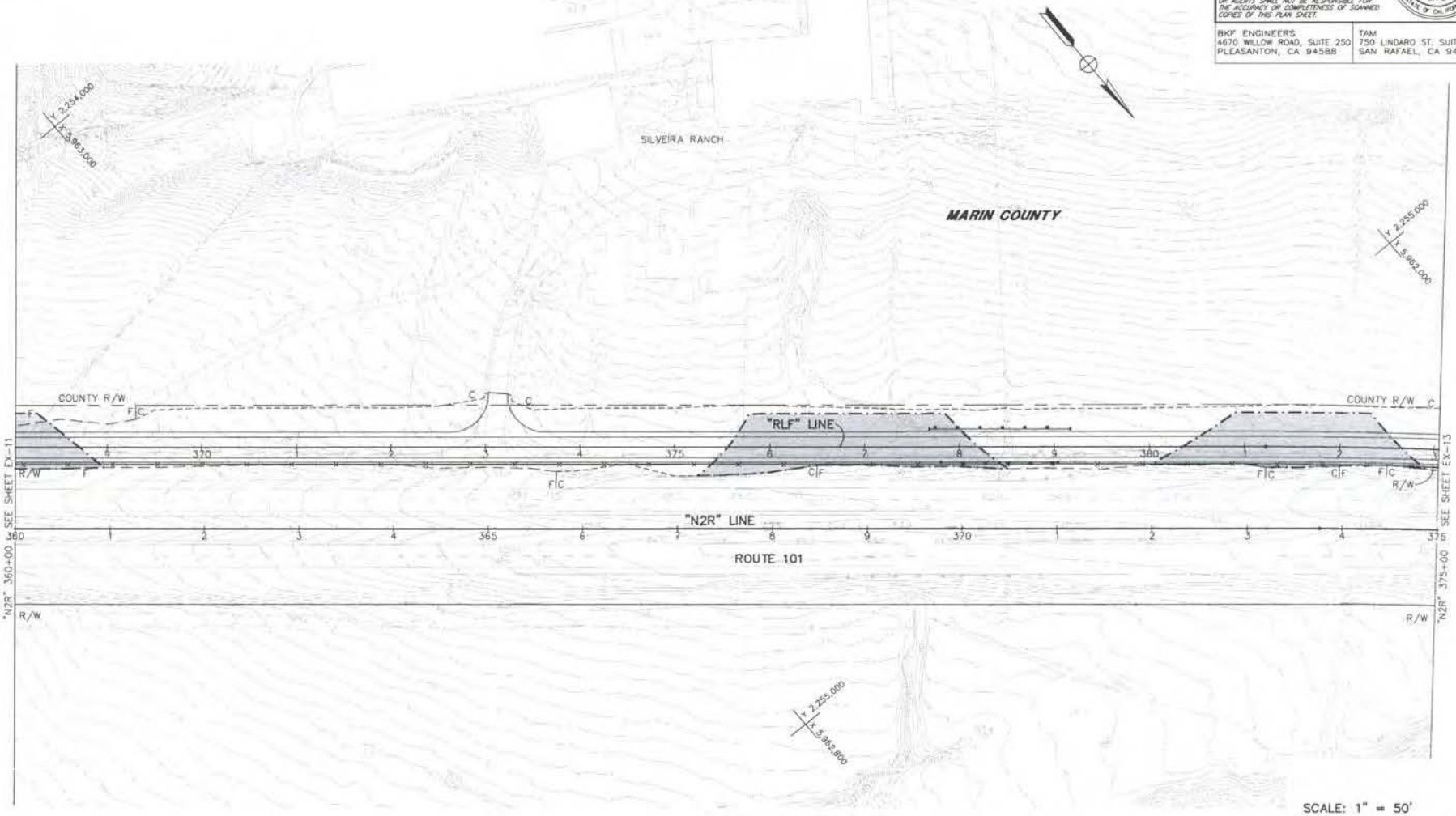
TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans



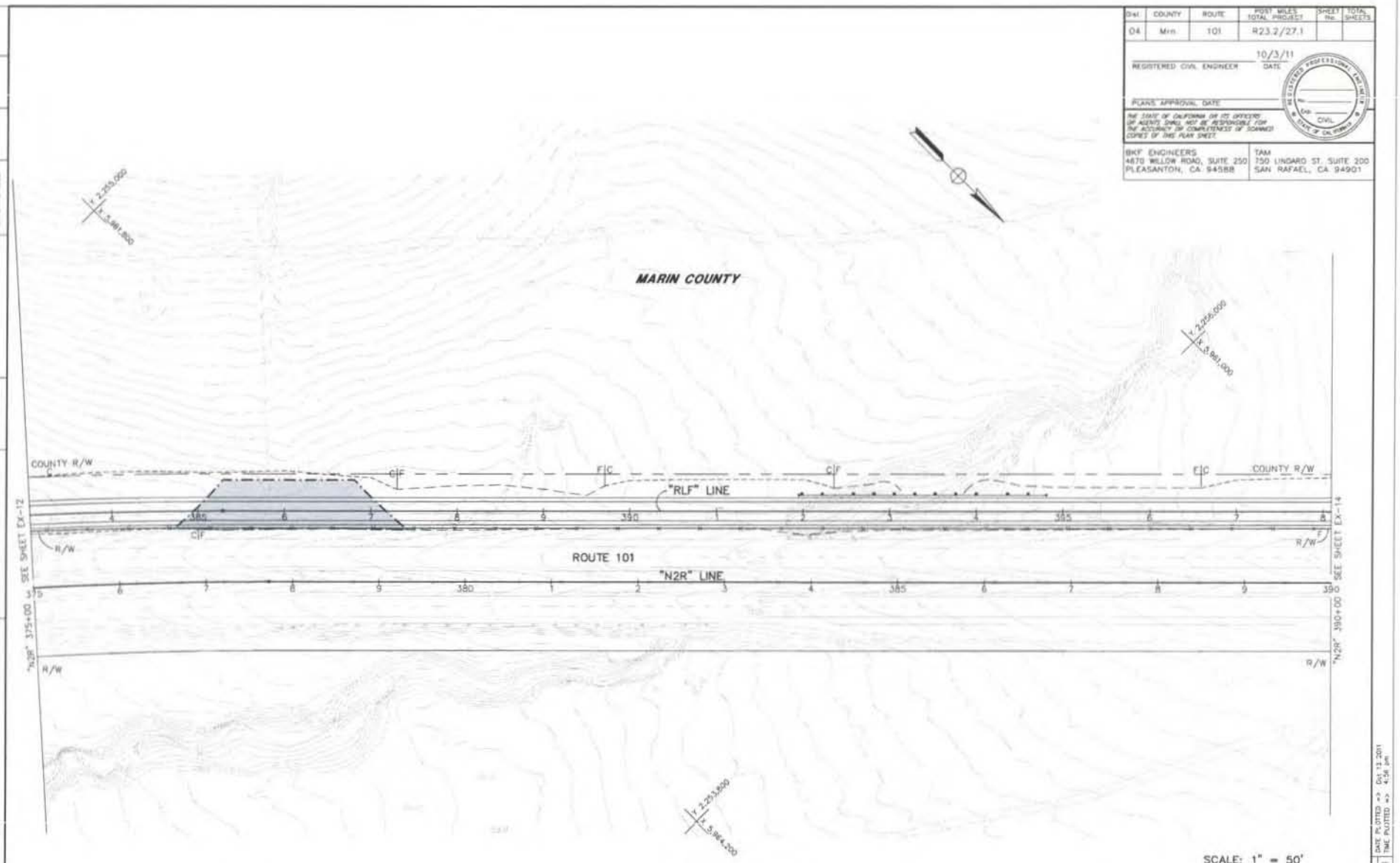
SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-12

LAST REVISION — DATE PLOTTED => Oct 13 2011
10-3-11 — TIME PLOTTED => 4:55 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $PREQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 0400000733I



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn.	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — No. — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

EX-13

LAST SAVED: DATE PLOTTED => Oct 13 2011
TIME PLOTTED => 4:54 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER, DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

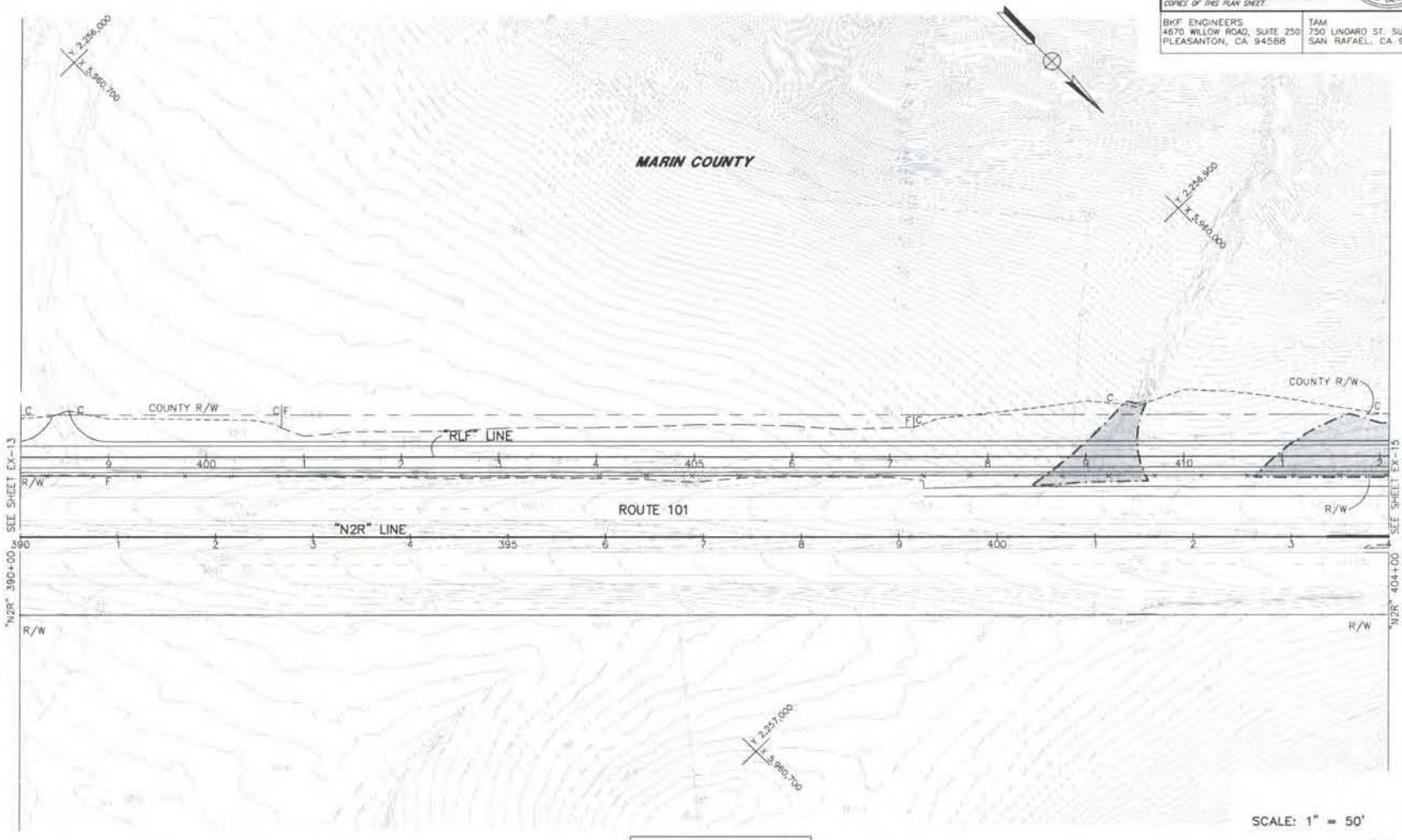
TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-14

JOB NUMBER — DATE PLOTTED => Oct 13 2011 — TIME PLOTTED => 4:37 pm
10-3-11

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER DGN FILE => $PREQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

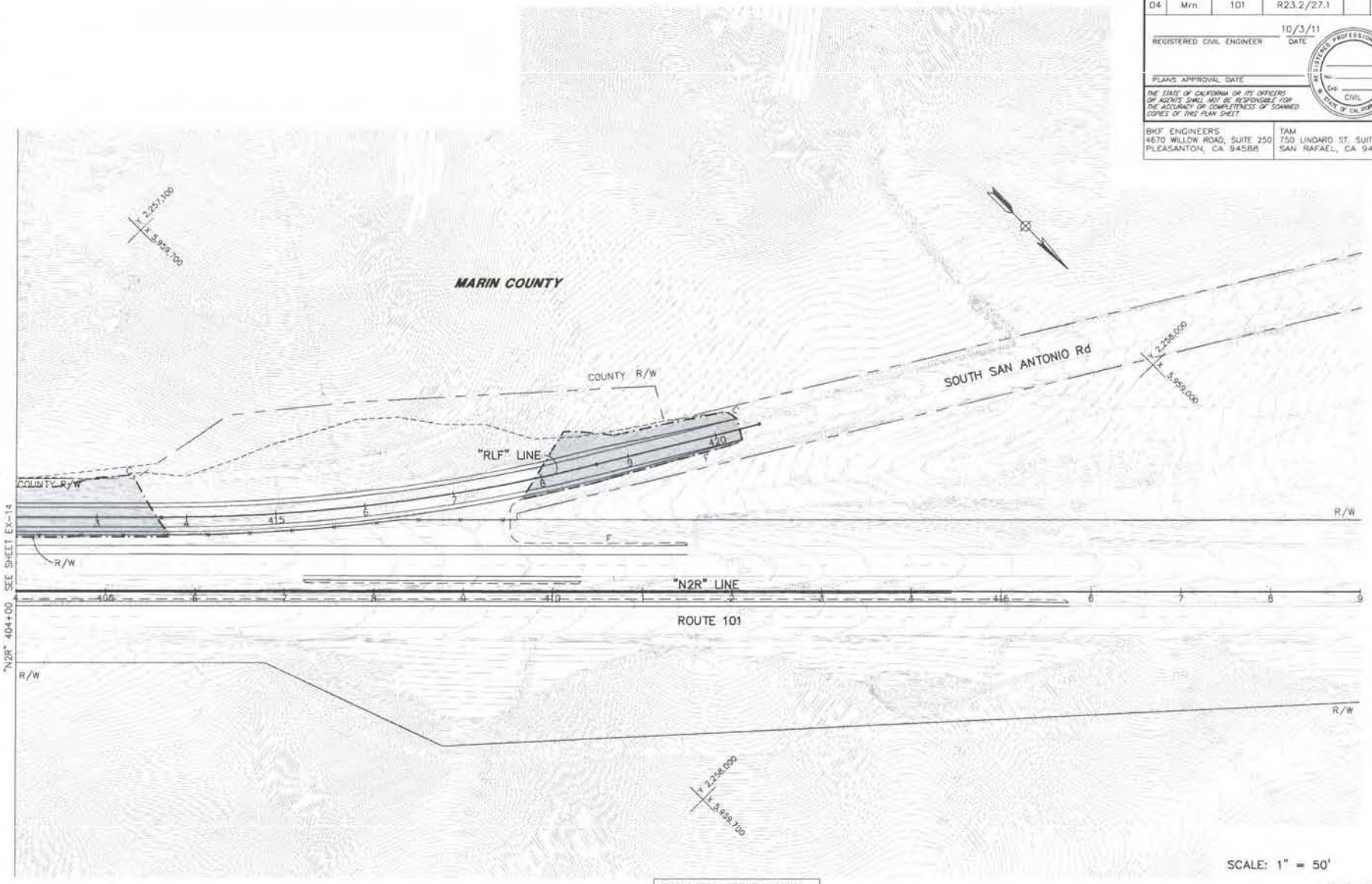
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-15

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

Caltrans

LAST SAVED — DATE PLOTTED => Oct 13, 2011
10-3-11 — TIME PLOTTED => 4:59 pm

BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 04000007331

NOTES:

1. DIMENSIONS OF THE PAVEMENT SECTION (STRUCTURAL SECTIONS) ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. SUPERELEVATION DIAGRAMS ARE SHOWN IN THE PROFILE AND SUPERELEVATION SHEETS.
3. SLOPE ROUNDING WILL BE REQUIRED ON ALL SIDE SLOPES UNLESS OTHERWISE NOTED.
4. FOR VEGETATION CONTROL, SEE Std DETAILS NSP A77C5, A77C6, A77C7, A77C8, A78C4, AND A78C5.
5. FOR LIMITS OF CONTOUR GRADING, SEE CONTOUR GRADING SHEETS.
6. FOR LOCATIONS OF RETAINING WALLS, SEE LAYOUT SHEETS. NOTE THAT RETAINING WALLS No. 1, 3, AND 6 ARE NO LONGER PROPOSED.
7. FOR LIMITS AND DETAILS OF DRAINAGE DITCHES AND UNDERDRAINS, SEE DRAINAGE PLAN, PROFILES, AND DETAILS SHEETS.
8. FOR MINOR Conc (TEXTURED PAVING) LIMITS, SEE LAYOUT AND CONSTRUCTION DETAILS SHEETS.
9. FOR LIMITS AND TYPES OF DIKE, FENCE, MBGR, DTBB AND Conc Barr, SEE LAYOUT, SUMMARY OF QUANTITIES AND CONSTRUCTION DETAILS SHEETS.
10. FOR ADL LOCATIONS DEPTHS, AND PLACEMENT, SEE CONSTRUCTION DETAILS SHEETS.
11. FOR LIMITS AND DETAILS OF PPPUD, SEE DETAILS A (SHEET X-10) AND DRAINAGE PLAN AND DETAILS SHEETS.
12. FOR APPROXIMATE LIMITS AND LOCATIONS OF ROADWAY EXCAVATION (AMA), SEE LAYOUT SHEETS.
13. FOR SAFETY EDGE DETAILS, SEE CONSTRUCTION DETAILS SHEETS.
14. IN AREAS IDENTIFIED AS ROADWAY EXCAVATION (UNSUITABLE MATERIAL) AND AS DIRECTED BY THE ENGINEER, CONTRACTOR SHALL OVEREXCAVATE A MINIMUM OF 2' (UNLESS OTHERWISE NOTED OR DIRECTED BY THE ENGINEER), PLACE SEG, AND BACKFILL WITH EMBANKMENT MATERIAL. LIMITS AND LOCATIONS OF ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SHALL BE VERIFIED BY THE ENGINEER. FOR ADDITIONAL INFORMATION, SEE GEOTECHNICAL REPORT. STATIONS SHOWN ARE APPROXIMATE; SEE LAYOUT SHEETS FOR ADDITIONAL INFORMATION REGARDING LIMITS AND LOCATIONS.

LEGEND:

ROADWAY EXCAVATION (UNSUITABLE MATERIAL) (SEE NOTE 14)

ABBREVIATIONS:

ADL	AERIALLY DEPOSITED LEAD
Barr	BARRIER
FDHMA	FULL DEPTH HOT MIX ASPHALT
MPH	MILES PER HOUR
PM(3)	PERMABLE MATERIAL CLASS 3
PFR	PAVEMENT FABRIC REINFORCEMENT
RAC	RUBBERIZED ASPHALT CONCRETE
RAC-G	RUBBERIZED AC (GAP GRADED)
RHMA-G	RUBBERIZED HMA (GAP GRADED)
Rem	REMOVE
SEG	SUBGRADE ENHANCEMENT GEOTEXTILE
WMF	WIRE MESH FENCE

PAVEMENT STRUCTURAL SECTIONS:

1: 0.70' HMA (A) / 0.65' LCB / 1.70' AS (Cl 4)

2: 0.65' HMA (A) / 0.70' LCB / 1.55' AS (Cl 4)

3: 0.50' HMA (A) / 0.85' AB (Cl 2) / 0.90' AS (Cl 4)

4: 0.50' HMA (A) / 0.85' AB (Cl 2) / 1.05' AS (Cl 4)

5: 0.30' HMA (A) / 0.55' AB (Cl 2) / 0.75' AS (Cl 4)

6: 0.30' HMA (A) / 0.55' AB (Cl 2) / 0.75' Cl 3 Perm Mtl

7: 0.30' HMA (A) / 0.55' AB (Cl 2) / 0.65' AS (Cl 4)

8: 0.30' HMA (A) / 0.55' AB (Cl 2) / 0.65' Cl 3 Perm Mtl

9: 0.25' HMA (A) / 0.50' AB (Cl 2)

10: 0.20' HMA (A) / 0.50' AB (Cl 2) / 0.50' Cl 3 Perm Mtl

11: 0.55' HMA (A) / 1.90' AB (Cl 2)

12: 0.50' HMA (A) / 0.50' AB (Cl 2)

13: 0.65' HMA (A) / 0.70' LCB / 0.55' AS (Cl 4) / 1.00' Cl 3 Perm Mtl

14: 0.50' HMA (A) / 0.85' AB (Cl 2) / 1.05' Cl 3 Perm Mtl

DESIGN DESIGNATION:

MAINLINE (ROUTE 101)	TI = 13.5	R VALUE = 10*	V_{DESIGN} = 70 MPH
RAMPS	TI = 10	R VALUE = 10*	V_{DESIGN} = 50 MPH
FRONTAGE ROADS	TI = 6.5	R VALUE = 10*	V_{DESIGN} = 40 MPH

*SEE NOTE 13.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — 10/3/11 DATE

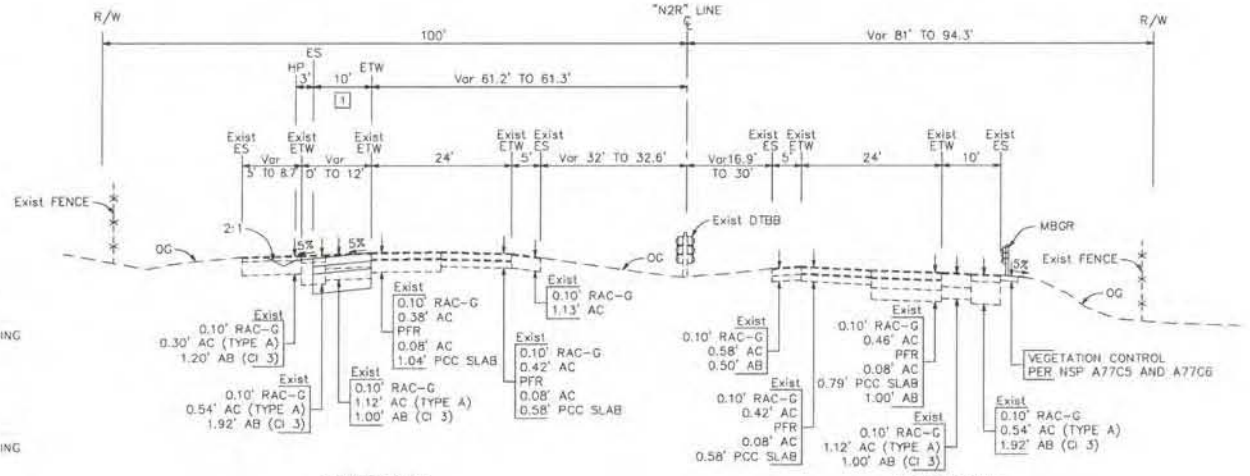
PLANS APPROVAL DATE

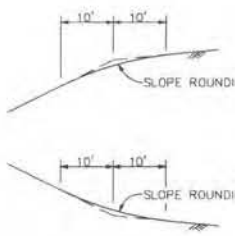
N.V. BERNARDI, No. 45407, Exp. 9/30/12, CIVIL, REGISTERED PROFESSIONAL ENGINEER, STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901





SLOPE ROUNDING DETAIL (TYPICAL)

SOUTHBOUND
"N2R" 273+75.00 TO "N2R" 286+90.00

NORTHBOUND
"N2R" 287+01.50 TO "N2R" 300+76.44

ROUTE 101

TYPICAL CROSS SECTIONS

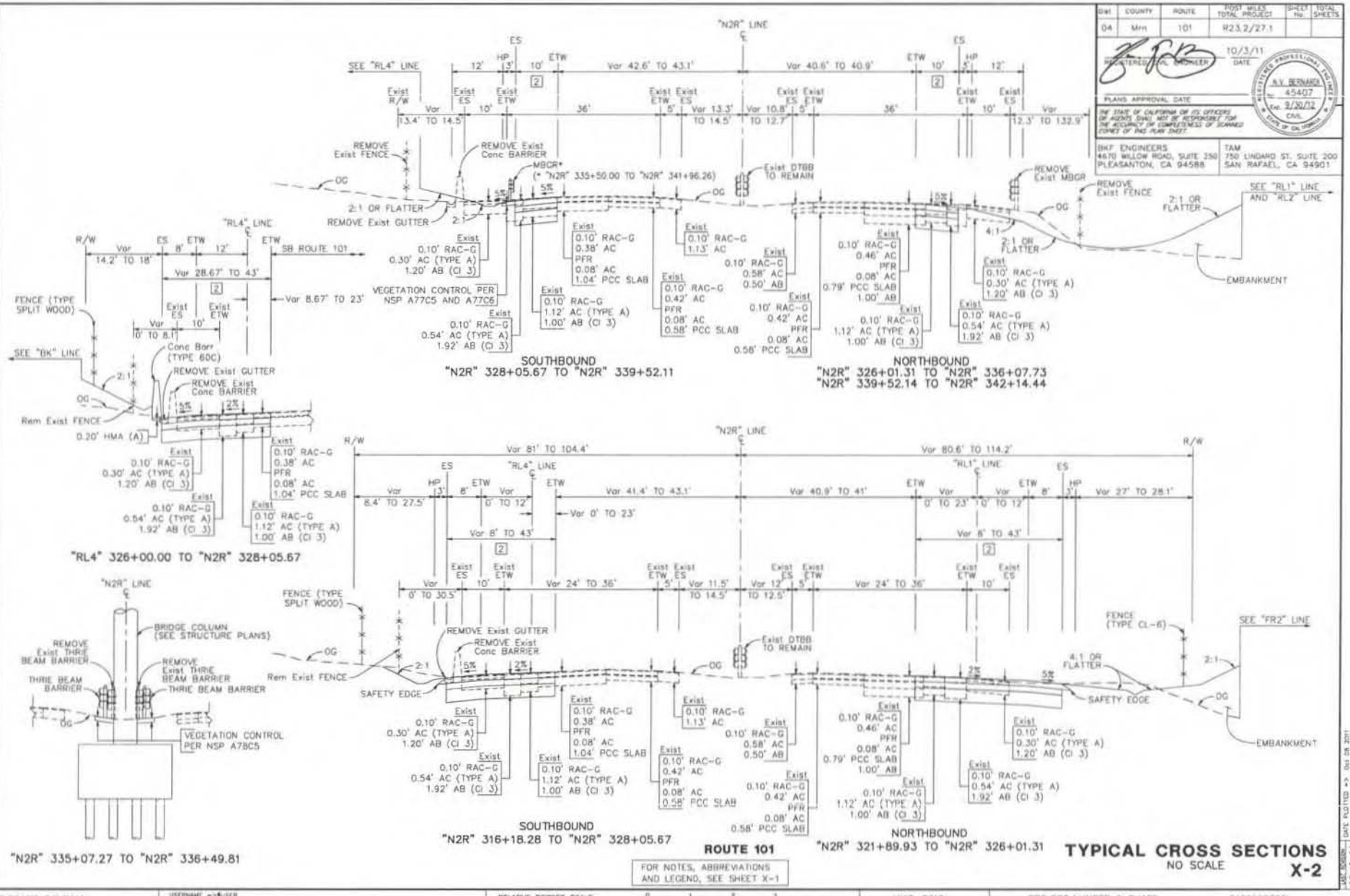
NO SCALE

X-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION | CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI | CALCULATED-DESIGNED BY: INNA ASHUROV | CHECKED BY: GORDON SWEET | REVISED BY: IA | DATE REVISED: 10/3/11

LAST PLOTTED => 04 OCT 2011 10:03:11 | TIME PLOTTED => 3:39 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER DGN FILE => $PREQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

N.V. BERNARD
No. 45407
Exp. 9/30/12
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

TYPICAL CROSS SECTIONS

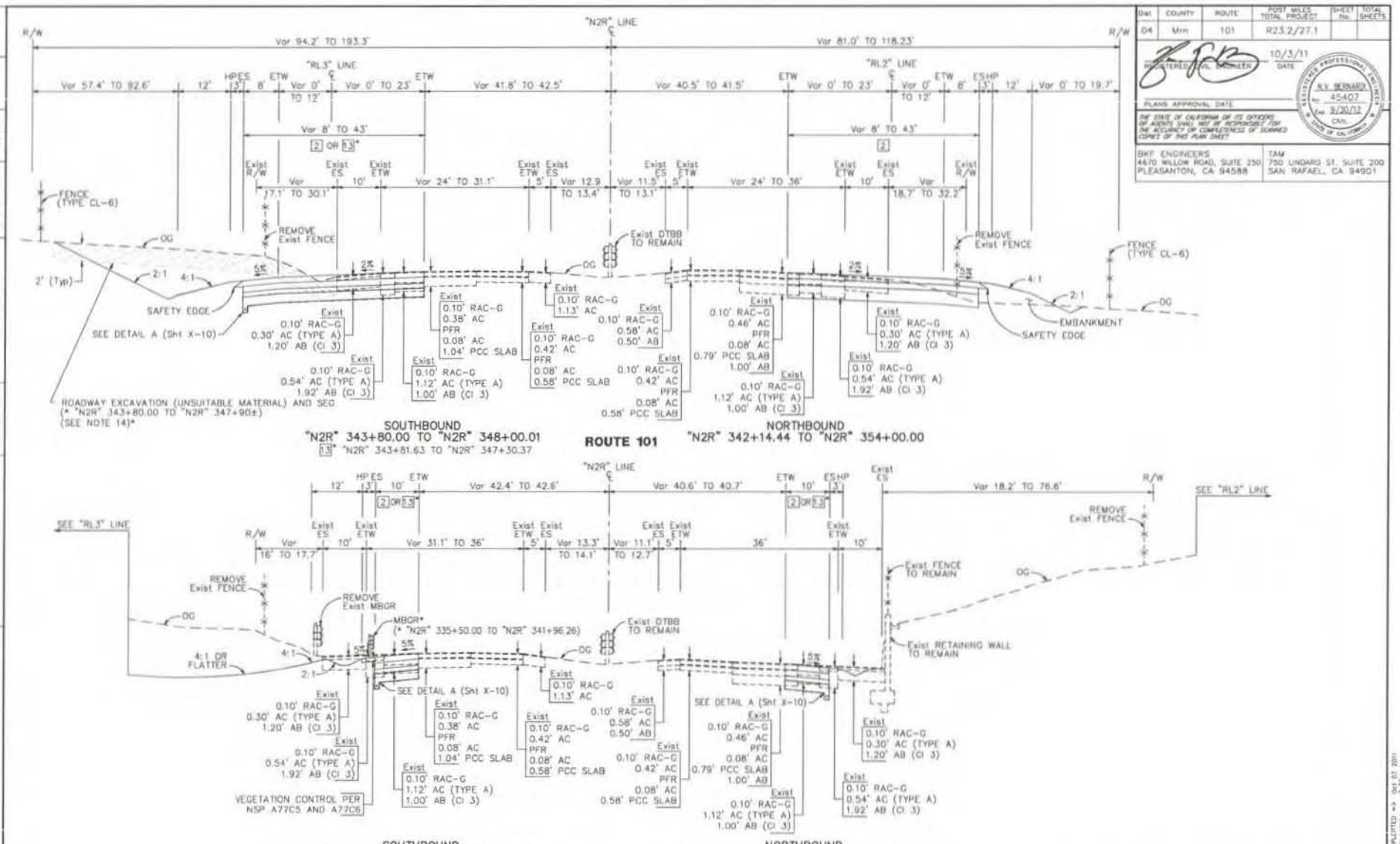
NO SCALE

X-2

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD
CALCULATED-DESIGNED BY
CHECKED BY
DRAWN BY: GORDON SWEET
REVISED BY: INNA ASHUROV
DATE REVISED: 10/3/11

DATE PLOTTED => Oct 28 2011
TIME PLOTTED => 11:38 am

BORDER LAST REVISED 7/2/2010
USERNAME => $USER
DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES
UNIT 0716
PROJECT NUMBER & PHASE 04000007331



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

N.V. BERNARD
No. 45407
Exp. 9/30/12
CIVIL

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD
CALCULATED-DESIGNED BY
CHECKED BY
CORDON SHEET
REVISED BY: INNA ASHUROV
DATE REVISED: 10/3/11

TYPICAL CROSS SECTIONS
NO SCALE

X-3

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:39 pm
10-3-11

BORDER LAST REVISED 7/2/2010
USERNAME => $USER
DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES
UNIT 0716
PROJECT NUMBER & PHASE 0400000731

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — 10/3/11 DATE

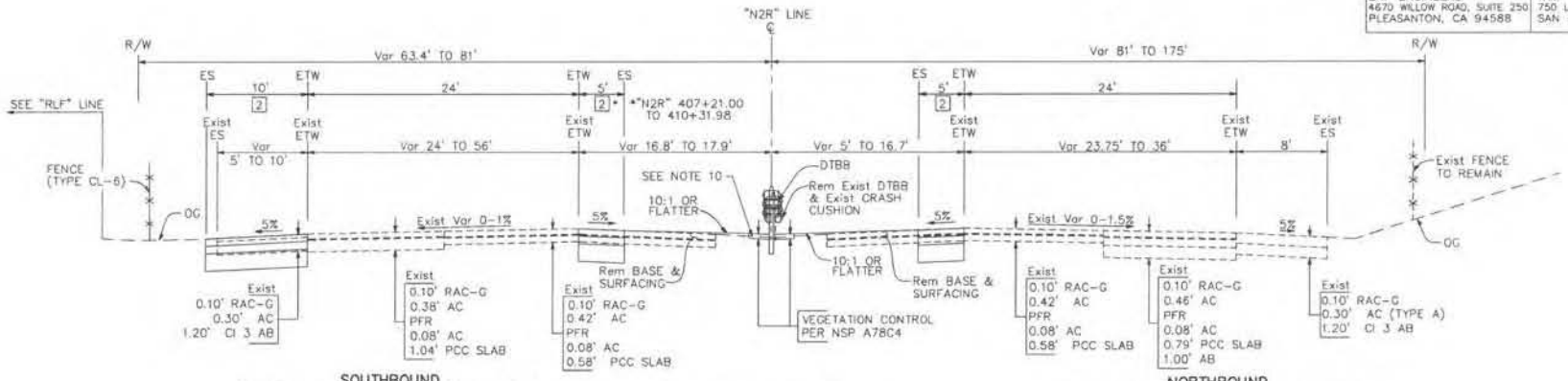
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

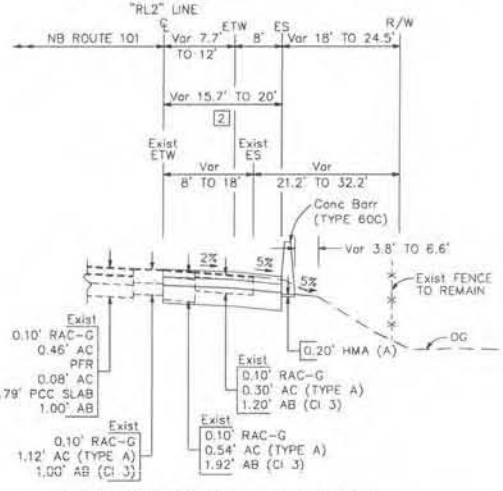
TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



SOUTHBOUND
"N2R" 399+25.00 TO "N2R" 411+50.00

ROUTE 101

NORTHBOUND
"N2R" 403+79.36 TO "N2R" 415+75.00



"N2R" 346+74.99 TO "N2R" 350+24.98

TYPICAL CROSS SECTIONS

NO SCALE

X-4

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

CALCULATED-DESIGNED BY: INNA ASHUROV

CHECKED BY: GORDON SWEET

REVISED BY: IA

DATE REVISED: 10/3/11

BORDER LAST REVISED 7/2/2010

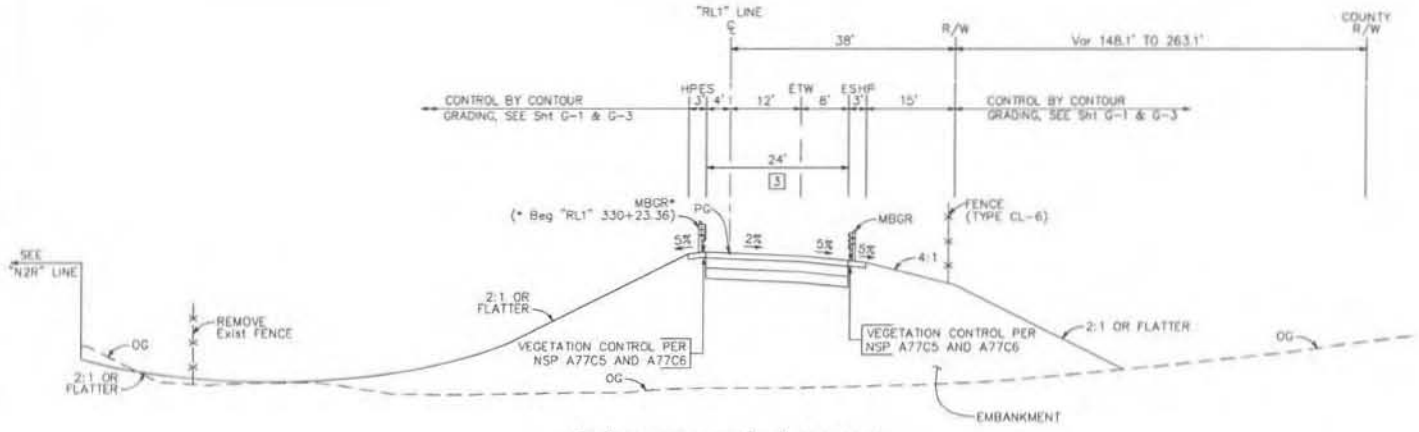
USERNAME =>$USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

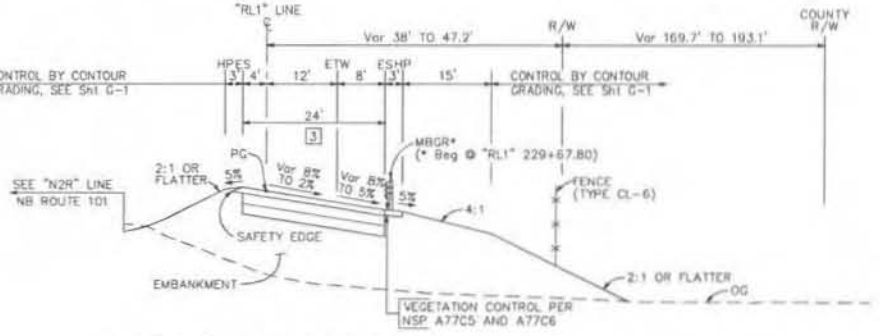
UNIT 0716

PROJECT NUMBER & PHASE 0400000733

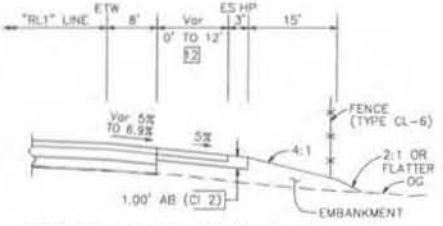
DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:39 pm



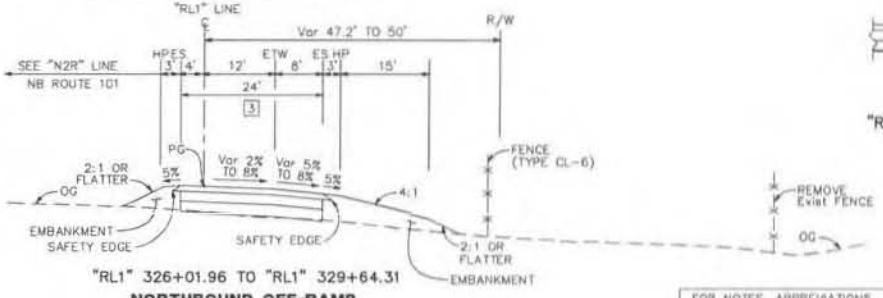
"RL1" 330+76.81 TO "RL1" 334+68.42



"RL1" 329+64.31 TO "RL1" 330+76.81



"RL1" 328+14.37 TO "RL1" 329+00.00



"RL1" 326+01.96 TO "RL1" 329+64.31

NORTHBOUND OFF-RAMP

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

N.V. BERNARD No. 45407 Exp. 9/30/12 CIVIL STATE OF CALIFORNIA

BKF ENGINEERS
#670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

TYPICAL CROSS SECTIONS

NO SCALE

X-5

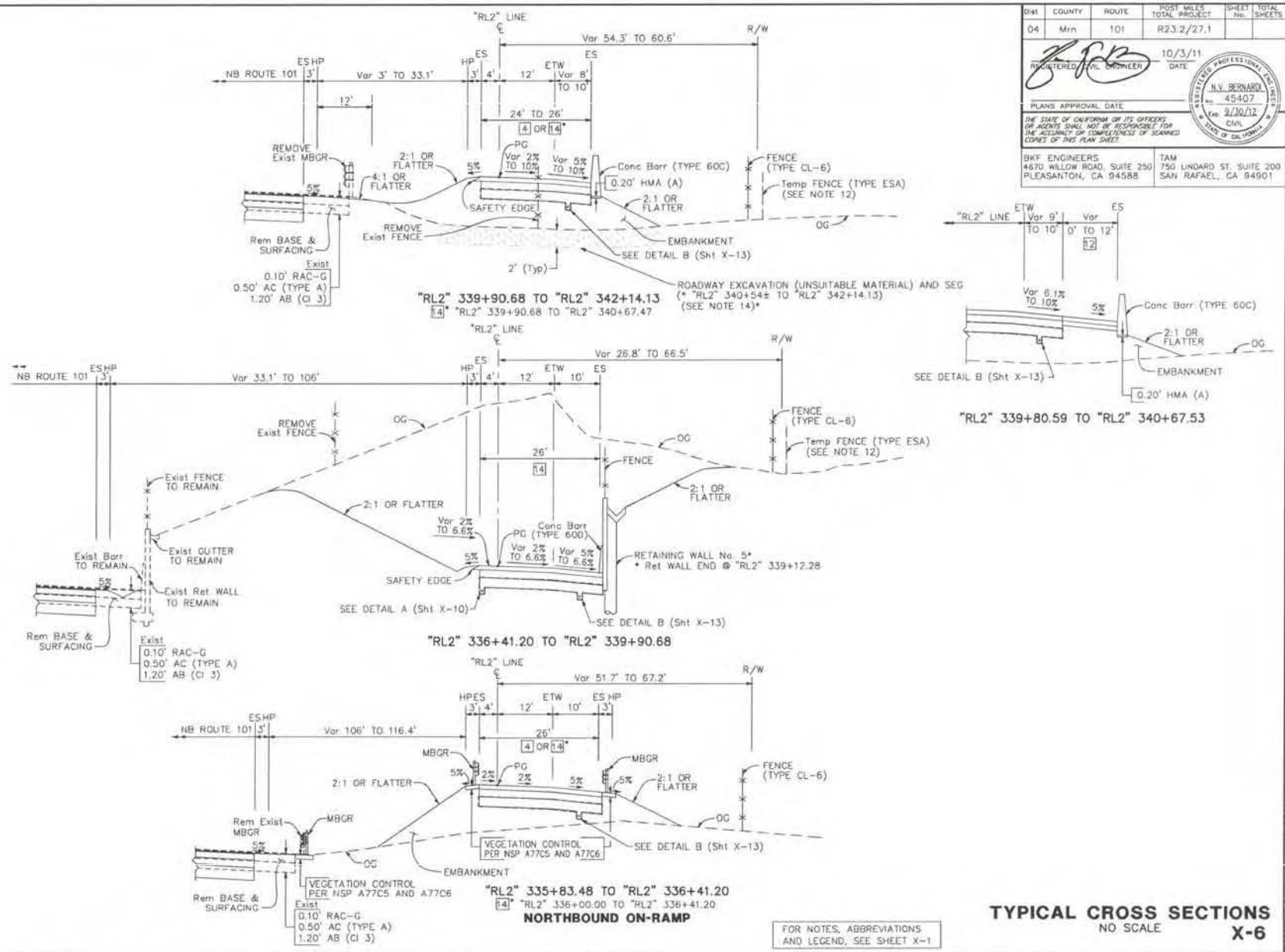
FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD
CALCULATED-DESIGNED BY: IVA
CHECKED BY: GORDON SWEET
REVISED BY: IVA
DATE REVISED: 10/3/11

BORDER LAST REVISED 7/2/2010 | USERNAME => \$USER | DGN FILE => \$REQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 0400000733 |

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:39 pm



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — 10/3/11 DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED
IA	10/3/11

CALCULATED-DESIGNED BY: HNA ASHUROV
CHECKED BY: GORDON SWEET

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

TYPICAL CROSS SECTIONS

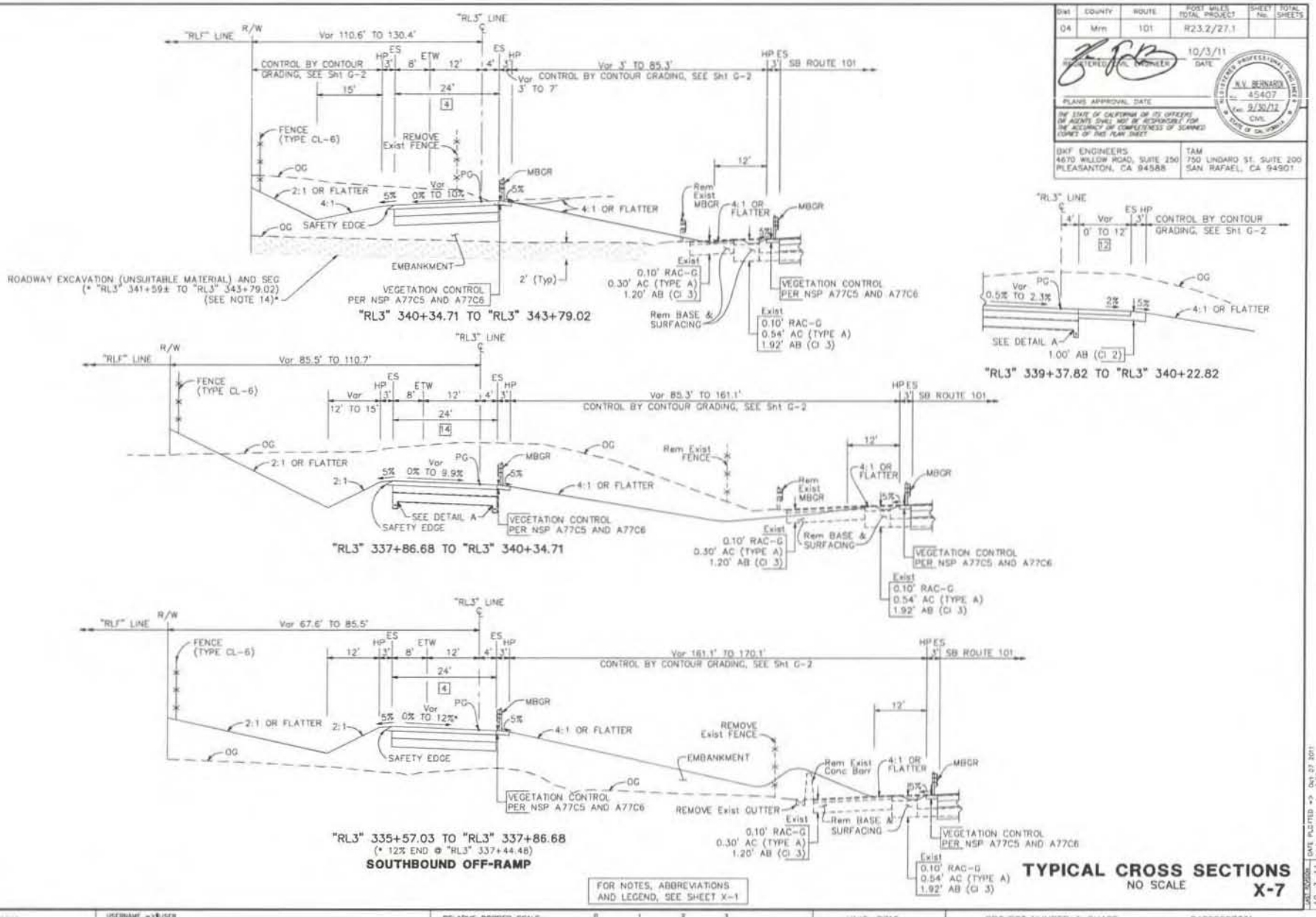
NO SCALE

X-6

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

LAST REVISION — DATE PLOTTED => Oct 07 2011 — TIME PLOTTED => 3:38 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

N.V. BERNARD No. 45407 Exp. 9/30/12 CIVIL

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

TYPICAL CROSS SECTIONS

NO SCALE

X-7

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARD

CALCULATED-DESIGNED BY: INNA KSHVOV

CHECKED BY: GORDON SWEET

REVISED BY: IA

DATE REVISED: 10/3/11

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:39 pm

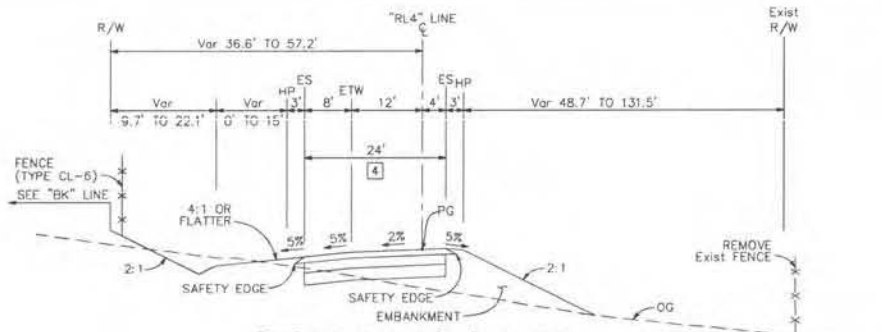
BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $REQUEST

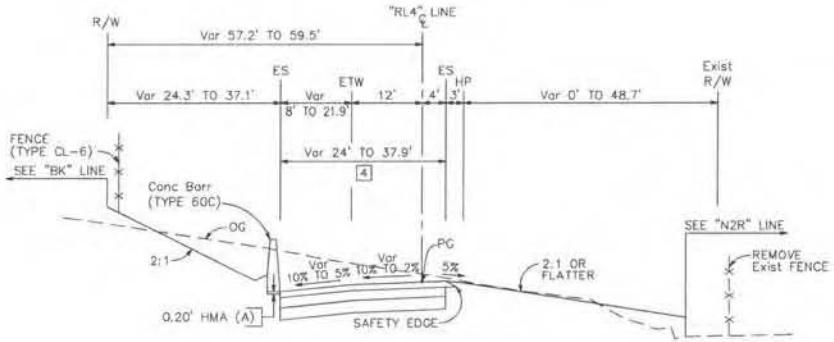
RELATIVE BORDER SCALE IS IN INCHES

UNIT 0716

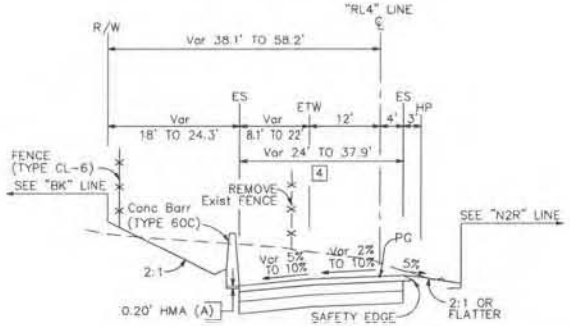
PROJECT NUMBER & PHASE 0400000731



"RL4" 332+00.00 TO "RL4" 334+90.52

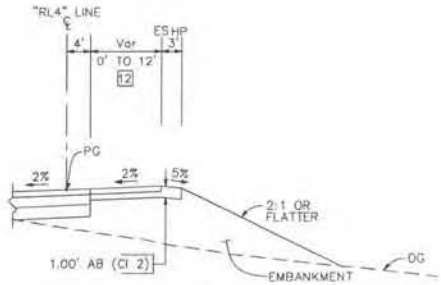


"RL4" 330+20.80 TO "RL4" 332+00.00



"RL4" 328+05.98 TO "RL4" 330+20.80

SOUTHBOUND ON-RAMP



"RL4" 333+90.00 TO "RL4" 334+75.00

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED
IA	10/3/11

INNA ASHUROV — CALCULATED-DESIGNED BY
GORDON SWEET — CHECKED BY
NATALINA V. BERNARDI — CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

TYPICAL CROSS SECTIONS

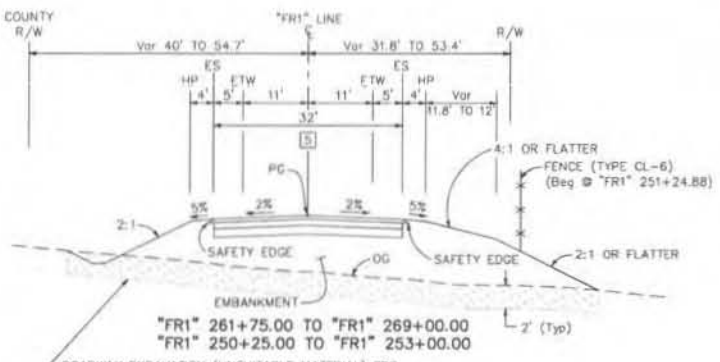
NO SCALE

X-8

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

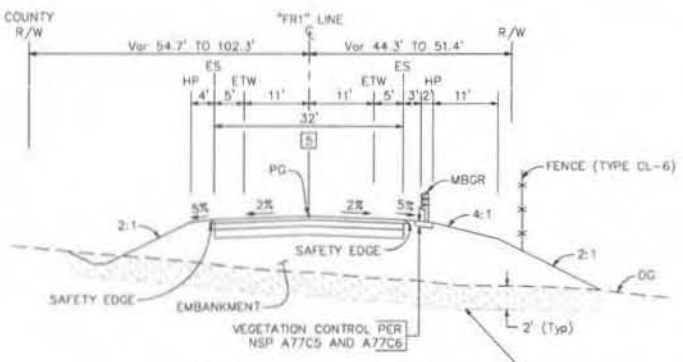
DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:40 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 0400000731



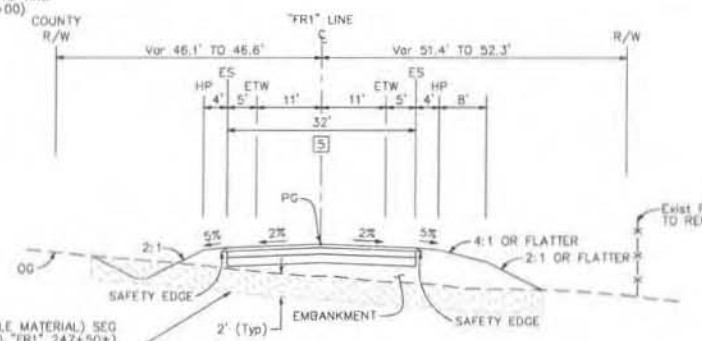
"FR1" 261+75.00 TO "FR1" 269+00.00
"FR1" 250+25.00 TO "FR1" 253+00.00

ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SEG
(* "FR1" 251+19± TO 253+00,
"FR1" 261+75 TO "FR1" 266+91± AND
"FR1" 267+74± TO "FR1" 269+00)
(SEE NOTE 14)*



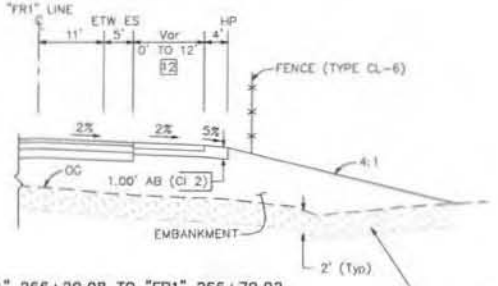
"FR1" 253+00.00 TO "FR1" 256+00.00

ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SEG
(* "FR1" 253+00 TO 256+00)
(SEE NOTE 14)*



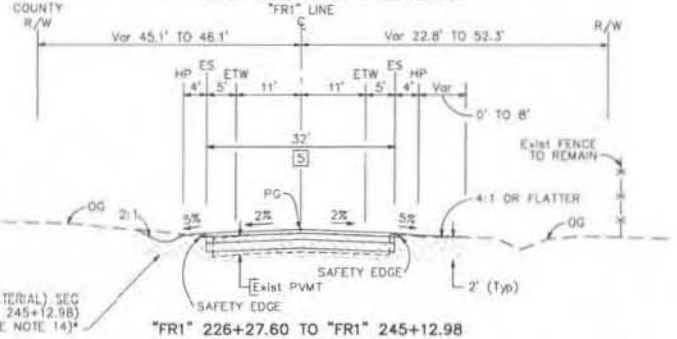
ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SEG
(* "FR1" 245+12.98 TO "FR1" 247+50±)
(SEE NOTE 14)*

"FR1" 245+12.98 TO "FR1" 250+25.00



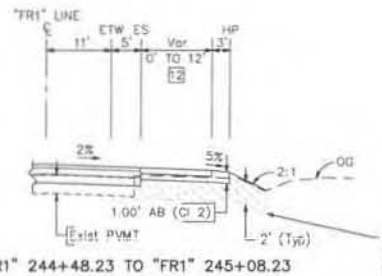
"FR1" 266+20.08 TO "FR1" 266+79.92

ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SEG
(* "FR1" 266+20.08 TO 266+73.92)
(SEE NOTE 14)*



ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SEG
(* "FR1" 242+50± TO "FR1" 245+12.98)
(SEE NOTE 14)*

"FR1" 226+27.60 TO "FR1" 245+12.98
FRONTAGE ROAD



"FR1" 244+48.23 TO "FR1" 245+08.23

ROADWAY EXCAVATION (UNSUITABLE MATERIAL) SEG
(* "FR1" 244+48.23 TO 245+08.23)
(SEE NOTE 14)*

FOR NOTES, ABBREVIATIONS
AND LEGEND, SEE SHEET X-1

TYPICAL CROSS SECTIONS

NO SCALE

X-9

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

N.V. BERNARDI
No. 45407
Exp. 9/30/12
CIVIL
STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

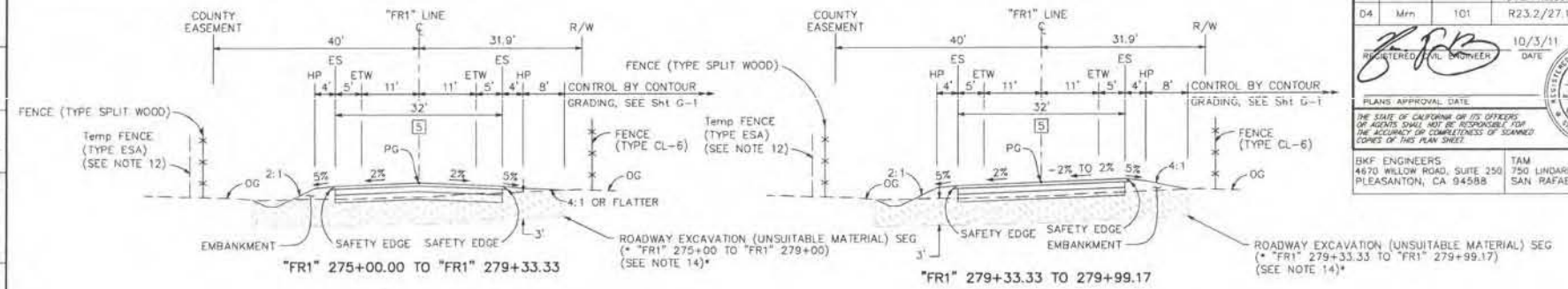
TAM
750 LINDARD ST. SUITE 200
SAN RAFAEL, CA 94901

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI
CALCULATED-DESIGNED BY: INNA ASHUROV
CHECKED BY: GORDON SWEET
REVISED BY: IA
DATE REVISED: 10/3/11

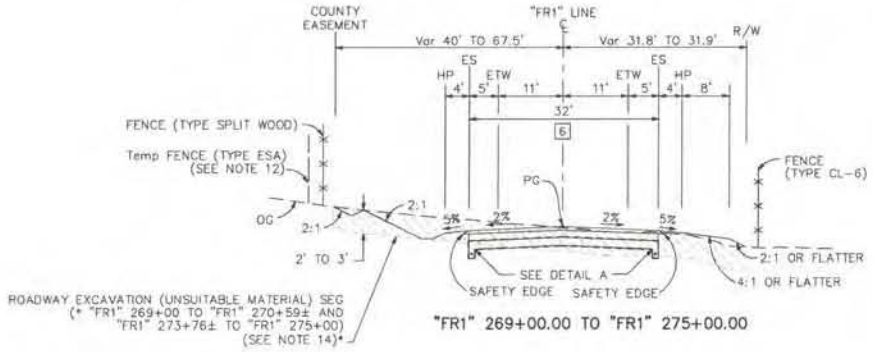
DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:40 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $PROJECTS | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0715 | PROJECT NUMBER & PHASE 04000007331

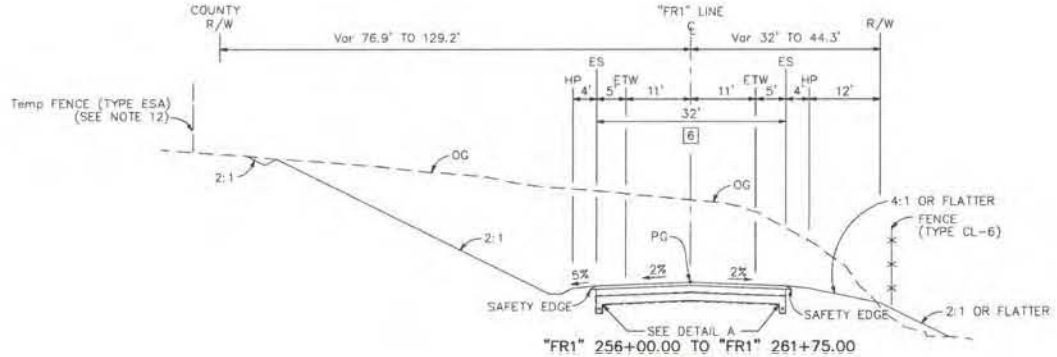


"FR1" 275+00.00 TO "FR1" 279+33.33

"FR1" 279+33.33 TO 279+99.17

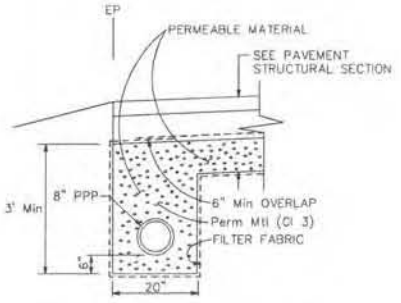


"FR1" 269+00.00 TO "FR1" 275+00.00



"FR1" 256+00.00 TO "FR1" 261+75.00

FRONTAGE ROAD



DETAIL A

TYPICAL PAVEMENT STRUCTURAL SECTION UNDERDRAIN

"FR1" 256+00.00 TO "FR1" 261+75.00 (LEFT)
"FR1" 256+00.00 TO "FR1" 261+75.00 (RIGHT)
"FR1" 269+04.59 TO "FR1" 278+86.25 (LEFT)
"FR1" 269+00.00 TO "FR1" 279+00.00 (RIGHT)
"BK 325+60.83 TO "BK" 333+93.35 (LEFT)
"BK 332+12.85 TO "BK" 333+80.00 (RIGHT)
"RL2" 336+38.68 TO "RL2" 339+42.75
"RL3" 337+86.00 TO "RL3" 340+34.00 (LEFT)
"RL3" 337+86.00 TO "RL3" 340+34.00 (RIGHT)
"RLF" 342+77.96 TO "RLF" 347+50.00 (RIGHT)
"RLF" 357+00.00 TO "RLF" 358+49.22 (LEFT)
"RLF" 357+00.00 TO "RLF" 361+20.00 (RIGHT)
"RLF" 409+34.26 TO "RLF" 419+00.00
"N2R" 339+50.00 TO "N2R" 342+75.09 (LEFT)
"N2R" 336+00.00 TO "N2R" 340+65.36 (RIGHT)
"N2R" 343+81.63 TO "N2R" 347+30.37

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

TYPICAL CROSS SECTIONS

NO SCALE

X-10

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — 10/3/11 DATE

PLANS APPROVAL DATE

N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

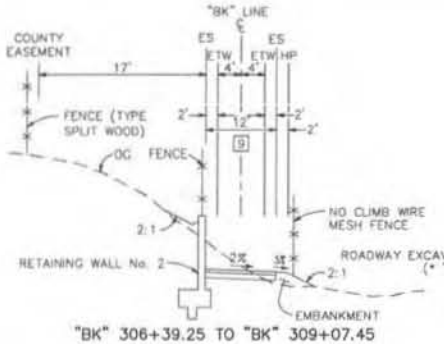
TAM
750 LINDARD ST. SUITE 200
SAN RAFAEL, CA 94901

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION — Caltrans

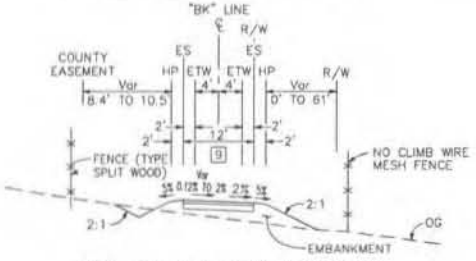
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI
CALCULATED-DESIGNED BY: INNA ASHUROV
CHECKED BY: GORDON SWEET
REVISED BY: IA
DATE REVISED: 10/3/11

DATE PLOTTED => Oct. 07, 2011
TIME PLOTTED => 3:40 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 0400000731

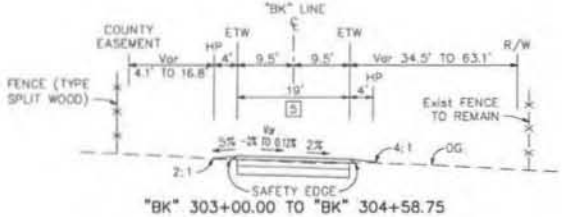


"BK" 306+39.25 TO "BK" 309+07.45

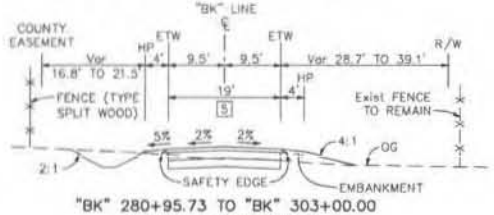


"BK" 304+58.75 TO "BK" 306+39.25

CLASS I
BIKE PATH

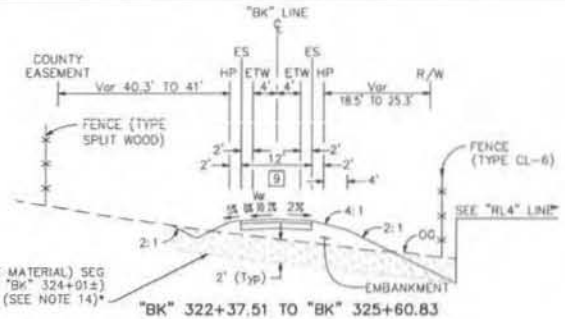


"BK" 303+00.00 TO "BK" 304+58.75

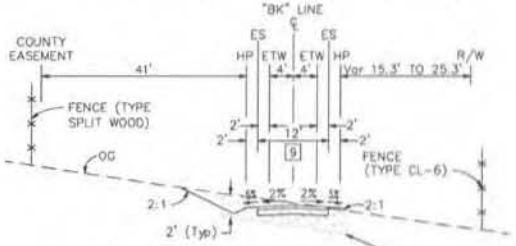


"BK" 280+95.73 TO "BK" 303+00.00

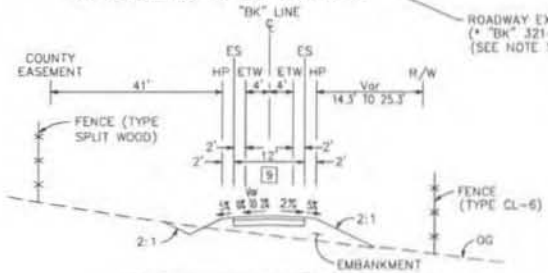
PRIVATE DRIVEWAY
ACCESS / MAINTENANCE ROAD



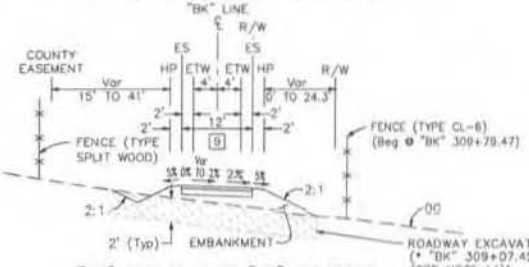
"BK" 322+37.51 TO "BK" 325+60.83



"BK" 319+43.42 TO "BK" 322+37.51

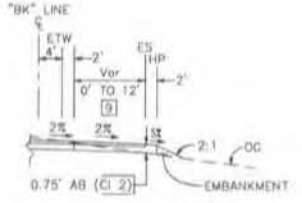


"BK" 312+03.00 TO "BK" 319+43.42

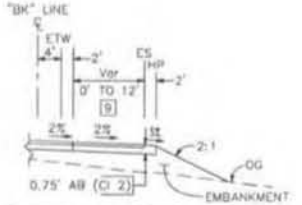


"BK" 309+07.45 TO "BK" 312+03.00

CLASS I
BIKE PATH



"BK" 320+30.90 TO "BK" 320+90.78



"BK" 312+75.86 TO "BK" 313+35.74

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — 10/3/11 DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION — Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI
CALCULATED-DESIGNED BY: IVA
CHECKED BY: IVANA ASHUROV
REVISED BY: CORDON SHEET
DATE REVISED: 10/3/11

TYPICAL CROSS SECTIONS

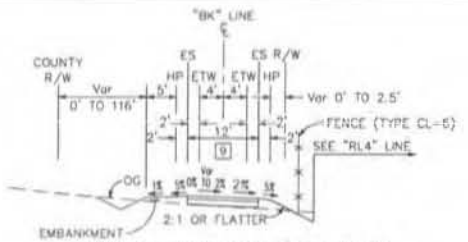
NO SCALE

X-11

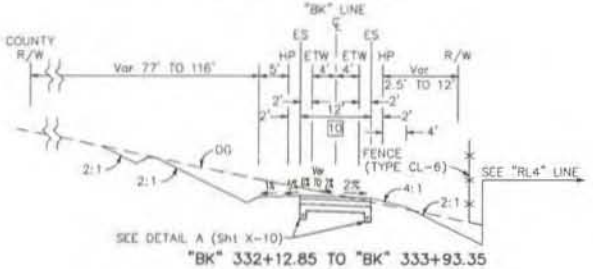
FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:42 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => \$USER | DGN FILE => \$REQUEST | RELATIVE BORDER SCALE IS IN INCHES (0 1 2 3) | UNIT 0716 | PROJECT NUMBER & PHASE 0400000733I



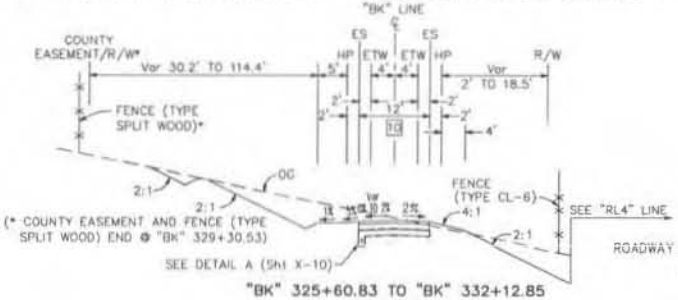
"BK" 333+93.35 TO "BK" 334+35.80



"BK" 332+12.85 TO "BK" 333+93.35

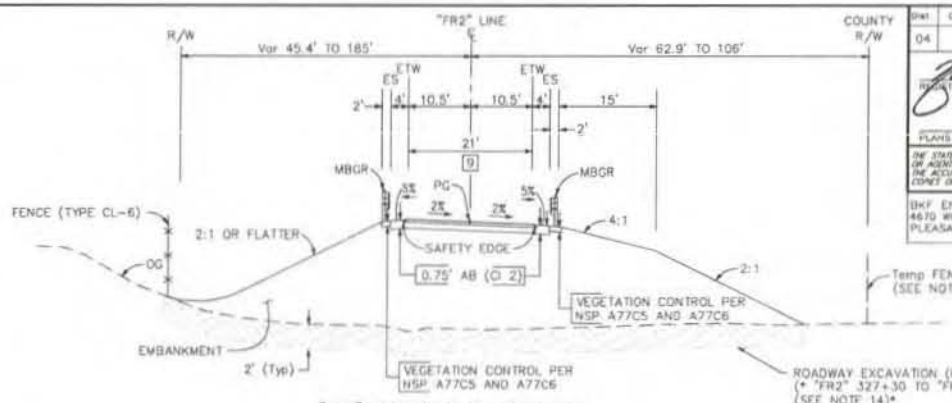
"BK" 330+30.13 TO "BK" 330+90.13

"BK" 325+31.74 TO "BK" 331+14.88

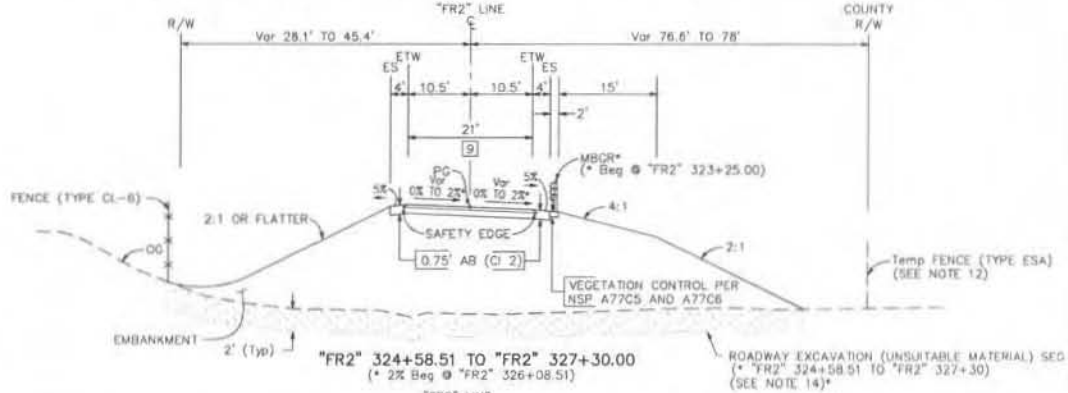


"BK" 325+60.83 TO "BK" 332+12.85

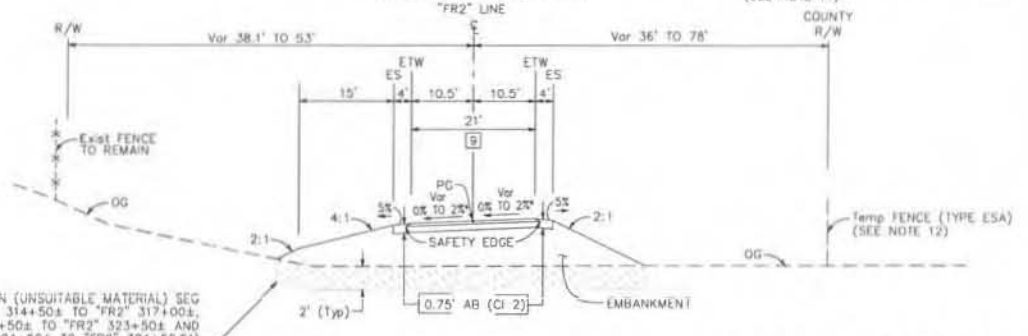
CLASS I BIKE PATH



"FR2" 327+30.00 TO 329+54.60



"FR2" 324+58.51 TO "FR2" 327+30.00
(* 2% Beg @ "FR2" 326+08.51)



"FR2" 301+12.98 TO "FR2" 324+58.51
(* 2% END @ "FR2" 323+08.51)

FRONTAGE ROAD

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N. V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS 4670 WILLOW ROAD, SUITE 250 PLEASANTON, CA 94588	TAM 750 LINDARO ST. SUITE 200 SAN RAFAEL, CA 94901

DATE	REVISED BY	DATE REVISED
	IA	10/3/11

CALCULATED-DESIGNED BY
CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

INNA ASHUROV
GORDON SWEET

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION
Caltrans

TYPICAL CROSS SECTIONS

NO SCALE

X-12

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:40 pm

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES | UNIT 0716 | PROJECT NUMBER & PHASE 0400000733I

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

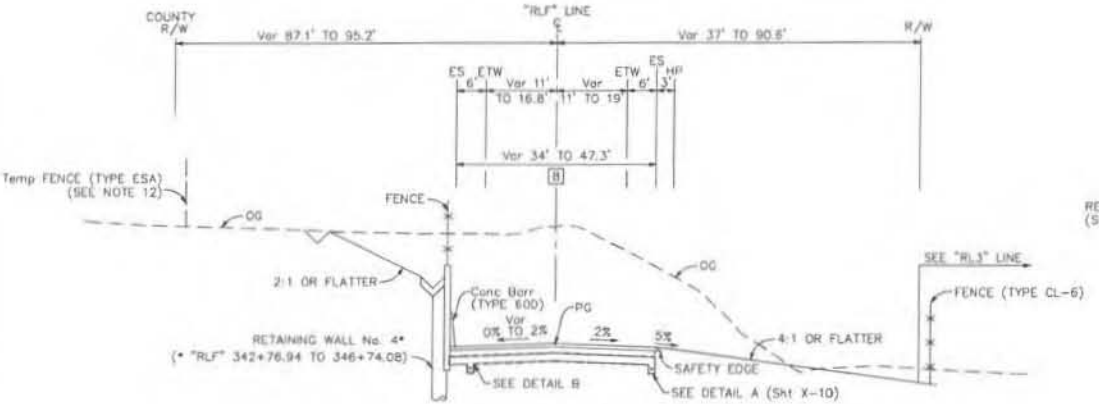
TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED
IA	10/3/11

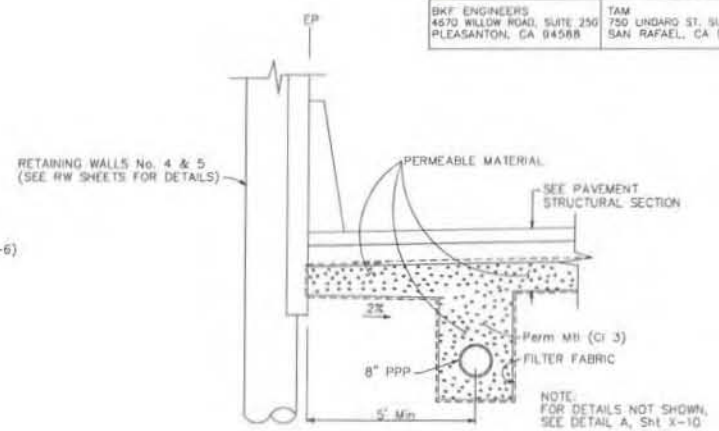
CALCULATED-DESIGNED BY: INNA ASHUROV
CHECKED BY: GORDON SWEET

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

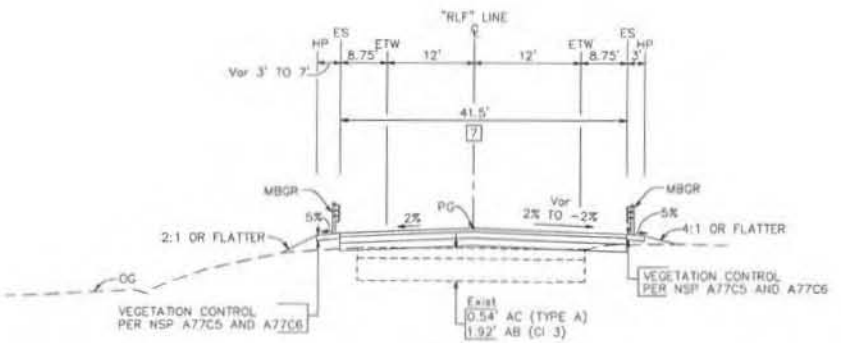
STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans



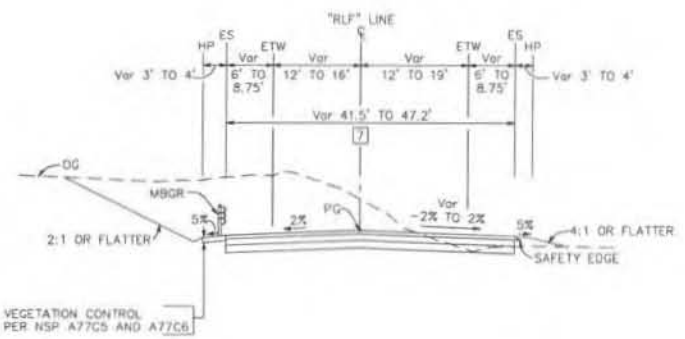
"RLF" 342+48.31 TO "RLF" 347+50.00



DETAIL B
TYPICAL PAVEMENT STRUCTURAL SECTION UNDERDRAIN
"RL2" 336+00.00 TO "RL2" 340+67.47 (RIGHT)
"RLF" 342+48.69 TO "RLF" 347+50.00 (LEFT)



"RLF" 340+74.89 TO "RLF" 341+79.85



"RLF" 341+79.85 TO "RLF" 342+76.94

FRONTAGE ROAD

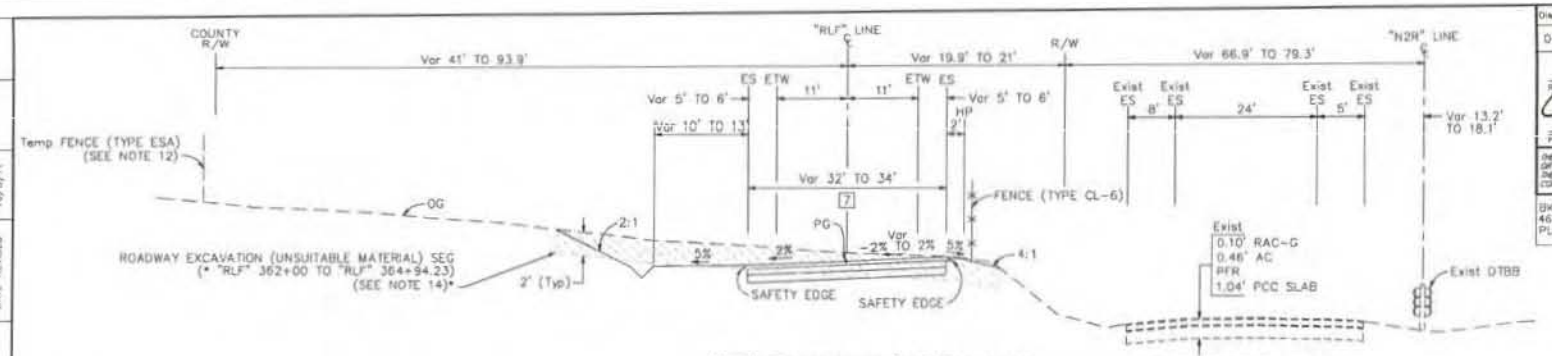
FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

TYPICAL CROSS SECTIONS
NO SCALE

X-13

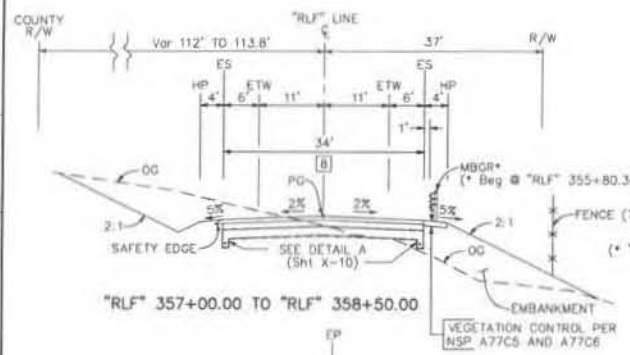
DATE PLOTTED => 04 JUL 2011
TIME PLOTTED => 3:40 pm

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 0400000753I

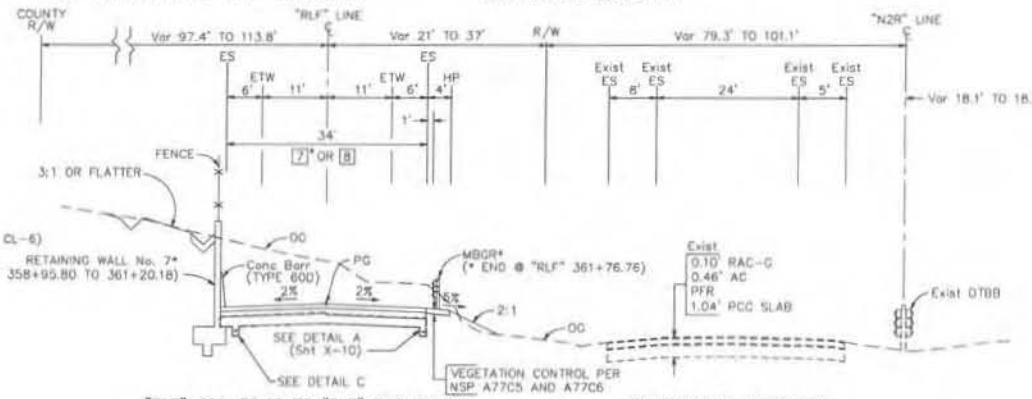


"RLF" 362+00.00 TO "RLF" 364+94.23

SOUTHBOUND ROUTE 101



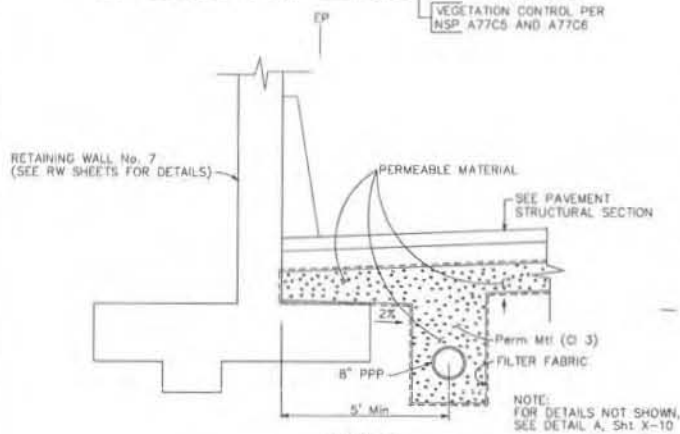
"RLF" 357+00.00 TO "RLF" 358+50.00



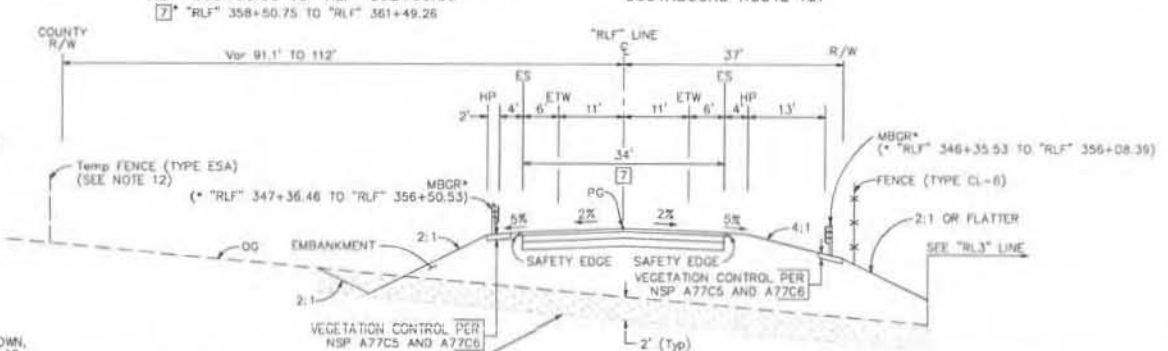
"RLF" 358+50.00 TO "RLF" 362+00.00

7* "RLF" 358+50.75 TO "RLF" 361+49.26

SOUTHBOUND ROUTE 101



DETAIL C
TYPICAL PAVEMENT STRUCTURAL SECTION UNDERDRAIN
"RLF" 358+50.75 TO "RLF" 361+49.26 (LEFT)



"RLF" 347+50.00 TO "RLF" 357+00.00

FRONTAGE ROAD

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET X-1

TYPICAL CROSS SECTIONS

NO SCALE

X-14

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED
IA	10/3/11

CALCULATED-DESIGNED BY: INNA ASHUROV
CHECKED BY: GORDON SWEET

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

BORDER LAST REVISED 7/2/2010

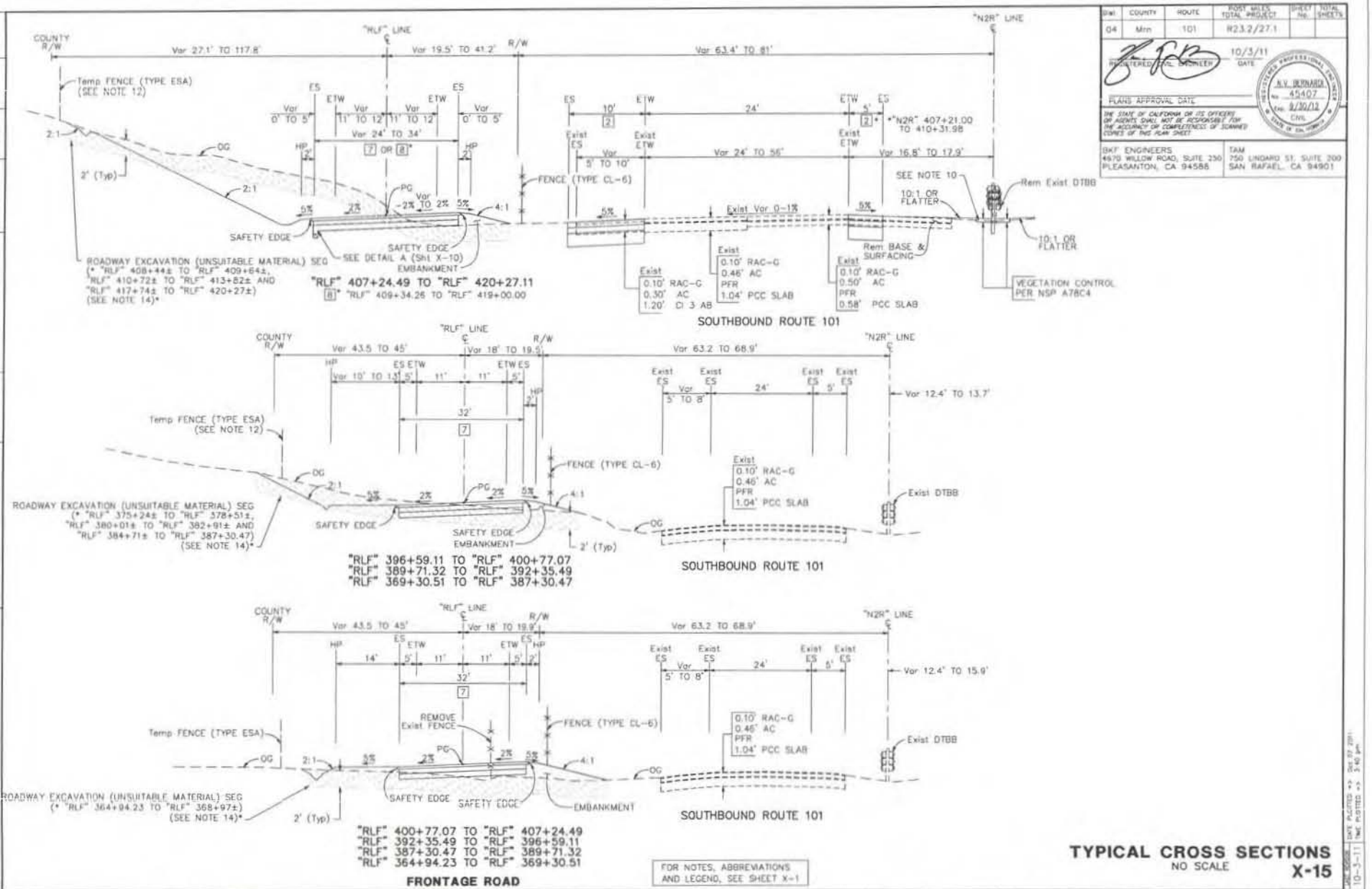
USERNAME => $USER
DGN FILE => $PROJECT

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 0400000733

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 3:42 pm



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED
IA	10/3/11

CALCULATED-DESIGNED BY: INNA ASHUROV
CHECKED BY: GORDON SWEET

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

TYPICAL CROSS SECTIONS

NO SCALE

X-15

DATE PLOTTED => Oct 03, 2011
TIME PLOTTED => 3:40 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 0400000733I

APPENDIX G

Marin/Sonoma Narrows – Segment B1
Redwood Landfill Interchange Project (EA 04-264071)

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotech Design	**Date Responded:**	9/30/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825		
Date Reviewed:	9/19/2011 and 9/22/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: 100% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		We disagree that Caltrans advised to compute consolidation settlement using elastic compression theory. Citing Caltrans' employee by name to justify the use of analytical method that the Consultant was advocating is not appropriate. Based on standard practice, the analytical method for settlement evaluation shall be consistent with the subsurface settlement characteristics determined by the Consultant. Consultant has been emphasizing that the clayey material underlying the entire site is dry, stiff to very stiff, and there is no consolidation potential due to the new embankment loading. They argued that the settlement is immediate. There was not sufficient consolidation data--only one sample was tested. This is not appropriate.	No comments. See below for mitigation program proposed.	G	G	G
1	#12 (From Previous JRT)	As a measure to minimize the impact of the unanticipated settlements and to determine actual embankment settlement period, we have suggested monitoring the ground and embankment settlement by survey hubs and fluid type settlement plates. The settlement plates are to be installed below the bottom of the fill to check the settlement of the ground. The survey hubs are to be installed on top of the embankment where it is not impacted by construction traffic. Consultant has agreed and we have provided sample specifications at their request. However, this monitoring is not clearly addressed in the current GDR. Monitoring locations and basic requirements need to be shown on the Plans and Specifications as well. ***Original Comment #12:*** *This waiting period is not justified for design purposes. Need to address long term settlement, not just constructability.*	Proposed Monitoring Program has been discussed in pages 45 and 46 of the GDMR. The proposed monitoring locations are presented in a table on page 45. Monitoring locations and the performance of the monitoring program are also presented and discussed in the plans and specifications for the project.	G	G	G

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotech Design	**Date Responded:**	9/30/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825		
Date Reviewed:	9/19/2011 and 9/22/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: 100% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Previous Response to #12: *A general consensus was established that the compressible soils under the embankment fills were very stiff unsaturated clays above water table. The settlements would therefore be rapid with the placement of fill and assumption of the classical consolidation process (settlement due to expulsion of pore water from a saturated soil) was unrealistic for the present situation . Caltrans (Mahmood) advised that this point be strongly made in the text. He further advised that settlements under the fills be computed using elastic settlement procedures.*				
2	#13 (from previous JRT)	We stand by our original comment. ***Original Comment #13:*** *Settlement magnitudes and mitigation measures should be specified* ***NOW, before contract bidding.*** *You cannot rely upon settlement monitoring during construction for this. Monitoring during construction is for confirmation only.* *Settlement magnitudes for each area need more justification.* *Information for fill placement is not needed for consolidation period determination. Use conservation assumption. Or specify fill placement rate and procedure.* ***Previous Response to #13:*** *In the revised version of the GDMR, settlements will be based on elastic settlement procedures and not consolidation (see response to*	The GDMR has clarified that the settlements are considered immediate (elastic) settlements. Estimates of settlement have been provided in page 44 of the GDMR dated August 26, 2011 for each of the seven fill areas using this approach. Supporting calculations were provided in Appendix C.	G	G	G

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotech Design	**Date Responded:**	9/30/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825		
Date Reviewed:	9/19/2011 and 9/22/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: 100% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Item 12). Monitoring during construction is not for confirmation only but is a process to assure all settlement has already occurred.				
3	#19 (from previous JRT)	We do not concur. Cut/fill limits shall be part of PS&E.	The cut fill limits were developed by BKF and are shown in the Layout Sheets of the PS&E. This data was provided to Parikh for incorporation into their GDMR dated August 26, 2011. We have complied with your request precisely. This comment is closed.	G	G	G
4	#23 (from previous JRT)	See Item 12 and 13 above. ***Original Comment #13:*** *Response not acceptable. GDR Appendix C: How is the consolidation data for only **one sample** in 1 location applicable to all 7 locations? Furthermore, actual results should be used for calculations. The reasons for modification not accepted. The assumptions used are unjustified.* ***Previous Response to #13:*** *Per the present consensus, consolidation settlements are unrealistic and elastic settlements will be calculated. See Item No. 12.* The consolidation test sample was from a location with the highest fill and the thickest compressible layer. The test results indicated the compression and recompression indices to be reasonable, albeit somewhat conservative (high) based on geotechnical literature (e.g.	See responses to Item Nos. 1 and 2 (original Item Nos. 12 and 13) above. In our professional opinion, settlement estimates should be based on elastic properties of the soil. See calculations in Appendix C of the GDMR dated August 26, 2011that justifies these estimates.	G	G	G

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotech Design	**Date Responded:**	9/30/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825		
Date Reviewed:	9/19/2011 and 9/22/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: 100% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Lambe and Whitman, 1969). The same concept was applied to all locations with site-specific information for each location (see Item No. 13). The calculations at each fill location uses water contents and strengths (based on blow counts) to compute the preconsolidation pressures for the alternative estimate, which yielded somewhat lower values of settlement as a sanity check.				
5	#24 (from previous JRT)	See Item 12 and 13 above. ***Original Comment #24:*** See (Previous JRT) Item 15. Comment from Previous #15 – "Still not clear." ***Previous Response to #24:*** See response in (Previous JRT) Item no. 13. Response from Previous JRT #13 - *In the revised version of the GDMR, settlements will be based on elastic settlement procedures and not consolidation (see response to Item 12). Monitoring during construction is not for confirmation only but is a process to assure all settlement has already occurred.*	See responses to Item Nos. 1 and 2 (original Item Nos. 12 and 13) above.	G	G	G
6	#27 (from previous JRT)	Differential settlement must be addressed in NMWD and GDR. We stand by our original comment.	Our discussion on Page 44 of the GDMR dated August 26, 2011 clarifies this issue. If, based on proper performance of the proposed monitoring program, the impacts due to the total settlements are mitigated, differential settlements will	G	G	G

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotech Design	**Date Responded:**	9/30/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825		
Date Reviewed:	9/19/2011 and 9/22/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: 100% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			not be an issue.			
7	#29 (from previous JRT)	The GDR only contain layout sheets with shaded areas for the overexcavation. Stations and offsets should be specified.	Stations and offsets for the areas for overexcavation are provided in the X sheets in Appendix F of the GDMR dated August 26, 2011.	G	G	G
		Additional Comments (Survey Monuments and Settlement Platforms)(9/22/11)				
30		We were asked to review the proposed locations for the survey monuments and settlement platforms (Pg 45, GDR dated 8/26/11). Here are our comments:		G	G	G
31	1	For all the fill areas listed in Table 3 (pg 40), only Areas 1 and 2 have proposed survey monuments and settle. platforms under the location of maximum fill. The rest do not have monitoring devices under the thickness locations.	Per the table on Page 44 of the GDMR dated August 26, 2011, four fill areas (Areas 1, 2, 5 and 6) were designated for monitoring using survey monuments on top of the embankments. In addition, based on the thickness and characteristics of the underlying native soils, areas 1, 2 and 5 have settlement platforms below the embankments at the maximum fill thickness locations. A 60-day monitoring period is recommended for these three locations. Fill areas 3, 4 and 7 have thinner "compressible layers" and/or relatively small fill thickness. Total estimated settlements for these 3 areas are in the order of one inch, therefore, no special monitoring was	A	A	A

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotech Design	**Date Responded:**	9/30/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825		
Date Reviewed:	9/19/2011 and 9/22/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: 100% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			planned. However, a 30-day waiting period was proposed for these locations in the GDMR. In the revised GDMR, we are recommending monitoring using survey monuments in Fill Areas 3, 4 and 7 also to confirm. The revised table can be found on page 45 of the GDMR.			
32	2	Fill Areas 6 & 7 do not have settlement platforms proposed at all. Please explain.	See response to Item No. 31 above.	A	A	A

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Plans – 6/30/11				
1	General	GDR talks about sub-excavation. Excavation limits (lateral limits and depths) should be on the Plans.	*This is now shown in the layouts (L-1 through L-15), typicals (X-1 through X-15), and quantity sheets (Q-3) as roadway excavation (unsuitable material). The specs and estimate have been updated as well.*	A	A	A
2	General	Instrumentation schedule should be on the Plans.	*Schedule for survey monument and platform monitoring is provided in the quantity sheets (Sheet Q-5) in a table as requested by DOE. This schedule has been removed from the specs (also as requested by DOE).*	A	A	A
3	General	All LOTBs from GDR should be on the Plans. BKF: Please check.	*DOE provided direction to CT Design on 8/15/11; the GDMR is legally part of the Caltrans contract document hierarchy via the supplemental information available to the Contractor.* *Therefore, there is no need to provide LOTBs for locations not affiliated with the project*	C	C	C

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			structures, and is redundant; DOE directed the consultant not to include additional LOTBs.			
		Specifications – 6/30/11				
4	P. 251	Settlement Period of 60 days is not acceptable.	*Estimated settlement period has been identified/updated in the revised specs. See SSP entitled "Settlement Platform Installation and Monitoring."* (See Page 44)	A	A	A
5	P. 252	Settlement hubs are "3 ft above ground surface"? Please explain.	*Per DOE's spec comments, the hubs are now standard Survey Monuments (Type A) which are flush with the OG; see Standard Plan A74. No elevation above ground surface will be provided and the specs have been revised. See SSP entitled "Survey Monitoring" and "81-010."*	C	C	C
6	P. 253	Reading of settlement markers "every two weeks"? Please explain why every 2 weeks.	*Recommended reading frequency and durations have been identified and updated in the revised specs. See SSPs entitled "Survey Monitoring" and "Settlement Platform Installation and Monitoring."*	A	A	A

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			(See page 46)			
7	P. 253	Reading of settlement markers should continue **past** the end of the contract. Reading frequency and reading stoppage should be under the direction and judgment of the engineer based on the progress of settlement.	*We agree that the reading frequency/stoppage should be under the direction of the engineer; this has been updated in the revised specs. See SSPs entitled "Survey Monitoring" and "Settlement Platform Installation and Monitoring."* (See Page 46)	A	A	A
		GDMR – 7/7/11				
12	14*	This waiting period is not justified for design purposes. Need to address long term settlement, not just constructability.	*A general consensus was established that the compressible soils under the embankment fills were very stiff unsaturated clays above water table. The settlements would therefore be rapid with the placement of fill and assumption of the classical consolidation process (settlement due to expulsion of pore water from a saturated soil) was unrealistic for the present situation . Caltrans (Mahmood) advised that this point be strongly made in the text. He*	A		

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			further advised that settlements under the fills be computed using elastic settlement procedures. (See Page 43, 3rd and 4th paragraphs)			
13	15*	Settlement magnitudes and mitigation measures should be specified **NOW, before contract bidding.** You cannot rely upon settlement monitoring during construction for this. Monitoring during construction is for confirmation only. Settlement magnitudes for each area need more justification. Information for fill placement is not needed for consolidation period determination. Use conservation assumption. Or specify fill placement rate and procedure.	*In the revised version of the GDMR, settlements will be based on elastic settlement procedures and not consolidation (see response to Item 12). Monitoring during construction is not for confirmation only but is a process to assure all settlement has already occurred.* (see page 46)	A		
14	20*	P. 51, GDR: Slide is "50 ft" beneath highway vs. "15 ft" beneath highway in Foundation Report. Please be consistent and **proofread** your reports before submitting. If the slide is only 15 ft beneath the freeway, why is it not confirmed with boring since it could be easily done?	The slide is estimated to be 50 feet below the bottom of the retaining wall and 15 feet below the highway. The Text in the GDR will be revised. The proposed slope cut has no measurable impact on the stability of the slope. This has been provided through the stability analyses. Before and	A		

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			after cut stability remain essentially the same. Therefore, further investigation other than the geomorphic interpretation was not deemed necessary. (See Pages 54 and 55)			
15	21*	Still not clear.	We got the Miller Pacific LOTBs from Caltrans files and documents. This is as clear as we can get. *We will try more.*	A		
16	24*	P. 48, Still inconsistent.	*The station limits identified on page 48 of the GDMR refer to the approximate limits of the tieback wall, which is a subset of the overall RW 4 station limits. Unless we misunderstood the comment – the limits are correct and consistent with the plans.*	D		
17	26*	Not revised in GDR.	It is revised on pg 39 from 5 feet to 8 feet. *Caltrans (Betty Lee agreed).*	G	G	G
18	29*	This should be stated in the GDR. GDR not revised.	As discussed in the introduction to slope stability analysis in Appendix C, local slope stability is automatically analyzed with global stability in the program	A		

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			SLOPE/W if the limits are specified appropriately and the soil properties are homogenous for the height of the slope. The safety factor that is presented is for the lowest value within the specified limits. *Caltrans advised that the explanation above should be presented in the text.* (See Page 32)			
19	30*	BKF to check.	*Agreed – BKF will re-provide Parikh the cut/fill limits electronically to be placed in the GDMR. The GDMR will follow the PS&E submittal by 1 week.*	A		
20	31*	Please show local slope stability analysis.	See response to Item No. 18.	A		
21	32*	Please show this slope stability analysis in the GDR.	The slope stability analysis was provided in the report (Sta. 337+40). *Caltrans agreed.*	G	G	G
22	33*	BKF to check.	*At our 8/5/11 meeting, the location and format showing the LOTBs for the Standard Retaining Walls (RW 2 and 7) and the structural sheets presenting the non-standard*	G	G	G

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			structures (RW 4, 5, and bridge widening) was discussed, and all parties were amenable to this presentation. No changes will be made.			
23	35*	Response not acceptable. GDR Appendix C: How is the consolidation data for only **one sample** in 1 location applicable to all 7 locations? Furthermore, actual results should be used for calculations. The reasons for modification not accepted. The assumptions used are unjustified.	*Per the present consensus, consolidation settlements are unrealistic and elastic settlements will be calculated. See Item No. 12.* The consolidation test sample was from a location with the highest fill and the thickest compressible layer. The test results indicated the compression and recompression indices to be reasonable, albeit somewhat conservative (high) based on geotechnical literature (e.g. Lambe and Whitman, 1969). The same concept was applied to all locations with site-specific information for each location (see Item No. 13). The calculations at each fill location uses water contents and	A		

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			strengths (based on blow counts) to compute the preconsolidation pressures for the alternative estimate, which yielded somewhat lower values of settlement as a sanity check.			
24	36*	See Item 15.	See response in Item no. 13.	A		
25	37*	Where is the response?	Seismic stability analyses will be performed. *It will be reported in updated GDMR. Caltrans (Mahmood) advised that the analyses should be performed for 0.5PGA and not 0.2g.* According to CGS Special Publication 117A (2008), the use of 0.5PGA closely resembles the selection of ground motion with a threshold of 5 cm. We have also evaluated Caltrans Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading (February 2011), which cites Bray and Travasarou (2007) for slope displacement	A		

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			evaluation. We have performed the pseudostatic analysis with 0.5PGA and provided the information in the response. The analyses using 0.5PGA yield factors of safety less than 1.0 for two cases (Block-Poor Bimrock and Sta. 337+40 "RL2" Line). Therefore, yield acceleration (ky) and slope displacement were evaluated. For the two cases of the project (Block-Poor Bimrock and Sta. 337+40 "RL2" Line), we adopted Kh = 0.5 PGA=0.315g and found that the FS was 0.93. Based on Bray and Travasarou (2007), which is a regression model for slope displacement, the anticipated displacement is on the order 2 inches (Mw=7.1, Rogers Creek fault and PGA = 0.63g). The displacement is considered tolerable for the			

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			slopes. The analysis results are attached with this response for information. For report preparation, we have performed analyses in accordance with the latest Caltrans Guidelines for Structures Foundation Reports (December 2009) using 1/3 PGA or max. of 0.2g with FS requirement of 1.1. Based on the analyses, the factors of safety were greater than the required value of 1.1. We have reported the analysis results in the report. (see Pages 32 & 47 and attached analyses for 0.5PGA)			
26	38*	Incomplete. See comments for 95% PSE (dated 6/30/2011).	*It was agreed that the current presentation in the plans (monitoring locations in the Layout Sheets) and specs (instrumentation schedule) was acceptable to Geotech at the 8/5/11 meeting. No changes will be made unless Betty Lee wants the monitoring locations*	D		

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services	**Date Responded:**	8/19/2011
Comments By:	Betty Lee	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	6/30/2011 and 7/7/11		

TECHNICAL COMMENT REVIEW AND RESPONSE

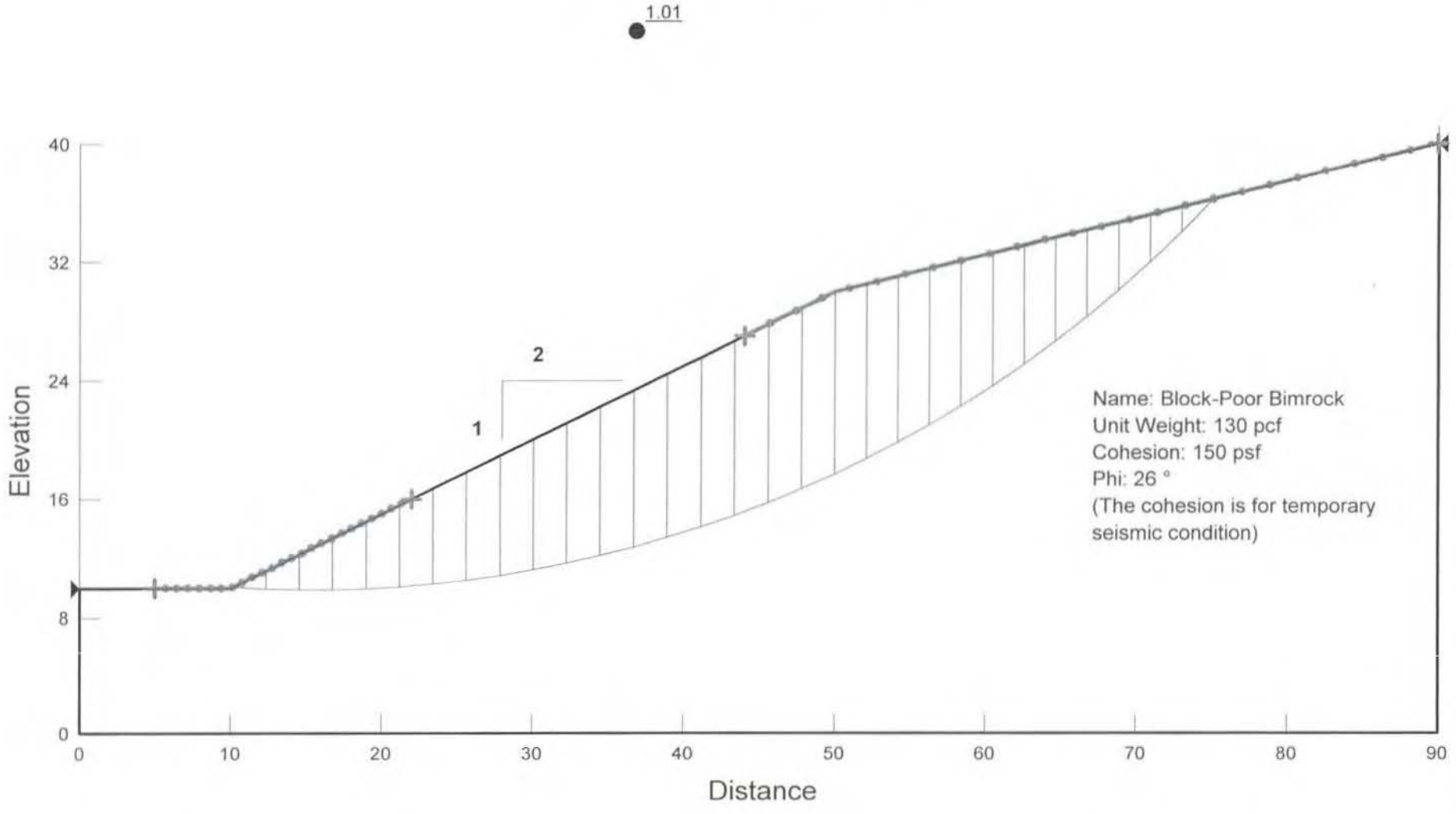
File: MSN B1 PS&E | **Submittal: Revised 95% PS&E (2011) and GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

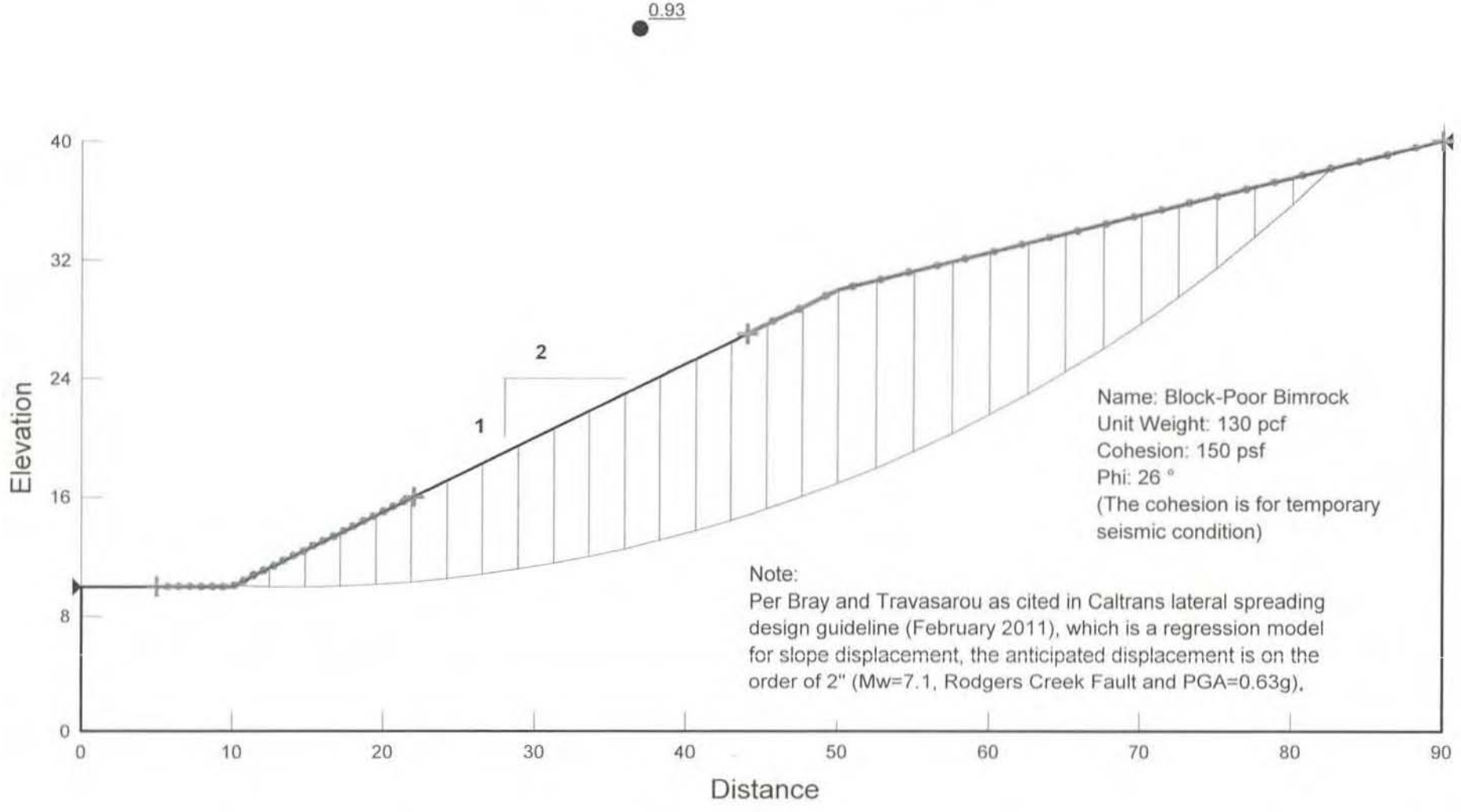
Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			changed; see comment/response/action item in #2.			
27	39*	Differential settlement not addressed in NMWD or GDR. Need to address this.	Differential settlements are of little concern for the pavements and the pipelines in the project on an embankment, since it is required that the pavements and the pipelines will be constructed after the settlement monitoring indicates settlements have occurred. *Agreed by Caltrans. This will be clarified in the updated GDMR.* (see Page 44)	A		
28	40*	If Retaining Wall #6 is eliminated, why is it still showing in the GDR Plans? Please **proofread** before submittal, as we said before.	Retaining Wall No. 6 will be removed from the plate.	A		
29	41*	Over-excavation of unsuitable material was previously discussed. Please specify in GDR and Plans the locations, limits, and depths of the over-excavation.	The locations, limits, and depths of the over-excavation have been shown on the plans by the Designer. We will include the same plans in the report. *The existing plans will be revised as noted in Item No. 2.* (See Page 66 and Appendix F)	A		

*Comment Number from Revised 65% PS&E Review

MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
CUT SLOPE IN BLOCK-POOR BIMROCK
SLOPE HEIGHT = 20 FEET
SEISMIC CONDITION - 0.27 g
(Yield Acceleration)

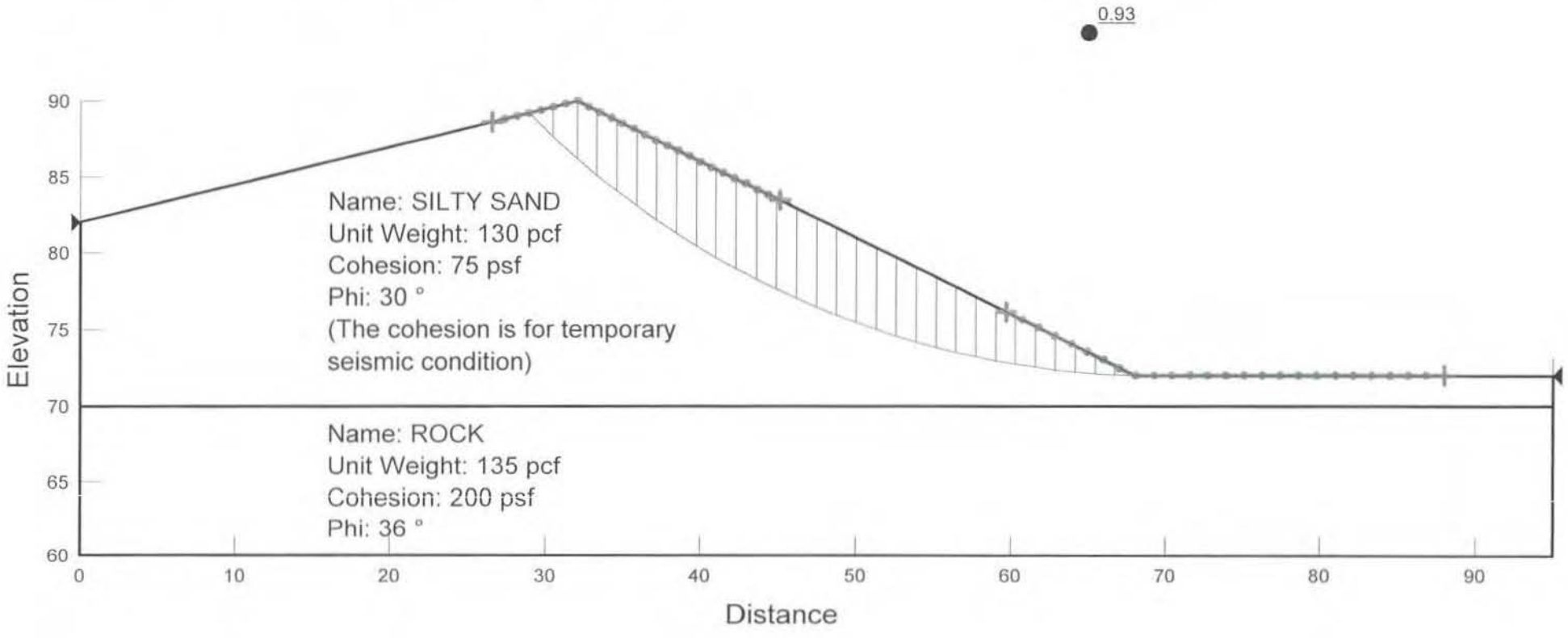


MARIN-SONOMA NARROWS CONTRACT B-1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
CUT SLOPE IN BLOCK-POOR BIMROCK
SLOPE HEIGHT = 20 FEET
SEISMIC CONDITION - 0.315 g
(SP 117A, 5-cm threshold, k=0.5PGA)

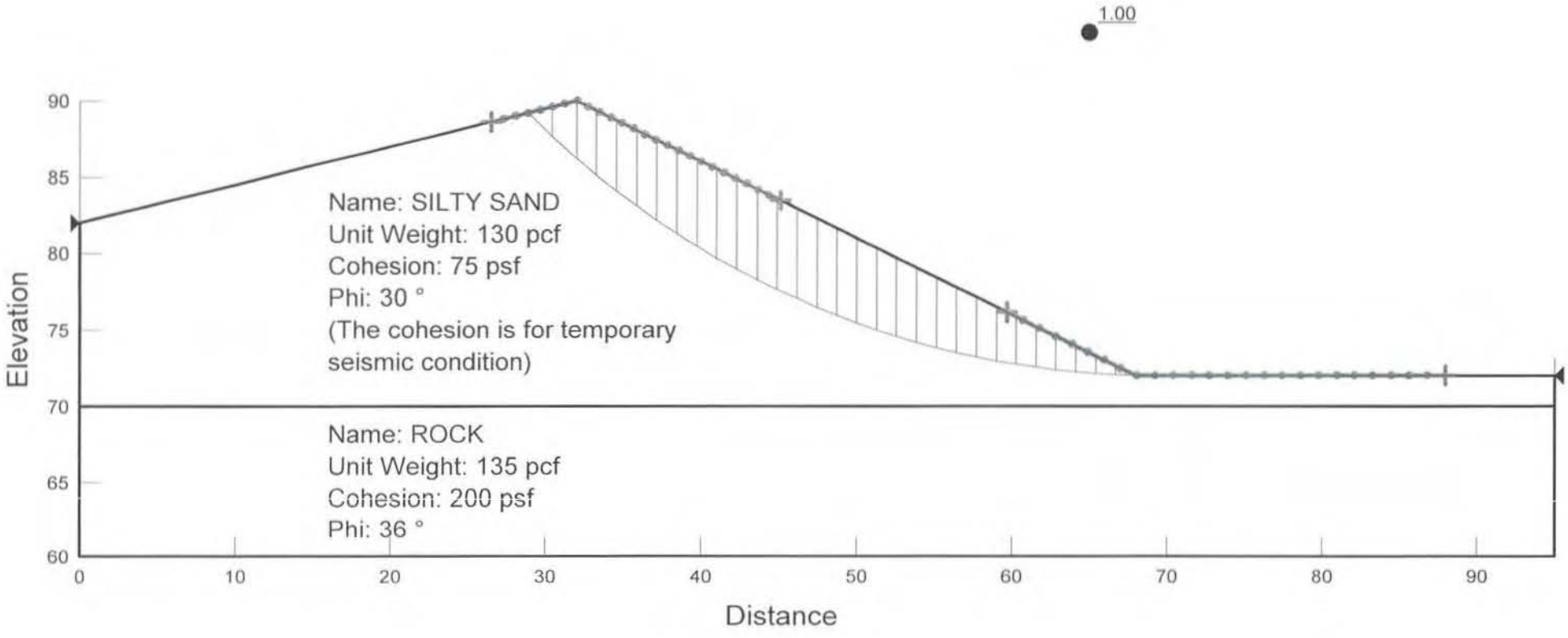


MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 337+40 "RL2 LINE"
(BASED ON BORING NO. A-09-112)
SEISMIC CONDITION - 0.315 g
(per SP 117A, 5-cm threshold, k=0.5 PGA)

Note:
Per Bray and Travasarou as cited in Caltrans lateral spreading design guideline (February 2011), which is a regression model for slope displacement, the anticipated displacement is on the order of 2" (Mw=7.1, Rodgers Creek Fault and PGA=0.63g).



MARIN SONOMA NARROWS HOV LANE WIDENING SEGMENT - B1
REDWOOD LANDFILL INTERCHANGE PROJECT
MARIN COUNTY, CALIFORNIA
STA. 337+40 "RL2 LINE"
(BASED ON BORING NO. A-09-112)
SEISMIC CONDITION - 0.27 g
(Yield Acceleration)



OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 264071 Project Name: REDOOD LANDFILL OC (MSN B1) OSFP Liaison: Tracy Bertram Phone: 916-227-8397 e-mail: tracy bertram@dot.ca.gov	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. 1) ☐ Construction Support ☒ Other: GDR (FINAL) **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Redwood Landfill OC Br No: ____	Reviewer Name: Rifaat Nashed Functional Unit:GS Phone Number: 510-622-1773 e-mail: rifaat_nashed@dot.ca.gov Date of Review: 07/19/11

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	GDR (FINAL)	Report Reviewed Title	Geotechnical Design & Material Report (FINAL) -Marine-Sonoma Narrows Contract B-1,Redwood Landfill Interchange At Route 101,Marin County, California 04-Mrn-101 EA 264071 Dated May 27, 2011	N/A	
2	GDR (FINAL)	**4.4 Regional Geology and Seismicity** Page 6	1- The GDR guide lines should be followed. The regional geology in guidelines includes the following issues: description of the geologic sitting of the project area including geomorphic province, major geologic features (such as mountain ranges,and valleys) and major charachteristics such as depth of alluvium over basement rock, geomorphology, basic types	1. Discussion of geomorphic provinces and thickness of alluvium will be added to the report.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			of rock types, etc… 2- Remove the parts concerning the developing of Franciscan Complex and plate tectonics theory, that do not serve the scope and the goal of the report. 3- According to USGS, MF-2337, the project area includes two main Mesozoic rock complexes (The Great Valley Complex and the Franciscan Complex), and lies on three different terranes (Great Valley Terrane, Yolla Bolly Terrane, and Melange). These Mesozoic rocks in the project area are un-conformably overlain by Miocene and younger strata (Tertiary Overlap Sequence). 4- Burdell Mountain fault should be labeled on the Geologic Map (Plate 3A)	2. The parts concerning the developing of Franciscan Complex and plate tectonics theory are pertinent to the development of the bimrocks, the understanding of which is very pertinent to the project. Some parts judged to be not required will be removed per suggestions of Caltrans (Rifaat). 3. MF-2337 was published in 2000. Our report uses the more current published geologic map by Wagner and Guttirrez (2010). A thorough explanation of the sequence of accumulation is presented in Appendix D. Per suggestion by Caltrans (Rifaat), the updated text will include discussion on the two Mesozoic rock complexes noted in the comment, as applicable. 4. Per suggestions from Caltrans (Rifaat), label will be added to Plate No.3A to identify the Burdell Mountain Fault.	
3	GDR (FINAL)	**7.1 SITE GEOLOGY** Page 18	1- To be consistent with the Geologic Map (Plate 3A) , the following rock units should be added: - Artificial fill placed over baymud (afbm) - Unnamed taffaceous sediments (TS). - Schist and semischist (block within Franciscan mélange). - Great Valley Sequence (KJgv). 2- The following rock units should be	1. Descriptions of the units will be added. 2. Tv cannot be omitted as it is the Burdell Mountain volcanics which cap Burdell Mountain itself. And are involved in large landslides which have deposited andesite	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			omitted: - Undifferentiated volcanic rock (TV). - Franciscan mélange (fm). 3- The Geologic Map (Plate 3A) is blown up too much, that the most of geologic unit symbols located in the project site became out of the map limits and unreadable.	boulders just west of Highway 101. Franciscan mélange (fm) is mapped east of the highway at the Redwood Landfill Overcrossing. 3. Per suggestions from Caltrans (Rifaat), the map will be enlarged to 1:50,000 scale to make the geologic units and symbols readable.	
4	GDR (FINAL)	**7.1.3 Structure** Page 19	You should clarify whether the bedding directions are in a favorable direction for cutting or an adverse direction .	Orientations of the bedding are not known within most of the project area and will vary considerably owing to the deformation history described. This will be further clarified in the updated report.	
5	GDR (FINAL)	**7.2.1 Information from Soil Borings** Page 20	1- General plan sheet showing the locations of all borings in relation to the project elements is missing. 2- For the statement" The sandstone and claystone are generally blocks within the Franciscan Complex(e.g. blocks-in matrix)" how could you come to that conclusion and they are not intact rocks, from borings. 3- All the LOTB's do not include the bench mark for their location as the Soil/Rock classification Manual stated.	1. Per suggestion from Caltrans (Rifaat), all retaining walls, the bridge structure and all associated borings will be included ii one to two site plans. 2. The block-in-matrix nature of the bedrock is the result of its deformation history. The bimrock nature is exposed in several existing cut slopes. 3. Bench marks will be added to the LOTBs as required.	
6	GDR (FINAL)	**7.3.1 Surface water** Page 28	The names of the 10 creeks running through the project limits should be listed	Only two of the creeks have names: Olompali Creek and Deer Creek. The other eight creeks are unnamed. This will be noted in the revised report.	
7	GDR (FINAL)	**7.3.1 Groundwater** Page 29	1- The groundwater information is not clear and definite: - There are 5 deep boreholes and all of them are labeled "groundwater was not measured/encountered due to	1. Groundwater was not encountered in the shallow borings in the overburden soils, even though the borings were drilled using hollow stem auger. It was encountered in only one boring (A-09-109) within the rock. It is therefore expected that if groundwater exists	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			rotary wash drilling method". - There is no any Pizometers installed in the project site and the only one is located at a distance of 400 ft away from the project site. 2- Although the LOTB for Borehole No. A-09-109 indicates that the groundwater elevation is -0.3, the same log is labeled " groundwater was not encountered during drilling". -	in the deep borings, it will be in the rock, which is not significant for design purposes. Groundwater may be presented as trapped water within the rock fractures at isolated locations, which may be encountered during excavations as noted in the GDMR. The above will be further clarified in the updated report. 2. Groundwater was encountered at El. -0.3 feet. The label "groundwater was not encountered during drilling" will be removed from the LOTB.	
8	GDR (FINAL)	**7.4.1 Ground Motion** Page 30	Attach the ARS curve	Agreed. ARS curve will be attached.	
9	GDR (FINAL)	**7.4.3 Liquefaction** Page 32	1- Define the project limits on the attached Liquefaction Map (Plate 5). 2- "there is no indication of the presence of loose or medium dense sands below the groundwater table …" this conclusion should be verified after obtaining solid information about groundwater elevation in the project site,.	1 Agreed. Project Limits will be added to the Liquefaction Map (Plate 5). 2. Solid groundwater information, e.g. absence of groundwater in the overburden soils is established from over 40 borings. See response to Item No. 9. Subitem 2.	
10	GDR (FINAL)	**8.2.2 Subsurface Soil Conditions** Page 41	1- Fill Area No.4. The fill area should be marked on plate 2H. 2- Fill Area No.6. The closest borehole is A-09-150 and not boring A-10-167.	Agreed. Site Plan (Plate2H) will be recised to clarify Fill Area No. 4. The relevant boring for Fill Area No. 6 is A-10-167. Boring A-09-150 is at the edge of the fill.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E — **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Draft GDR				
1	General	The Report should have been better proof-read before submitting to us for review	Agreed.	A		
2	GDR	For the GDR, please refer to locations by Line and Stationing. For example, when you refer to the Verizon area or Buck Center, we don't find these on the Plans. It would help if you label those referenced areas on the Plans.	Agreed. They will be identified on the Project Location Map and Site Plans.	A		
3	Page 19, Section 7.2.1	"…rock in 'relatively shallow' depths? Please indicate the range of these depths.	As noted in Section 7.2.1, the deepest depth of rock was 35 feet. Rocks was encountered at several locations within 5-ft depth, including some where rock occurred at the surface. Text is revised to clarify.	A		
4	Page 18, Section 7.1.3	Do you mean 1V:5H instead?	Yes. It will be corrected in the revised report.	A		
5	Page 18, 20, 21	Please use Stationing to indicate locations of Retaining Walls 4 and 5 (and all wall locations).	Agreed.	A		
6	Page 6, Section 4.3	What are the line and stations of these features?	The stationing for Verizon Tower will be noted. The stationings for the existing retaining wall are noted in appropriate places. It is not feasible to add stationings for other items and the	A/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			information will provide little added value to the report.			
7	GDR Plates 2A-2M	Some Station Lines are not labeled.	Agreed. They will be labeled in the revised report.	A		
8	LOTB	LOTB (log of test borings) for Borehole A-09-152 is missing.	R-value borings are not in LOTB. A-09-152 is a shallow (R-value) boring. Text is revised to clarify.	C/D		
9		Project Manager, Betcy Joseph informed us that a proposed frontage road will be extended at Line FR1 Sta. 270+50 over soft soil. The closest borehole (A-09-151) does not show soft soil. However, the borehole is only 19 deep. Please clarify the reason that the drilling did not advance to sufficient depth.	The soft soil Betcy was presumably indicating was that which could occur in the young/recent alluvial fans after a rain. The soft soil condition could be limited in the upper 2-3 feet and is more of a constructability discussion rather than a long term settlement concern. A deeper boring would not have provided any added information as the underlying (native) material is relatively	C/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			competent (stiff clays and medium dense to dense sands)			
10		For all proposed 7 embankment fill areas, what magnitude of settlement do you expect? Please justify your answer with test data and calculations.	Magnitude of settlement has been calculated for all 7 areas, based on the height of fill and thickness and strength of compressible layer. Compressibility of the layer (s) will be based on the consolidation test on a sample from Boring A-09-110 at 10-ft depth.	A		
11	Page 41, Section 8.2.3	Embankment Settlements: Settlement calculations are only shown for Fill Area #2 in Appendix C. What about the other 6 fill areas? As for the calculations for Fill Area #2, the report indicated that "Settlement of Fill = 0.5 to 0.75 pct of Height of Fill". Please justify this. In the immediate settlement calculation for the "very stiff clay" foundation soil, please use a more accurate formula/correlation. Long term consolidation calculations must be done. Please indicate the reason for not conducting soil consolidation testing.	The settlement for Fill Area No. 2 is the highest at the site. Calculations will be provided for the other fill areas (See Item 10). Settlement of Fill = 0.5 to 0.75 pct of Height of Fill" is based on our information from field observations. A more refined formula or correlation will be used. Compressive layer below groundwater table is not	A		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			expected. Therefore, short-term (immediate) settlement will be similar to long-term. Additionally ,major portion of the settlement will occur during fill placement. There is one consolidation test (Boring A-09-110), where the fill thickness is highest.			
12	Page 42, Second paragraph	Please explain that removing only 2 ft of soft material is sufficient for design purpose.	It was noted during test pit excavations that water percolating from above due to rain and surface runoff saturated the upper 2 feet of the alluvial fan deposits and making it soft. This recommendation is provided to pre-empt a design and construction issue so that the plans reflect the mitigation in the event the saturated conditions are encountered.	G/D		
13	Page 42,	"If the soft material persists after 2 ft of excavation, a layer of geofabric should	Yes.	G/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Second paragraph, last sentence	be placed at the bottom of the excavation prior to placement of the compacted fill. This is primarily to facilitate mobility of equipment." Does this eliminate the need for the mitigation of the additional permanent settlement?				
14	Page 42	Waiting Period: How was 60 days determined?	A 30-day waiting period is standard practice for Caltrans. Since the fill at certain locations is relatively high (almost 30 feet), a 60-day waiting period is recommended. Justification is provided in the text.	G/D		
15	Page 43	"The final waiting period should be determined, based on the monitoring program per Caltrans Test Method 112." (Instrumentation). Total settlement magnitude and consolidation period should be determined in the Design Stage and this information should be part of the construction bid documents for the Contractors. Contractors will need this information to estimate their cost and schedule.	The range of total settlement magnitude (2.5 to 4.0 inches) is noted in the report. Since there is no information regarding the rates at which the fill will be placed, consolidation period cannot be determined . It should be rapid. This is why we have included (and it is a common practice) to recommend a settlement monitoring program. It is	C/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			explained in the report.			
16	LOTBs	What are the two readings to the right hand side of the logs? This is not indicated on the legend.	The two readings are for dry unit weight and moisture content of the sample. Legend sheet will be revised to clarify.	A		
17	Appendix C, Slope Stability Analysis	What is the meaning of "Cl" and "Fg"?	Cl indicates 2-ft thick clay layer; fg indicates Franciscan Melange	A		
18	Appendix C, Slope Stability Analysis, Retaining Wall 7	Please explain "Preslide", "Postslide", and "Existing with Cut/Wall".	"Preslide" indicates the configuration prior to occurrence of the landslide as inferred by our Geologist based on geomorphology. This analysis was performed to establish a slide zone and the shear strength characteristics of the slide zone material. "Post-Slide (Existing)" indicates the present existing configuration. The slide zone location and properties determined from the "Preslide" analysis was	A		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			used to determine the stability of the existing configuration. "Existing with Cut/wall" indicates the configuration due to introduction of the proposed cut wall Retaining Wall No. 7). Discussions are provided in the attached calculations in Appendix C			
19	Appendix C, Slope Stability Analysis, last page	"Sta. 416+00" refers to what line?	"RLF " Line, as noted in Page 34. The page in Appendix C will be revised to identify the line.	A		
20	Page 49, 3rd paragraph	If slope stability's factor of safety is the same with and without retaining wall #7, then why build retaining wall?	Retaining Wall 7 is built to retain the vertical cut which is much shallower than the inferred deep seated old landslide.. Stability analyses were performed to investigate if the introduction of the vertical cut affected the overall stability within the (deeper) landslide mass. It	C/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			did not, since the inferred slide plane was much deeper as is evident from the slope stability analysis for "Existing with Cutwall"			
21	The last 2 pages of LOTBs	The last 2 pages of LOTBs are not legible.	Will try to improve legibility of the LOTBs in the revised report. The LOTBs came from Caltrans files & documents (Miller Pacific).	A		
22	The last 2 pages of LOTBs	The last 2 pages of LOTBs are in metric while the rest of the LOTBs are in English units.	The last 2 pages of LOTBs are from documents obtained from Caltrans – (Miller Pacific Report for borings drilled in 2002). Caltrans used Metric at that time.	C/D		
23	Borehole A-10-158	Borehole A-10-158 is missing.	LOTB for A-11-158, 158A and 158B is present in Appendix A. They are mis-labeled as A-10 158, 158A and 158B in Table -1A on page 12. Will be corrected.	A		
24	Page 45,	Sta. 341+31 is outside of wall limits.	It should be 343+31 to	A		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Retaining Wall #4, tieback wall		345+99. It will be corrected in the revised text.			
25	Page 36, Section 8.1.2	Are the recommended toe drains/underdrains on the Plans?	***BKF to check***	A		
26	Page 36	It is stated here that surface drainage ditches and underdrains be installed for all cut/slopes exceeding 5 ft. Previously, it was indicated for 8 ft. Please be consistent.	It should be 8 feet. Text will be revised.	A		
27	Page 31, Last paragraph	For the CU test, total stress analysis, the report indicated a cohesion of 45 psf and phi = 22 degrees. Shouldn't phi=0?	No. The phi angle should not be 0 for a CU total stress. The phi angle is a reflection of the increased strength due to increased confining pressure. Since, in a CU test, a sample is consolidated under different pressures, leading to decreased void ratio (increased density) and therefore increased strength with increasing confining pressure, even for total stress (where pore pressure is not allowed to dissipate during shear), there will be a non-zero phi	G/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			angle. In contrast, for a UU test on a saturated sample, where no change in volume occurs when different confining pressures are applied, the strength is essentially the same under all confining pressures, e.g. phi = 0.			
28	Page 32, 2nd paragraph	"…top of slope be rounded off…" Please explain what this means.	The sharp edge on top of slope (hinge point) between the existing slope and the new cut slope will be rounded off to obtain a smoother transition between the two slopes. This is normally incorporated in the grading plans by the Civil Designer. This approach allows the removal of sharply angled cuts that leave material perched up on a newly cut slope. Eventually this material (if not rounded) could slump on its own creating a	G/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			maintenance issue.			
29	Page 33	Was *local* slope stability analyzed? Please explain.	The program analyzes all circles within the limits specified for the top and bottom of the circular failure surface. In all the slope stability analyses, the local slope stability have therefore been automatically analyzed (along with the global stability) when soil properties for the slope are homogenous for the height of the slope and the circle is within the limits specified, e.g. not on the edge of al limit. The safety factor result that is presented is for the lowest value for the analysis (local and global).. For very shallow failures (e.g. slump conditions) it is not feasible to model and analyze the slopes and	G/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E | **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			therefore specific mitigation measures are discussed to minimize such slumps. These measures are presented in Sections 8.1.1 and 8.1.2.			
30	Page 33	Limits of cut of bike path area is shown different in Plans (greater) than GDR.	The limits will be reconciled.	A		
31	Page 34	Boring A-9-145 is only 10 ft deep. Why such a shallow boring?	Hard clay was encountered at the bottom of the boring, which was 5 feet below adjacent road surface. A minor cut is involved which does not require additional depth of exploration.	G/D		
32	Page 35, 2nd paragraph	On the western side of the ramp (RL2 line, sta. 336+24 to sta. 339+43), the proposed cut is 20 ft in height. The report stated that the stability of the proposed 2H: 1V cut slope "is considered satisfactory." You used Borehole A-9-112 as reference. However, LOTB showed that the top 10 ft consists of silty sand with gravel (SM), medium dense, with SPT of 18. Without doing a slope stability analysis, how was it determined that the proposed cut slope will be "satisfactory"?	In Borings A-9-112 and A-9-113, rock occurs within 10-ft depth. Potential failure (if any) could therefore occur within 10 to 15-ft depth. We had used our experience and assessed the stability. However we have now	A/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E	**Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			analyzed for slope stability analysis with sand to 15-ft depth overlying rock. Phi = 30 degrees and c = 50 psf.. The factor of safety is 1.61.			
		Plans				
33	LOTB	The LOTB sheets are scattered. They are not together in one section.	***BKF to check***	D		
34	LOTB	Not all the LOTBs in the GDR are in the Plans.	***BKF to check***	A		
		Additional Comments (4/14/11) on BKF's Response 3/2011 to Comments				
35	3/2011 JRT Response to Comments	Item 14: Regarding consolidation, their response needs justification.	Strength of the soils compressible (clay) layers under the fill as inferred from the SPT blow counts indicated very stiff to hard clays. Based on accepted correlations, the additional load from the fill will not be enough to exceed the preconsolidation pressure. The layer will be in the overconsolidated range in all cases.. Also, groundwater table was not indicated within the potentially compressible layer. There is one	G/D		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E — **Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
			consolidation test, to determine the recompression index. Hence, more consolidation tests were not meaningful and were not performed,			
36		Item 15: Regarding waiting period, their response needs justification.	Justification is provided.	A/D		
37		Item 16: Regarding seismic slope stability, their reponse needs justification.	Justification is provided.	A/D		
38		Item 23: Instrumentation & monitoring needs to be in PLANS AND SPECS, not just in the geotech report.	***BKF to check***	A/B		
39		Item 2 (at the end): "report for the proposed NMWD pipeline", we want to see this	A copy of the NMWD report has been provided to Caltrans.	G		
		Additional Comments (5/10/11) on NMWD Geotech Report				
40		The reason that I asked to see the NMWD Report was that BKF Engineers' response to my question of Differential Settlement was that it will be addressed in the NMWD Report. My comment was: "What is the magnitude of soil settlement? How will this impact the pipe, in terms of ground differential settlement? Are there any mitigation measures?" This is not addressed in the NWMD Report. Please address this both in the Geotechnical Design Report (GDR) and NWMD Report.	Agreed. The settlements in the pipeline route will be the same as the ground adjacent to the pipe. As noted in the GDMR, the settlements in the fills will be monitored till the settlements become acceptable for subsequent construction. Therefore, if	A		

Agency:	Caltrans		**Responded By:**	BKF Engineers/Parikh
Review Unit:	Geotech		**Date Responded:**	05/20/11
Comments By:	Betty Lee	Mahmood Momenzadeh	**JRT Meeting Date:**	
Contact Info:	(510) 286-4825	(510) 286-5732		
Date Reviewed:	4/7/2011, 4/14/11, and 5/10/11			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E	**Submittal: Revised 65% PS&E (2011), Including GDMR and NMWD Geotech Report**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** - TAM to Evaluate; **F** - County to Evaluate; **G** - N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		By the way, all my comments regarding soil settlement for the GDR applies to the NWMD as well.	the pipeline is installed after the acceptable level of settlements are reached, the total settlements along the pipeline and consequently the differential settlements will be small and therefore of little concern.			

Marin/Sonoma Narrows – Segment B1
Redwood Landfill Interchange Project (EA 04-264071)

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
		Geotechnical Design Report					
1		This GDR needs a better location map with clearer reference points, i.e., cross streets, landmarks, etc.		PCI	A	A	
2	Page 3	What is the height of Retaining Wall #1? What is it suppose to retain?	Retaining Wall 1 has been eliminated.	PCI	C	C	
3	LOTB's	Are the positions of the "Moisture Content" and "Unit Weight" switched? Please follow guideline.	They have switched. Key has been revised.	PCI	A	A	
4	Page 22, Section 7.3.1.2, Erosion	What are the mitigation measures? Please incorporate into design.	Mitigation measures are discussed in Sections 8.1.1 and 8.1.2	PCI	A	A	
5	Page 23, Section 7.3.1.3, Groundwater:	What are the groundwater levels in borings other than Borehole A-09-109? Discuss what your conclusion is based on?	Groundwater was not encountered in any of the other borings, even though most were drilled using hollow stem auger. This has been clarified in the revised GDMR	PCI	A	A	
6	Page 24	Describe and explain the purpose of Retaining Wall #1.	Wall has been eliminated.	PCI	C	C	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
7	Page 25, Section 7.4.3, Liquefaction	Please describe what kind of soil is below the groundwater table.	Groundwater below water table is sandstone; this has been identified in the revised GDMR.	PCI	A	A	
8	Page 25	The last sentence, "On the eastern side….", is unclear. Please rewrite.	The ramp is essentially north-south. Eastern side indicates away from the Highway.	PCI	A	A	
9	Page 27, First and second sentences	Are these interceptor drains incorporated into the design? Please indicate where these are located on the Plans.	They are incorporated and locations (station) identified	PCI	A	A	
10	Page 27, Section 8.1.1, First paragraph	Where are the "proposed cuts that will expose debris flow and landslide deposits."	They are in all cuts on the western side, except the northernmost cuts (Sta. 408+50 to Sta. 418+50 ("RLF" Line). This has been clarified in the revised GDMR.	PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
11	Page 27, Section 8.1.1	Are these erosion mitigation measures (i.e. surface drainage ditches to intercept surface runoff) incorporated into the design? Please indicate where these features are located on the Plans.	These are erosion protection measures and will be included in the plans. Approximate locations have been identified in the revised GDMR.	PCI	A	A	
12	Page 28, Section 8.1.3, Rippability:	Please indicate the areas where "large boulders and blocks of rocks may be present…making them hard to excavate."	They cannot be specifically determined since they are bimrocks. This is discussed in greater detail in the revised report.	PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
13	Page 29, Section 8.2, Embankments	Please justify the accuracy of your conclusions about groundwater levels and consolidation settlements, given that: a) they are based on a single borehole in a large area, b) the boreholes are drilled in the summer (hence, dry), c) Borehole A-09-117 is relatively shallow (only 10 ft.).	(a)There are many boreholes over a large area – only one encountered groundwater (b and c) agreed. But several boreholes are deep and permanent groundwater, if present, should have been encountered. An expanded discussion regarding the conclusions has been added to the revised GDMR.	PCI	A	**A**	
14	Page 30, Second sentence	"The estimated settlement is in the over-consolidated/elastic range…": Were consolidation tests done to confirm that the soils are overconsolidated?	The soils are stiff to hard. For their depths, they should be overconsolidated. Consolidation tests were not run.	PCI	G	**G**	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
15	Page 30, Waiting Periods:	Please justify the 30-day waiting period.	30-day waiting period is standard practice, and takes care of the settlement of fills and overconsolidated soils. It has been changed to 60 days.	PCI	A	A	
16	Page 30, Section 8.2.4:	What about seismic slope stability?	Seismic slope stability was not computed, but expected to be greater than the required 1.0.	PCI	A	A	
17	Page 31	"The entire wall will lie within the toe of a previously mapped landslide…", "The proposed cut could potentially exacerbate the existing instability of the slope…": What are the mitigation measures?	Wall no. 1 has been eliminated.	PCI	G	G	
18a	Page 33, First paragraph	Please explain the "problem" and "impacts" of the problem.	Wall has been eliminated. The landslide has been studied further and found to be inconsequential to the cut slope.	PCI	G	G	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
18b	Page 33, First paragraph	"Tiebacks should be anchored into the underlying bedrock." However, since "depth to bedrock is not known at this time.", how do you know this is feasible?	Wall No. 1 has been eliminated.	PCI	G	G	
18c	Page 33, First paragraph	When will you find out the "depth to bedrock"? This is already 95% PS&E.	Same as Response No. 20.	PCI	G	G	
19	Page 33, RetainingWall #2	"...without additional treatment, the existing cut slope...will continue to erode and slump causing debris to flow down onto the path.". What treatments do you suggest?	Treatments are discussed in Section 8.1.1	PCI	A	A	
20a	Page 35, Retaining Wall #3	Are you saying the entire roadway and retaining wall is in a localized slide? Description of geology needs clarification. A drawing may help.	Retaining Wall No. 3 has been eliminated and replaced by cut slopes. for Bike Path and southbound on-ramp. New borings have been drilled and the geology is clarified in the revised report.	PCI	A	A	
20b	Page 35, Retaining Wall #3	Is Boring No. 120 the same as Boring #A-9-102? The report says it is near the center of the alignment. The alignment of what? The highway or wall?	Center of the wall alignment. Now the wall is eliminated.	PCI	G	G	
21	Page 40, Last line	Are subsurface drainage included in the design plans? Please indicate where these are located on the Plans.	They should be included in the Drainage Plans.	PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Geotechnical Services Division of Engineering Services	**Date Responded:**	
Comments By:	Betty Lee Associate Material & Research Engineer	**JRT Meeting Date:**	
Contact Info:	510.286.4825		
Date Reviewed:	4/23/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E, Waterline Relocation PS&E and GDMR	**Submittal: 95% Submittal (2010) and 65% Waterline Relocation Submittal (2010)**	**Date: 4/23/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
22	Page 44, First paragraph, Retaining wall #6	Wrong grammar. Please rewrite sentence.		PCI	A	A	
23	Page 57, Section 12.3, Construction Monitoring and Instrumentation	This is 95% PS&E. If monitoring and instrumentation are needed, they must be included in the Plans and Specifications.	Monitoring for the fill settlements is required and included in the report.	PCI	A	A	
	65% Waterline Relocation PS&E						
1		Will there be any pipe-jacking involved?		CSW			
2		What is the magnitude of soil settlement? How will this impact the pipe, in terms of ground differential settlement? Are there any mitigation measures?	Will be addressed in the report for the proposed NMWD pileline.	PCI and CSW			

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
1	General	It is not acceptable to use a 35 year-old geologic map when a new, state-of-the-science map is available for free online. Every part of the report that references the geologic map and every interpretation made based on the map should be re-thought and re-written. We are concerned about the potential for claims during construction if this GDR is adopted as written. About 1/2 of the project alignment passes through Franciscan Complex rock. Retaining walls 2, 3, 4, and 5 are located within mapped Franciscan rock, according to plates D1-D5. It is not clear in which geologic unit the proposed cuts will be located. Construction claims of differing site conditions are common in Franciscan ground, particularly where the geotechnical investigation did not describe the unique Block-in-Matrix structure and random distribution of blocks that characterize the Franciscan Complex. The report should be rewritten with reference to: Wakabayashi, J. and Medley, E.W., 2004, Geological Characterization of Melanges for Practitioners, Felsbau, v. 22, no. 5, http://bimrocks.geoengineer.org/files/WakabayashiFelsbau2004.pdf and Wakabayashi, J., 2008, Franciscan Complex, California: Problems in Recognition of Melanges, and the Gap Between Research	The latest information (Ford (2007), and Wagner's 2010 map have been considered in the report in addition to the earlier maps. Detailed discussions on the development of our maps are presented in Appendix D of our revised report. The geologic interpretations in the report have been revisited with due consideration for the 'bimrock' characteristics of the Franciscan Complex rocks, the debris flow and the landslide deposits. Medley has been	PCI	A/B/D	A/B/D	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR | **Submittal: 95% Submittal (2010)** | **Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
		Knowledge and Professional Practice, ARMA 08-357, http://www.csufresno.edu/ees/Faculty&Staff/Wakabayashi/Publications/Wakabayashi2008.pdf These papers summarize techniques for differentiating between coherent terranes and Block-in-Matrix terranes, describing Block-in-Matrix rocks for engineering purposes, and gives techniques for estimating block size and distribution. However, if the consultant has evaluated the area and judges that the area is a coherent terrane of the Franciscan Complex, we can accept much of the report as written, as long as this can be justified. This is a complex question that would best be dealt with in person. One more round of comments is unlikely to resolve the problems with this report, so we would like to meet with the technical staff to go over the report in detail before the next draft is submitted to Caltrans. Following are comments that can be addressed before submitting the next draft to Caltrans.	consulted and pertinent technical papers by Medley, Wakabayashi have been reviewed. The report has been revised significantly to address the issues raised. Construction Advisories have been revised to highlight the high variability of the bimrock formations. A meeting with Caltrans was held where the above issues were discussed and a reasonable resolution of the issues was arrived at.				
2	Section 2 Proposed Facilities and	List proposed cuts and their locations.	Significant proposed cuts and their locations are presented in Section 8.1.	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
	Proposed Improvements						
3	Section 4.2 Topography and Drainage	List existing cuts and describe their size, slope ratio, and condition (or do this in another section).	The issue has been touched in Section 7.1.3. The section has been divided into natural and manmade slopes. Additional details on the size of the slopes, slope angles, rocks exposed and condition of the slopes have been discussed in Sections 7.1.3 and 7.2.2.	PCI	A	A	
4	Section 4.4 Regional Geology and Seismicity	*"....Franciscan rocks were formed by metamorphism of massive sandstone and alternating thin beds of sandstone and shale."* This is in direct contradiction to commonly understood Franciscan geology. Revise this or justify it.	Section on Regional Geology has been revised significantly and/or justified, with particular emphasis on the formation of the Franciscan Complex rocks.	PCI	A		

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal:** 95% Submittal (2010)	**Date:** 4/21/10

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
5	Section 4.4 Regional Geology and Seismicity	*"....abundant tiny flakes of macaceous minerals...."* Have you actually identified mica in the field? There is no mica listed on the boring logs, and much of the rock mapped as schist or semi-schist is actually foliated graywacke, without mica. Mica has structural and chemical properties that can affect slope stability and clay formation, so it is important to be accurate. If there is mica present, show and describe which areas contain micas on a map, and show and describe which structures if occurs in.	Mica was not definitively identified on our revisit to the site. Report has been revised as appropriate.	PCI	A		
6	Section 4.4 Regional Geology and Seismicity	*"Franciscan melange underlies portions of the region."* Please discuss the occurrence of melange with our staff. Since you assert that much of the Franciscan present in the study area is melange, it is very important to describe the Block-in-Matrix nature of the material in terms of rippability, slope stability, and constructability. For each unit (Franciscan, Sonoma Volcanics, Alluvium), describe its distribution in the project. What proposed structures or what part of the roadway does it underlie?	The block-in matrix structure of the mélange (Franciscan Complex rock) and its implications to rippability, slope stability, and constructability have been addressed as applicable in the revised report. The distribution of the various rock types have been shown on the	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal:** 95% Submittal (2010)	**Date:** 4/21/10

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
			geologic maps and the impact of their occurrences have been addressed as applicable for the proposed structures and other improvements they underlie.				
7	Section 4.4 Regional Geology and Seismicity	*"Colluvium... Within the region, there are numerous debris flow and avalanche-type deposits...."* Wagner, et al. shows very little colluvium along the project alignment. This is one of many reasons why the 35 year-old geologic map is not acceptable for use on this project. This needs to be revised based on the latest map.	The latest maps Ford (2007), and Wagner (2010) show more colluviums along the alignment. In addition, we have used the project and county topo contours and our boring and test pits to map the existing colluviums and debris flow deposits.	PCI	A	A	
8	Section 4.4 Regional Geology and Seismicity	*"Seismologists at the USGS have estimated that there* is *a* 67% *probability"* Cite the source. These look like old probabilities. Use the most	Recent probabilities for each fault per USGS (2008) have been	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
		recent probabilities. Describe the probabilities for each of the relevant faults.	reported in Section 4.4.				
9	Section 5.1 Drilling and Sampling & Section 6.1	*"When correlating SPT data, the blow counts .... may be converting .... by multiplying a factor of 0.65."* Cite the source for this. Also correct section 6.1.	The factor 0.65 may be justified by reference to DMG Special Publication 117 (Guidelines for Analyzing and Mitigating Liquefaction) . The reference has been added in Sections 5.2 and 6.1.	PCI	A	A	
10	Section 5.2 Geologic Interpretation and Mapping	*"...expressions in the photogrammetrically produced topographic contours and stereoscopically viewed aerial photographs...."* Rewrite this to state simply how the map was developed.	The text has been revised	PCI	A	A	
11	Section 5.2 Geologic Interpretation and Mapping	Each map in Appendix D should have a legend.	A legend has been added in Appendix D, pertaining to all the maps in the Appendix	PCI	A	A	
12	Section 7.1 Site	As stated, this section should be rewritten with reference to the	The section has been	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
	Geology	latest map. This is not the section to put a map legend in.	rewritten.				
13	Section 7.1 Site Geology	Rewrite this to state simply how the map was developed.	In the revised report, the old maps (Plates 3A-C) presented in 7.1 have been replaced by a more recent map from CGS by Wagner et el (2010).	PCI	A	A	
14	Section 7.1 Site Geology	The emphasis of the 1975 map is very different than the emphasis of new mapping. This could mislead contractors as to the makeup of the rocks and sediments along the alignment. The unit descriptions rely heavily on mineralogy, which is less relevant here than geotechnical properties. Summarize all that is known about the geotechnical properties of the units along the alignment. In particular, address the nature of the Franciscan Complex along the alignment.	A section discussing the properties of bimrocks, which include the rocks of the Franciscan Complex has been added as section 7.2.4.	PCI	A	A	
15	Section 7.1.1 Lithology	This section does not give any information on lithology.	The section on Lithology has been revised	PCI	A	A	
16	Section 7.1.2 Structure	*"Structural discontinuities ... generally strike parallel with Route 101 and dip steeply to near vertical. Consequently, they are considered to be not significant to the design of the project. "* This section dismisses structural features without sound reasoning. Rewrite this section. Discuss in detail structural features and how	The section has been revised with respect to its applicability to the project. In particular, the orientations of the structural discontinuities	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
		they may interact with proposed cuts, borings, etc.	have been noted and the zones of faulting and sheared zones have been identified in the section.				
17	Section 7.1.3 Existing Slope Stability	Describe the angle and condition of existing cut slopes. How steeply can native materials be cut and remain stable? Where are cuts and temporary backslopes proposed and what geologic units do they lie in? Describe the stability of each mapped geologic unit that will be cut.	The section has been revised to address the slope angles and conditions of the existing cut slopes.	PCI	A	A	
18	Section 7.2 Subsurface Soil and Geologic Condition (sic)	The first paragraph should be re-written. How deep were the borings? Were they drilled to bedrock and then stopped? If so, how can you justify this if this is an area of melange? What is the evidence for and importance of mylonite?	Depths of borings are noted in Tables 1A and 1B. As may be noted from the Log of Test Borings (LOTB) sheets in Appendix A, they were drilled through bedrock to specified depths or stopped earlier if could not be drilled. Mylonite was encountered in Boring	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
			A-10-131 and in the shear zone exposed in the existing cut slope. It is weaker material than block-rich bimrock. Section 7.2 has been revised.				
19	Section 7.2 Subsurface Soil and Geologic Condition (sic)	According to Wagner, et al., there is very little colluvium mapped along the alignment.	See response to Item No. 7.	PCI	A	A	
20	Section 7.2 Subsurface Soil and Geologic Condition (sic)	Describe whether groundwater was measured in all borings or not, whether the borings were rotary wash or augur borings. Interpret the presence of groundwater in Boring A-09-109. The distinction "deep borings" is not meaningful.	Except for the four rotary wash borings, all "deep borings were drilled using hollow stem auger techniques, which enable the identification of groundwater if encountered during drilling.	PCI	D	D	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
			The water encountered in Boring A-09-109 is within the Metasandstone. It could be 'trapped' water. Also, the elevation at which it is encountered is 'deep'. In the absence of a better word, the word "deep boring" was used to distinguish it from 5-ft deep (e.g. shallow") borings drilled for R-value testing for pavement design.				
21	Section 7.2 Subsurface Soil and Geologic Condition (sic)	What is the organizational scheme for this section? Why are these particular sites picked out for further description? There is no description of borings and surface geology around proposed cuts. Are they the only proposed wall sites? What about subsurface conditions where cuts are proposed? Provided figures are not	The particular sites were picked for further description because major improvements are planned at these	PCI			

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
		helpful in understanding the text, as the figures lack legends and boring locations.	locations, e.g. retaining walls, major cuts, etc. Thereby the descriptions of the subsurface conditions become more focused and therefore more meaningful. In the revised text, the soil descriptions have been moved to improvement-specific locations. Legends and boring locations have been added to all plates.				
22	Section 7.2 Subsurface Soil and Geologic Condition (sic)	If borings were not done for the proposed cut slopes, maps of the existing slopes should be provided.	Borings or test pits logged have been logged at each of the planned cut slopes and included in the revised GDMR	PCI	A	A	
23	Section 7.2 Subsurface Soil	Reconsider the use of the word overburden when referring to areas of Franciscan	'Overburden' was used to describe 'soil-like'	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR | **Submittal:** 95% Submittal (2010) | **Date:** 4/21/10

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
	and Geologic Condition (sic)	Complex.	material to distinguish from underlying 'rocklike' material. It has been changed to 'soils overlying rock'.				
24	Section 7.2 Subsurface Soil and Geologic Condition (sic) Area Near Retaining Wall #2	*"There are no deep borings in the vicinity a/proposed Retaining Wall No. 2..."* Since borings are required for each structure, explain when the borings will be done for this retaining wall and how the results will be reported.	This wall was a later addition, e.g. subsequent to the field investigations. Thus, no borings were performed at that time. Subsequently, borings have been drilled and the information has been provided in the revised report.	PCI	A	A	
25	Section 7.2 Subsurface Soil and Geologic Condition (sic)	*"However the subsurface conditions are exposed in the cut above the highway. "* If the consultant has determined that the area is not a Block-in-Matrix terrane, and can demonstrate this, then this interpretation is	Block in matrix geology has now been incorporated into the work. RW2 is in block-	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
	Area Near Retaining Wall #2	acceptable. However, it is not clear that the question of Block-in-Matrix geology has been incorporated into the work. Please meet with us in person to discuss this.	rich material.				
26	Section 7.2 Subsurface Soil and Geologic Condition (sic) Area Near Retaining Wall #4	Were any borings advanced within the wall limits?	Boring Nos. 129 and 130 were advanced within the alignment limits for Wall No. 4 and No. 131 approximately 30 feet beyond the northern edge of the wall. Also, test pit TP-171 is within the limits of the wall alignment.	PCI	A	A	
27	Section 7.2 Subsurface Soil and Geologic Condition (sic) Area Near Retaining Wall #4	*"Several significant cuts..."* Why are the proposed cuts not shown on the map or discussed in this section? It appears they are not discussed in the report.	There is a major cut slope, with approximately 40 feet high, along the western edge of the loop connecting the overcrossing to 'parking lot. The cut has been	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
			used to advantage to establish the characteristics of the subsurface conditions in the Wall No. 4 area. This has been added in the report.				
28	Section 7.2 Subsurface Soil and Geologic Condition (sic) Area A - North of Retaining Wall #4	Why are the proposed cuts not shown on the map or discussed in this section? It appears they are not discussed in the report.	The cuts have been added to the revised maps. The cut is discussed in Section 8.1 (Cuts and Excavations).	PCI	A	A	
29	Section 7.2 Subsurface Soil and Geologic Condition (sic) Area near Retaining Wall #5	The rocks in this paragraph and Figure 5B are variously identified as metasandstone, schist, and chert. Justify this.	The rock names have been clarified to make them consistent. LOTB sheets have been revised as appropriate. The "meta" prefix has been	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
			eliminated.				
30	Section 7.2 Subsurface Soil and Geologic Condition (sic) Figures 1-5, 5A, 5B, etc.	Identify the structures, cuts, or fills that are proposed at each photo site. Identify the location of each photograph such that it can be located on a topographic map. Identify the locations on the geologic map. It is not clear that these photographs have any relevance to the text.	Stations, for each photo location, are noted on the photographs included in the appendix.	PCI	A	A	
31	Section 7.2 Subsurface Soil and Geologic Condition (sic) Figure 5B	Why is the bedding in this chert assumed to be consistent? What is the significance of the description of near-vertical bedding, assuming that the bedding is consistent throughout the area of interest?	We did not assume the bedding in the chert to be vertical for the design. The observation in the cut is noted.	PCI	A	A	
32	Section 7.4.1 Ground Motion	*"It is possible that ....but it should have the flexibility to withstand fault movement. "* This statement is overly simplistic and the entire proposal of building a retaining wall on a fault needs to be carefully described and justified.	The retaining wall (Former Retaining Wall No. 1) has been eliminated and replaced by a cut slope.	PCI	C	C	
33	Section 7.4.2. Ground Rupture	*"Burdell Mountain fault zone may be crossing a portion of the proposed Retaining Wall No. I. "* What mitigation should be considered for this? Should	Since the wall has been replaced by a cut slope (See Response No. 32),	PCI	C	C	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal:** 95% Submittal (2010)	**Date:** 4/21/10

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
		paleoseismic studies be conducted? What factors could affect type selection? How likely is the fault to rupture? Would it be possible to construct a cut slope instead of a wall or to realign the road so a wall is not needed? Discuss the potential problems in detail.	the comment does not apply.				
34	Section 7.4.3. Liquefaction	This section does not address published liquefaction maps that identify moderately liquefiable zones.	The liquefaction map based on work by Lettis & Assoc. and USGS as presented in the PGR, indicates low liquefaction potential for the entire project limits. A new map from 2006 indicates moderate liquefaction potential for the alluvial soils, with a small zone in the southern end with a very high liquefaction potential. These have been noted in the revised report.	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
35	Section 8.1.1 Erosion Control and Mitigation	List proposed cuts that will expose debris flow or landslide deposits. What is the extent of potential exposed debris flow or landslide deposits? What other soil units are present that are potentially subject to erosion? What about published soil surveys - are any of the soils along the alignment highly erodible?	The revised report describes each significant cut based on the related exposure of debris flow and landslide.	PCI	A	A	
36	Section 8.1.3	The estimates of rippability could be unreliable and misleading if the bedrock has not been characterized adequately. Determining whether this bedrock in the study area has a Block-in-Matrix structure is crucial to understanding rippability. The report needs to be revised to expressly address this question, and this section must address the excavation of Block-in-Matrix material if it is determined that the study area is part of a Block-in-Matrix terrane. List proposed cuts, walls, and structures that will lie in melange rock. For each of these, use boring logs and surface outcrops to estimate the percentage and size of blocks and percentage of matrix. Estimate the rippability of each component.	The section on Rippability has been revised to reflect the high variability of the Franciscan Complex rocks. Potential for presence of large boulders and hard rocks difficult to excavate by conventional equipment has been noted in the revised report.	PCI	A	A	
37	Section 8.3 Earth Retaining Systems	Recommendations for each wall within mapped Franciscan complex should be revised after discussing concerns with our staff.	We have discussed the concerns regarding Franciscan Complex with Caltrans and our report has been revised	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
			to address their concerns as appropriate,				
38	Retaining Wall No.2	Justify the statement that the slumps appear to be surficial. Could this be erosion of an older cut slope? If they area surficial slumps, would this repair involve removing the toe of the slope to build the wall? Can the material support the typically steep temporary cut? What geologic unit is this mapped in? If it is in Franciscan Complex, address issues specific to the Franciscan in this area.	Retaining Wall 2 has been moved upslope and is now a small cut wall.	PCI	A	**A**	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/21/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
39	Retaining Wall 4	Do Figures 4A and 4B show the location of Retaining Wall 4? While we have not visited the site, it appears from Figure 4A that the cut slope could be in Block-in-Matrix rock. The contact between the dark gray rock and the reddish-brown loose material appears to be near-vertical. If this is true, the calculations of thickness of debris flow deposits cannot be correct. If this is incorrect, you could revise the figure by adding a dotted line showing the contact between two units.	Based on a new test pit (TP-171) excavated subsequently , the thickness of debris flow deposits above the Franciscan Complex rock is in the order of 4 feet throughout the wall alignment. It should be noted that on our revisit to the site, 25-foot wide essentially vertical shear zone was identified in the cut slope at centered at approximately Sta. 345+75. A photo (Photo No. 3) in the report is presented for the location.	PCI	A	A	
40	Section 12.1 Construction Advisories	If, upon review, the area is judged to be located within a Block-in-Matrix unit of the Franciscan Complex, this section must be revised.	This section has been revised to reflect block-in matrix issues like extreme variability, etc.	PCI	A	A	

Agency:	Caltrans		**Responded By:**	BKF Engineers
Review Unit:	Office of Geotechnical Design Geotechnical Services Division of Engineering Services		**Date Responded:**	
Comments By:	Anna Sojourner Engineering Geologist	Grant Wilcox Chief, Branch B	**JRT Meeting Date:**	
Contact Info:	(510) 622-8839	(510) 286-4835		
Date Reviewed:	4/21/10			

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal:** 95% Submittal (2010)	**Date:** 4/21/10

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
41	Appendix D, Plates D-l to D-5	Each map needs a legend.	A Legend has been added in Appendix D. in the revised report for all the maps.	PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
	Draft Geotechnical and Materials Report (GDMR) Review						
1	General	The report should include all relevant information / data from the Materials Report dated August 15,2005, prepared by Caltrans North Region	All relevant information/data from the Materials Report dated August 15, 2005 prepared by Caltrans North Region has been included in the revised report.	PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
2	General	Please include a section addressing the feasibility of lime treatment of the existing subgrade soil	Statements have been included in the revised report, indicating that lime treatment was determined not to be a viable option based on width and limited extent of paving at this location..	PCI	A	A	
3	Page 28	Subsurface Drainage Mitigation: Caltrans typically uses an 8" perforated PVC pipe not a 6" perforated PVC pipe as stated		PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
4	Page 52 Table 6	We noticed several R-values missing which according to Plates 2A thru 2H had been taken. The missing R-values are A-09-107, A-09-121, A-09-123, A-09-141, A-09-153, A-09-155	All bulk samples collected for R-value testing were not tested; only selected samples were tested. All samples tested are included in Table 6 (Revised as Table 6A).	PCI	C	**C**	
5	Page 52 Table 6	Add a column to indicate the NB or SB location of the boring		PCI	A	**A**	
6	Page 52 Table 6	Include a table for R-value sampling, similar to the one prepared by Caltrans North region	Table 6B has been added for R-values for the Caltrans North Region	PCI	A	**A**	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
7	Page 52 Table 6	All R-values from the Caltrans North Region Report should be considered in deciding the Design R-values.	All relevant R-values from Caltrans North Region report have been considered in deciding the design R-values.	PCI	A	A	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
8	Page 52	Using an R-value of 5 for the entire job is wasteful considering there are no R-values as low as 5 that were taken. Most of the R-values taken were high with only a few low ones. From Sta N2 279+05 to 417+17 I suggest using an R-value of at least 10. I believe this would be more than conservative. There are other R-values taken in this area to verify our belief.	Per the comment, design R-values were revisited. Data from existing GDMR and the R-values from the Caltrans North Region report were considered.. An R value of 5 was used south of Sta. 279+05 and 10 for north of Sta. 279+05 as noted in the comment.	PCI	A	**A**	
9	Page 52	For all fill areas use an R-value of 15	An R-value of 15 has been used for the NB Off-ramp, which is totally on fill.	PCI	A	**A**	

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
10	Pages 54 - 55	Caltrans now uses AB(2) instead of AB(3) in its roadway designs.	AB (Class 3) has been changed to AB (Class 2) in the revised report.	PCI	A	A	
11	Pages 54 - 55	Include a specification for the permeable material blanket.	Agreed. A specification for the permeable material has been included.	PCI	A	A	
12	Pages 54 - 55	As stated on page 28 of this report, a structural section using PM(3) for cut areas is necessary. Up to one foot of the AS(4) shall be replaced with PM(3). The depth of the underdrain trench shall be a minimum of 3' below the proposed structural section. Encapsulate both the PM(3) and the underdrain trench with filter fabric. The 8" underdrain shall be placed along the edge of pavement.	Disagree. A 3-ft deep toe drain will be placed at the toe cut slopes to prevent subsurface flows into the pavement..	PCI	C	C	

Marin/Sonoma Narrows – Segment B1
Redwood Landfill Interchange Project (EA 04-264071)

Agency:	Caltrans	**Responded By:**	BKF Engineers
Review Unit:	Engineering Services I – Materials B	**Date Responded:**	
Comments By:	Paula Kindinger-Wilcox Materials Design Engineer	**JRT Meeting Date:**	
Contact Info:	(510) 286-4692		
Date Reviewed:	4/7/10		

TECHNICAL COMMENT REVIEW AND RESPONSE

File: MSN B1 PS&E and GDMR	**Submittal: 95% Submittal (2010)**	**Date: 4/7/10**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-Caltrans to Evaluate; **E** – TAM to Evaluate; **F** – County to Evaluate; **G** – N/A (No Action Required at this Time)

Item No.	Drawing or Page No.	Review Comments	Design Responses	Consultant Responsibility	Revision Action	JRT Disp.	Final Disp.
13	Page 59	For Imported Borrow, use an R-value no less than 15	An R-value of no less than 15 has been used for Imported Borrow in the revised report.	PCI	A	A	
14	Page 59	Use AB(2) instead of AB(3)	AB (Class 3) has been replaced by AB (Class 2) in the revised report	PCI	A	A	
15	Site Plan	Plates showing the boring locations should be updated to include all locations of R-value sampling conducted by Caltrans North Region	Site Plans have been revised to include all locations of R-value samples within the project limits collected by Caltrans North Region.	PCI	A	A	

7. Geotechnical Investigation Report – North Marin Water District Aqueduct Relocation

FINAL
GEOTECHNICAL INVESTIGATION REPORT
NORTH MARIN WATER DISTRICT AQUEDUCT RELOCATION
MARIN-SONOMA NARROWS CONTRACT B-1
AT RTE 101
MARIN COUNTY, CALIFORNIA
04-MRN-101 R23.2/27.1 EA 264071
Project No. 040000073 Phase 1

For

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A,
San Jose, CA 95131
(408) 452-9000

October 31, 2011 Job No. 208140.MWD

TABLE OF CONTENTS

Page

INTRODUCTION 1
PURPOSE AND SCOPE 1
PROPOSED CONSTRUCTION 2
SITE CONDITIONS 3
PERTINENT PROPOSED IMPROVEMENTS 4
TOPOGRAPHY ALONG ALIGNMENT 5
REPORTS AND INVESTIGATIONS 6
FIELD INVESTIGATIONS 7
- Soil Borings and Test Pits 7
- Cone Penetrometer Testing (CPT) 10
- Geologic Interpretation and Mapping 11

LABORATORY TESTING 12
SUBSURFACE SOIL AND GEOLOGIC CONDITIONS 12
- Information from Soil Borings, Test Pits and CPTs 12
- Cut Slopes 13
- Geologic Interpretation 13

SITE GEOLOGY 15
- Bimrocks (Blocks-in-matrix rocks) 15

GROUNDWATER 18
SURFACE WATER AND EROSION 19
EARTHQUAKE CONSIDERATIONS 19
FINDINGS AND RECOMMENDATIONs 21
- General 21
- Seismic Design 21
  - Transient Ground Movements 22
  - Fault Movements 22
  - Liquefaction 23
  - Seismic Settlements 24
- Unstable Soil Zones 24
  - Shear Zone approximately at Sta. 345+75 (“RLF” Line) 24
  - Landslide Deposit between Sta. 353+00 and Sta. 361+00 (“RLF” Line) 24
- Cut Slopes along Pipeline Alignment 25
- New Embankments along Pipeline Alignment 27

Subsurface Soil Conditions 28
Fill Area No. 1 28
Fill Area No. 2 28
Fill Area No. 3 28
Embankment Settlements 29
Evaluation of Embankment Stability 32
Pipeline Trench 33
Pipe Zone Material 33
Trench Zone Material 33
Subgrade Preparation 34
Check Dams and Drains 34
Temporary Excavation and Shoring 34
Selection of Shoring 35
Working Platform 36
Construction Dewatering 37
Corrosion 38
MATERIAL DISPOSAL 39
CONSTRUCTION CONSIDERATIONS 39
Construction Advisories 39
Construction Consideration that Influence Specifications 40
Hazardous Waste Considerations 41
Differing Site Conditions 41
RECOMMENDED MATERIALS SPECIFICATIONS 41
Standard Specifications 41
INVESTIGATION LIMITATIONS 42
REFERENCES 44
AERIAL PHOTOGRAPHS 44

LIST OF TABLES

TABLE 1A: DEEP BORINGS 9
TABLE 1B: SHALLOW BORINGS 10
TABLE 1C: TEST PITS 10
TABLE 2: CONE PENETROMETER TESTS (CPT) 11
TABLE 3: SEISMIC SOURCES 20
TABLE 4: SUMMARY OF MAXIMUM FILL THICKNESS 28

LIST OF PLATES

Project Location Map ..... Plate 1
Project Site Plan ..... Plate 2
Site Plan Sheets ..... Plates 2A thru 2M
Area Geologic Map ..... Plate 3A and 3B
Regional Fault Map ..... Plate 4
Liquefaction Susceptibility Map ..... Plate 5
Typical Sections ..... Plates 6A and 6B

APPENDICES

Appendix A

Log of Test Borings
As-built Log of Test Borings (Miller Pacific Engineering)
Table for Shallow Borings for Pavement Design
Logs of Test Pits
CPT Results

Appendix B

Laboratory Tests ..... Plates B-1A and B-1B
Plasticity Chart ..... Plates B-2A and B-2B
Particle Size Distribution Curves ..... Plates B-3A thru B-3E
Corrosion Tests ..... Plates B-4A thru B-4V
Consolidated Undrained Triaxial Test ..... Plates B-7A and B-7B
Unconfined Compression Tests ..... Plates B-8A thru B-8F
Direct Shear Tests Test ..... Plates B-9A and B-9B
Unconsolidated Undrained Compression Test ..... Plate B10

Appendix C

NMWD Standard Specifications Section 02223 (Trenching, Excavation, Backfilling, and Compacting)

Appendix D

INDEX- Site Geologic Map Sheets ..... Plate No. D
Site Geologic Map - Sheet D-1 ..... Plates No. D-1
Site Geologic Map - Sheet D-2 ..... Plates No. D-2
Site Geologic Map - Sheet D-3 ..... Plates No. D-3
Site Geologic Map - Sheet D-4 ..... Plates No. D-4
Site Geologic Map - Sheet D-5 ..... Plates No. D-5
Site Geologic Map - Sheet D-6 ..... Plates No. D-6
Site Geologic Map - Sheet D-7 ..... Plates No. D-7
EXPLANATION FOR SITE GEOLOGIC MAPS ..... Plates No. D-8

Appendix E

Index – Photo Locations

Slumps in Existing Cut Slope at Station 267+00 ..... Photo No.1
Slumps in Existing Cut Slope at Station 308+00 ..... Photo No.2
Proposed Retaining Wall No.4 ..... Photo No.3
Chert exposed in Existing Cut Slope at Station 338+00 ..... Photo No.4
Erosion and Slumping of Existing Cut Slope ..... Photo No.5

Appendix F

Monitoring Locations

Appendix G

Comments and Responses

FINAL
GEOTECHNICAL INVESTIGATION REPORT
NORTH MARIN WATER DISTRICT AQUEDUCT RELOCATION
MARIN-SONOMA NARROWS CONTRACT B-1
MARIN COUNTY, CALIFORNIA
PROJECT NO. 040000073 PHASE 1

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed relocation of the North Marin Water District (NMWD) Aqueduct associated with the Marin-Sonoma Narrows Project, Segment B-1, hereinafter referred to as the "project". The project is part of the Caltrans Marin-Sonoma Narrows (MSN) Project, Segment B, which proposes to upgrade the existing Rte 101 between the cities of Novato and Petaluma from an expressway with at-grade intersections and driveway access to a freeway with interchanges and Frontage Roads to provide access to intersecting roadways and adjacent parcels. Segment B-1, beginning at Redwood Boulevard in Novato and ending at the existing Rte 101/South San Antonio Road intersection, is the most southerly of the three subsegments of Segment B. The work described in this report was performed in general accordance with the scope of work outlined in our proposal to BKF Engineers (Designer). The general location of the project site and its limits are shown on Plate 1 - Project Location Map.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the proposed water main and to recommend design and construction criteria for the water main.

The geotechnical recommendations presented in this report are intended for design input and are not intended for use as specifications. These recommendations should not be used for direct bidding purposes.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide recommendations for the relocation of the NMWD Aqueduct. The basis for this investigation is the preliminary plans provided to us by BKF Engineers. Relevant information from the Geotechnical Design and Materials Report

prepared for the Redwood Landfill Interchange Project, Marin Sonoma-Narrows Contract B-1 as it pertains to the present project were extracted and are presented in this report.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

PROPOSED CONSTRUCTION

Proposed construction for this project involves relocation of segments of the 30-inch NMWD aqueduct that are located within the Caltrans right-of-way (R/W). The pipe will be a 30-inch OD, 0.1875" thick C200 welded steel pipe with a 0.75" cement-mortar and a three-layer polyethylene wrap. A minimum of 4 feet and a maximum of 8 feet of cover will be provided for the pipeline, unless otherwise approved by NMWD. All construction discussed above will be on the west side of Rte 101 In addition, a lateral from the pipe will cross the highway at around Sta. 329+48 and will be in a jacked casing.

The replacement aqueduct will be placed within a 20-foot easement along the new Frontage Road and Bike Path improvements. The proposed alignment of the new pipe and tie-ins to the existing pipe are shown on the Site Plan for the project (Plate 2). The alignment consists of two segments as follows:

- Buck Center Segment: The easement will be located along the east side of the edge of pavement of the proposed new Southwest Frontage Road from Sta. 250+50 to Sta. 270+14.62 ("FR1" Line).
- Redwood Landfill Interchange and Silvera Dairy Segment: The alignment for this segment will extend from Sta. 322+41 ("BK" Line) in Olompali State Park to Sta. 419+33 ("RLF" Line) in Silvera Dairy. Following are the subsegments of the pipeline easements:
    - Olompali State Park to Redwood Landfill Interchange (Sta. 322+41 to Sta.334+00 "BK" Line): The easement will be located just west of the proposed new Bike Path.

- Across Redwood Landfill Interchange (Sta. 334+00 ("BK" Line) to Sta. 346+33 ("RLF" Line): The easement will cross the proposed new on- and off-ramps to the eastern side of the proposed Northwest Frontage Road.
- Along the proposed Northwest Frontage Road:
  - The easement will be located on the eastern edge of the Northwest Frontage Road pavement from Sta. 346+33 to Sta. 361+80 ("RLF" Line)
  - The easement will cross over at Sta. 361+80 ("RLF" Line) and will be located under the Northwest Frontage Road pavement from Sta. 363+60 to Sta. 406+80 ("RLF" Line)
  - The easement will cross over at Sta. 406+80 ("RLF" Line) and will be located within the Northwest Frontage Road pavement from Sta. 407+50 to the end of the line at Sta. 419+33 ("RLF" Line)
- A jacked pipe casing will cross over from the western side to the eastern side of Rte 101 at about Sta. 329+48 ("N2R" Line).

SITE CONDITIONS

Rte 101 is a north-south interstate highway. Within the project limits, the freeway is a four-lane facility with two travel lanes in each direction and shoulders separated by a median. The western side of Rte 101, the site of the proposed construction, has a rolling terrain. The terrain rises from the road level throughout the alignment within project limits. Steepest slopes (approximately 2:1) are present in several locations with slope heights up to 40 feet higher than adjacent grade (e.g. at Sta. 344+50 ("N2R" Line)).

The slopes at the project site consist of natural slopes and man-made cut slopes on the hillsides and man-made embankment slopes at the existing bridge abutments. Most of the natural slopes have gradients of 2(H):1(V) or flatter and are covered with vegetation. However, except for some localized areas, the vegetation is limited to natural grasses and is not a result of specific plantings. In general, the higher natural slopes (steeper than 5(H):1(V)) are underlain by hard rock (usually Franciscan Mélange) at relatively shallow depths except where debris flows or

landslides have deposited significant thicknesses of deposits or where colluvium has accumulated.

Significant man-made cuts pertinent to the pipeline project are noted at the following locations:

- A 2:1 cut slope exists on the western edge of Rte 101 along the alignment between Sta. 256+58 and 260+97 ("FR1" Line). Several local slumps and erosion gullies are noted on the cut slope. (See Photo No. 1 in Appendix E)
- A major cut slope exists along the west/southwest edge of the existing on-ramp from the northwest to the Redwood Landfill Bridge. The slope is steeper than 2:1 and is approximately 30 feet high. A few small scarps are noted on the slope. (See Photo No. 3 in Appendix E)
- Cut slopes exist on the southwestern edge of Rte 101 in the area of proposed Retaining Wall No. 7 (Sta. 358+96 to Sta.361+20 ("RLF" Line)). Localized erosion and slumps are noted on the cut slopes. (See Photo No. 5 in Appendix E)

As noted above, there is evidence of shallow slumps in several locations within the project limits, particularly in the steeper cuts. Localized failure of a 25- to 30-foot wide portion of the existing cut slope is located northwest of the Redwood Landfill Overcrossing, where a shear zone in Franciscan sandstone is exposed (See Photo No. 3 in Appendix E). It is an ancient fault contact with no evidence of recent movement.

PERTINENT PROPOSED IMPROVEMENTS

The Redwood Landfill Road Overcrossing (Bridge No. 27-0115) is within the project limits. The existing overcrossing is approximately 253'– 6" long and 34'- 4" wide and carries one lane of traffic each in the southwest and northeast directions. Widening of the bridge is proposed as part of the Redwood Landfill Interchange Project, Marin Sonoma-Narrows Contract B-1. Other improvements in the Contract B-1 pertinent to this aqueduct relocation project are:

- New diagonal on- and off-ramps for southbound Rte 101 at the Redwood Landfill Road Overcrossing;
- New Frontage Road on the west side of Rte 101, starting from the Redwood Landfill Road Overcrossing and connecting to San Antonio Road (Northwest Frontage Road) – Sta. 340+75 to Sta. 420+27 ("RLF" Line);
- New Frontage Road on the west side of Rte 101, starting from Sta. 226+00 ("FR1" Line) and ending at the gate to the Olompali Park Historic site at Sta. 280+70 ("FR1" Line) (Southwest Frontage Road);
- A new Class 1 Bike Path running parallel to Rte 101 on the western side of the freeway, from Sta. 304+10 to Sta. 334+37 ("BK" Line);
- Two retaining walls on the western edge of the Northwest Frontage Road:
    - Retaining Wall No. 4 (Sta.342+69 to Sta. 346+67 ("RLF" Line))
    - Retaining Wall No. 7 (Sta. 358+96 to Sta.361+20 ("RLF" Line))

TOPOGRAPHY ALONG ALIGNMENT

The proposed pipeline alignment is located along the western side of Rte 101 across hills and valleys. The pipelines will generally follow the Frontage Roads and the Bike Path alignments and at some locations will follow natural terrain. The proposed alignment is shown on Plate 2. Typical sections are shown on Plates 6A and 6B. Per the present plans, the proposed pipe cover is generally around 4 feet.

The topography along various segments of the alignment is presented below.

Buck Center Segment Sta. 250+50 to Sta. 270+14.62 ("N2R" Line):

The finish grade elevations along the alignment range from 25 to 34 feet. In this segment, the alignment crosses two significant new fills (Sta. 251+00 to Sta. 257+00); and Sta. 261+00 to Sta. 264+50 ("FR1" Line) and a significant new cut (Sta. 256+50 to Sta. 261+97 ("FR1) Line)).

Olompali State Park to Redwood Landfill Interchange (Sta. 322+41 to Sta.334+00 "BK" Line):
The finish grade elevations along the alignment rise from approximately 26 feet at the southern end to 77 feet at the northern end. The alignment crosses a significant cut slope (Sta. 328+91 to Sta. 334+37 ("BK" Line)).

Across Redwood Landfill Interchange (Sta. 334+00 ("BK" Line) to Sta. 346+33 ("RLF" Line):
The pipeline crosses the southbound on- and off-ramps. The finish grade is approximately at elevation 77. The pipe cover varies from 4 feet at the southern end to 12 feet at the northern end.

Along the proposed Northwest Frontage Road (Sta. 346+33 to Sta. 419+33 ("RLF" Line)):
The alignment starts with a large fill (Sta. 347+00 to Sta. 359+50 ("RLF" Line)). Finish grade in this segment ranges from 76 to 88 feet. Thereafter, the pipeline follows the existing terrain. Elevations range from 76 feet at the southern end, going down to 45 feet at Sta. 365+80. Thereafter it rises to elevation 101 feet near the end of the line.

REPORTS AND INVESTIGATIONS

The following geotechnical investigation report and Caltrans as-built plans were also reviewed to supplement the subsurface soil information for the project:

- "Preliminary Design Report for Relocation of the North Marin Water District Aqueduct associated with the Marin-Sonoma Narrows Project Segment B-1" prepared by CSW/ST2, April 22, 2010 (Revised January 5, 2011)
- "Preliminary Geotechnical Report for Marin/Sonoma Narrows HOV Lane Proposed Improvements" (PGR), prepared by Caltrans, August, 2005
- "Final Geotechnical and Materials Report, Marin-Sonoma Narrows Contract B-1, Redwood Landfill Interchange Project, Marin County, California", prepared for BKF Engineers by Parikh Consultants, October 17, 2011

FIELD INVESTIGATIONS

Field investigations were conducted in conjunction with the Geotechnical Design and Materials Report for this project. These included:

- Geological Interpretation and Mapping
- Drilling Soil Borings and Collecting Soil Samples
- Excavating Test Pits
- Performing Cone Penetrometer Tests (CPT)

Soil Borings and Test Pits

Based on the plans and discussions with the design team, and readily available geotechnical data in the vicinity of the project area, 41 borings and 8 test pits were relevant to the design and construction of the proposed pipelines. These include 3 borings in the general area of the proposed pipe jacking location. Depths of these borings ranged from 5 to 142 feet. The test pits ranged in depth from approximately 7.5 feet to 11 feet. Thirty of the borings were drilled in 2009. Subsequently, eight additional borings were drilled and the eight test pits were excavated between November, 2010 to January, 2011 to allow for the design and alignment changes.

Pertinent information for the deep borings (deeper than 5 feet) is summarized in Table 1A. Pertinent information for the 5-ft deep borings is summarized in Table 1B. Pertinent information for the test pits is summarized in Table 1C.

The locations of all the borings and test pits are presented in the Site Plans (Plates 2A through 2M). Boring logs for the borings greater than 5 feet deep are presented in the Log of Test Borings (LOTB) sheets in Appendix A. Appendix A also includes as-built LOTB sheets. Most of the borings were drilled with truck-mounted drill rig using 8-inch-diameter hollow stem auger. At two locations that presented access difficulties, the borings were drilled using a portable drill rig using a 4-inch-diameter solid stem auger. Seven borings were drilled using a track-mounted rotary wash drill rig, using an approximately 5-inch diameter hole. Test pits were excavated

using a backhoe with a 30-inch bucket. The test pits ranged in depth from approximately 6 feet to 13 feet.

Soil samples were generally obtained by driving either a 2.5-inch I.D. (Modified California, MC) sampler or a 1.4-inch I.D. (Standard Penetration Test, SPT) sampler at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The blow counts are presented on the LOTB sheets in Appendix A. When correlating standard penetration data, the blow counts for the Modified California Sampler may be converted to equivalent Standard Penetration Test blow counts by multiplying a factor of 0.65 (DMG Special Publication 117 (Guidelines for Analyzing and Mitigating Liquefaction). The samples were sealed and transported to our laboratory for further evaluation and testing. A few rock core samples were obtained using HQ diamond core barrels. The core barrel had a 2.4-inch ID and was advanced by hydraulic pressure.

The field investigation was conducted under the supervision of our field engineer/geologist who logged the soils encountered in the test borings during drilling and prepared the samples for subsequent laboratory testing and evaluation.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

TABLE 1A: DEEP BORINGS

Boring No.	Station (ft.) "N2R" Line	Offset (ft.)	Drilling Method	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
A-09-149	250+35	65 Lt.	Hollow Stem Auger	15	19	*
R-10-167	254+83	136 Lt.	Rotary Wash	19	17	*
A-09-150	255+70	70 Lt.	Hollow Stem Auger	10	12	*
A-10-166	257+00	50 Lt.	Hollow Stem Auger	6	13	*
A-10-164	259+12	50 Lt.	Hollow Stem Auger	19	14	*
R-10-161	259+80	500 Lt.	Rotary Wash	142	95	*
R-10-162	260+00	235 Lt.	Rotary Wash	62	67	*
R-10-162A				14		
A-10-163	261+00	53 Lt.	Hollow Stem Auger	22.5	13	*
R-10-165	262+32	113 Lt.	Rotary Wash	16.5	19	*
A-09-151	270+50	75Lt.	Hollow Stem Auger	10	14	*
A-09-120	329+50	75 Lt.	Hollow Stem Auger	13	37	*
A-09-122	332+60	150 Lt.	Hollow Stem Auger	15	56	*
A-09-129	334+95	295 Lt.	Hollow Stem Auger	21.5	85	*
R-09-130	336+45	435 Lt.	Rotary Wash	60.5	120	*
A-09-125	336+85	230 Lt.	Hollow Stem Auger	22.5	71	*
R-09-131	338+25	385 Lt.	Rotary Wash	47.5	101	*
A-09-132	340+10	325 Lt.	Hollow Stem Auger	35	74	*
A-09-126	341+40	135 Lt.	Hollow Stem Auger	18.5	51	*
A-09-133	342+00	265 Lt.	Hollow Stem Auger	15	63	*
A-09-127	343+50	60 Lt.	Hollow Stem Auger	10	51	*
A-09-134	345+35	215 Lt.	Hollow Stem Auger	20	63	*
A-09-135	349+45	215 Lt.	Hollow Stem Auger	35	93	*
A-09-136	352+15	210 Lt.	Hollow Stem Auger	10	90	*
A-09-137	355+15	180 Lt.	Hollow Stem Auger	15.5	59	*
A-09-138	357+35	175 Lt.	Hollow Stem Auger	22.5	49	*
A-09-139	361+25	175 Lt.	Hollow Stem Auger	10	54	*
A-09-143	384+55	140 Lt.	Hollow Stem Auger	90	83	*
A-09-144	395+10	105 Lt.	Hollow Stem Auger	30	96.5	*
A-09-145	401+50	100 Lt.	Hollow Stem Auger	10	117	*
A-09-146	407+10	75 Lt.	Hollow Stem Auger	23.5	127	*
A-09-105**	326+25	275 Rt.	Hollow Stem Auger	20	10.5	*
A-09-108**	326+45	75 Rt.	Hollow Stem Auger	15	24	*
A-09-109**	330+00	95Rt.	Hollow Stem Auger	38	26.5	-3.5

* Groundwater was not encountered in the boring during drilling ** For jacked pipe casing

TABLE 1B: SHALLOW BORINGS

Boring No.	Station (ft.) "N2R" Line	Offset (ft.)	Boring Depth (ft.)	Soil Description
A-09-118	325+65	5 Lt.	23	Sandy Lean Clay with some Gravel
A-09-119	326+80	45 Lt.	28	Sandy Silt
A-09-124	344+00	45 Lt.	52	Sandy Silty with some Gravel
A-09-128	346+45	45 Lt.	48	Sandy Lean Clay with some Gravel
A-09-140	364+50	150 Lt.	66	Sandy Lean Clay with Gravel
A-09-141	372+65	125 Lt.	69	Silty Sand
A-09-142	379+65	113 Lt.	76.5	Sandy Lean Clay
Note: All borings are 5 feet deep. Groundwater was not encountered in any of the borings.				

TABLE 1C: TEST PITS

Test Pit No.	Station (ft.) "N2R" Line	Offset (ft.)	Excavation Method	Test Pit Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
TP-156	268+12	242 Lt.	Backhoe	9.5	40	*
TP-159	331+40	300 Lt.		7.5	85	*
TP-160	334+40	500 Lt.		6	175	*
TP-168	348+36	184 Lt.		8.5	75	*
TP-169	349+80	175 Lt.		11	82	*
TP-170	352+20	164 Lt.		7.5	82	*
TP-171	339+10	300 Lt.		7.5	75	*
TP-172	343+65	204 Lt.		13	65	*
* Groundwater was not encountered in the test pit excavation						

Cone Penetrometer Testing (CPT)

Four cone penetrometer tests (CPT) were performed for this project to augment the existing information from the Redwood Landfill Road Interchange GDMR, primarily for assessment of potential for liquefaction in the alluvial soils along the pipeline route. Pertinent information for the CPTs is presented in Table 2.

CPT work was performed by California Push Technologies Incorporated on February 23, 2011 using a track mounted CPT rig. The CPTs were conducted using a 60-degree cone attached to a

1.7-inch diameter rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure dissipation measurements during CPT operation. Detailed information from the CPT investigation is presented in Appendix A.

TABLE 2: CONE PENETROMETER TESTS (CPT)

CPT No.	Station (ft.) "N2R" Line	Offset (ft.)	CPT Depth[(1)] (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Depth (ft)	Approx. Groundwater Elevation (ft)
CPT--11-S1	243+60	105.0 Lt.	37.5	11.0	4.0[(2)]	7.0
CPT-11-S2	360+36	122.5 Lt.	22.5	50.5	18.0[(3)]	32.5
CPT-11-S3	373+50	124.5 Lt.	29	71.5	10.0[(3)]	61.5
CPT-11-S4	383+40	131.0 Lt.	36	84.0	7.0[(3)]	77.0
Notes: (1) Refusal encountered, possibly bedrock encountered: (2) tape measured; (3) based on dynamic pore pressure profile						

Geologic Interpretation and Mapping

Published geologic maps and other geologic information pertinent to the project were reviewed. In addition, apparent surface contacts between deep-seated landslides, debris flow deposits, alluvial fans, and "bedrock slopes" (area of thin soil over in-place bedrock) were mapped based upon their distinctive geomorphic expressions in the photogrammetrically produced topographic contours and stereoscopically viewed aerial photographs. In general, such interpretations involved recognition of the intersections of different fan-shaped surfaces formed by accumulation of slopewash and debris flow deposits, as well as the lobate toes of the landslides.

Site visits were conducted and photographs were taken at various locations of interest to the project. Selected site photographs and a key map of the photograph locations are presented in Appendix E. On-the-ground observations enabled us to map the approximate extents of scarps and depositional lobes of localized slumps. This helped confirm the available information or modify it as appropriate. Project-specific geologic maps were thereby generated for use in the development of appropriate engineering recommendations for various elements of the project.

The resulting geomorphic maps are presented in Appendix D (Plates D-1 through D-7). The plates in Appendix D show the inferred geologic contacts in the vicinities of the planned walls and cut slopes, presented on the project's topographic base map overlaid on recent orthophotos.

LABORATORY TESTING

Laboratory tests performed for the study include the following: Laboratory determination of Moisture-Density (California Test Method 226), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), Unconsolidated Undrained (UU) and Consolidated Undrained (CU) Triaxial Tests, Direct Shear Test, and Corrosion Test (California Test Method 643. The laboratory test results are included in Appendix B. Laboratory test results for moisture content, unit weight and unconfined compression tests are presented on the LOTB sheets in Appendix A at the appropriate sample depths.

SUBSURFACE SOIL AND GEOLOGIC CONDITIONS

Subsurface information for the project site consisted of (a) information from soil borings and test pits; (b) information from cuts and rock outcrops within the project limits and vicinity; (c) information from geologic maps and interpretations of the geologic maps in conjunction with geomorphology.

Information from Soil Borings, Test Pits and CPTs

General subsurface information as revealed by the soil borings, test pits and CPTs is summarized below:

- In general, rock was encountered at relatively shallow depths. The deepest depth to rock in the borings is 22 feet in Boring A-09-132, drilled on the west side of the proposed Northwest Frontage Road, south of Retaining Wall No. 1. Rock was not encountered in five of the deep borings (boring depths greater than 5 feet), all drilled to depths of 15 feet or less. Refusal (exceeding 20 tons thrust capacity) was encountered in all the four CPTs,

at depths ranging from 22.5 feet to 36 feet; it is inferred that rock or "rocklike" material was encountered at that depth. The rock in the borings and test pits was generally identified as weathered sandstone or claystone. There is evidence of mylonite below the sandstone (in boring A-09-132) west of the freeway along the proposed Northwest Frontage Road. The sandstones and claystones are generally blocks within the Franciscan Complex (e.g. blocks-in-matrix (bimrocks)). The debris flow deposits and landslide deposits are also classed as bimrocks. Further discussion on bimrocks is presented in the following sections of the report.

- The soils overlying the rock are alluvium, colluvium, or landslide deposits consisting predominantly of very stiff lean clays and sandy clays and medium dense to very dense silty and clayey sands with gravel. Significant portions of the colluvium have been identified as debris flow deposits.

Cut Slopes

Soil/rock exposed by the cut slopes of interest to the project discussed below.

- Apparent landslide deposits (containing rounded fragments of Burdell Mountain Volcanic rocks) are present at the ground surface above the existing cut off the slope along the western edge of Rte 101, at the proposed cut between Sta. 256+58 and Sta. 260+97 ("FR1" Line).
- Colluvium and debris flow deposits overlie Franciscan Complex rock in the southern end of the cut slope along the western edge of the existing southbound off-ramp from Rte 101 to the Redwood Landfill Bridge. The thickness of the colluvium increases to the north, where the cut face exposes debris flow deposits over the full 8-foot height (see Photo No. 3 in Appendix D). A shear zone, approximately 25 feet wide was noted in the cut face and fragments of serpentinite were observed within the zone.

Geologic Interpretation

Geologic interpretation based on review of existing literature and field mapping indicated that the project site is underlain by the Franciscan Complex blocks–in-matrix rock (Franciscan

Mélange (fm) (fch)), which consist of various rock types, having different origins. For the most part, within the project area, Franciscan Complex and mélange rocks were the result of tectonic agglomeration of massive sandstone and alternating thin beds of sandstone and shale with minor chert. It appears that the predominant rock type on the northeastern side of Rte 101 is chert and on the southwestern side it is greywacke sandstone.

The geologic maps prepared by our geologist (Plates D-1 through D-7 in Appendix D) indicate the following interpretations in the areas of the proposed major improvements for the Interchange project:

- As shown on Plate D-2, Southwest Frontage Road alignment between Sta. 256+58 and Sta. 260+97 ("FR1" Line) lies partially within an area of a mapped landslide deposits (Qls). The toe of the landslide extends on to the upper portion of the proposed cut slope for the new Southwest Frontage Road.
- As shown on Plates D-4 and D-5, cut slopes for the Bike Path between Sta. 328+91 and 334+37 ("BK" Line) cross over a ridge of Franciscan Mélange, flanked on both sides by colluvial slope wash deposits. Per the published map on Plate 3A, the alignment is located within debris flow deposits, which is essentially similar to slope wash deposits but containing larger blocks within the sandy matrix.
- As shown on Plate D-5, the Retaining Wall No. 4 alignment crosses over an area of debris flow deposits. The debris flow deposits extended to the Highway prior to construction of the interchange. The geologic map is confirmed by the borings and the existing cut exposure discussed in the previous section, where the debris flow is underlain by greywacke sandstone within Franciscan Mélange.
- A cut (which includes Retaining Wall No. 7) is proposed on the west side of Northwest Frontage Road, north of Retaining Wall No. 4. The cut alignment as shown on Plate D-5 crosses a zone of landslide deposits, confirmed by test pits TP-168, 169, and 170.
- Another significant cut is proposed on the southwest side of Northwest Frontage Road, near the north end of the project boundary. The cut alignment as shown on Plate D-7 crosses the toe of a fan where colluvium has been deposited at the mouth of a swale between two ridges.

SITE GEOLOGY

General geologic features pertaining to the site were evaluated by reference to the "Preliminary Geologic Map of the Napa 30' x 60' (100k) Quadrangle, California", compiled by Wagner, D. L. and Gutierrez, C. I. (California Geological Survey, 2010). A portion of the map that covers the project vicinity is shown on Plate 3A; a companion key to the map is presented on Plate 3B. As noted earlier in the section, Geologic Interpretation, project-specific geologic maps (Plates D-1 through D-7 in Appendix D) were generated for use in the development of appropriate engineering recommendations for various elements of the project.

Based on the available geologic maps, the geologic units at the project location consist predominantly of Alluvium (Qa), Colluvium (Qc), and Franciscan Complex blocks-in-matrix (KJf). Presence of Undifferentiated Volcanic Rock (Tv) and Franciscan Mélange (fm) is also noted in the vicinity of the project on the western side of Rte 101. Landslide Deposits (both deep-seated rotational slumps and shallow debris flow deposits) occupy much of the lower slopes west of Rte 101. Bay Mud (Qm) is mapped in several places east of Rte 101, beneath a small portion of the freeway alignment. Published maps also note areas of Debris Flow Landslides and Block Slump Landslides. Detailed descriptions of the rock units are included in Appendix D.

Structural discontinuities (such as bedding, folds, fractures, joints) within the rock generally strike parallel with Rte 101 (Southeast to Northwest) and dip steeply to near vertical. In general, structural discontinuities are not significant to most of the project improvements. However, there are several localized areas, where shear zones cross the project alignment (e.g. Retaining Wall No. 4 and the cut for Southwest Frontage Road between Sta. 256+50 and 261+97).

Bimrocks (Blocks-in-matrix rocks)

The distribution and types of the various material types present at the site have been discussed in the previous sections. Two material types are predominant in the areas of planned major modifications: Franciscan Complex and landslide and debris flow deposits. A third material type

of significance is within the sheared zone. The behavior of all these three material types is of primary significance to the design and construction of the project.

A common characteristic of all these three material types is that they are chaotic mixtures of strong blocks within a weaker matrix. They may, therefore, be designated as "bimrocks," a geologically neutral word coined by Medley (1994) as a short form for "block in matrix rocks" per Raymond (1984). This section on bimrocks is presented due to the predominant presence of bimrocks in the project area and since their mechanical properties are significantly different from those of conventional 'soil' or 'rock' units.

Major work on bimrocks has been published by Medley and others in recent years, which has greatly enhanced our understanding. Based on available literature, the following may be noted:

- Bimrocks are mixtures of rocks composed of geotechnically significant blocks within a bonded matrix of finer texture.
- There is a mechanical contrast between the blocks and the matrix between the blocks.
- The volume and size of the blocks influence the mass properties at the scales of engineering interest.
- Block sizes may range from millimeters to several kilometers.
- Bimrocks may have considerable spatial, lithological and textural variability.
- Bimrocks should not be approached as stratigraphically orderly ("layer-cake") rocks.
- Important engineering characteristics of bimrocks include:
    - Block volumetric proportions (volume occupied by blocks/total volume)
    - Block size distributions and overall block orientations
    - Matrix strengths and matrix-to-block contact strengths
    - Matrix and block discontinuity fabrics.

Block lithologies, block strengths, individual block shapes and matrix lithologies are of lesser importance to predicting overall behavior of cut slopes along and in the vicinity of the pipeline alignment and consequent effect on the integrity of the pipeline.

From associated literature, it appears that block volumetric proportions are probably the most significant parameter for design for this project. This literature indicates relationships between volumetric block proportion and strength or deformation characteristics of the material as a whole. These relationships enable a practicing engineer to avoid overly conservative designs using only the strength characteristics of the matrix. Also present in the literature are projects where extensive focused investigation enabled the determination of a spatial distribution of block volumetric proportions (BVP) and development of project-specific relationships between block volumetric proportions and strength characteristics (e.g. friction angle) of the bulk material.

Two terms that are very significant for our purposes emerge from literature: "block-rich" and 'block-poor". The fundamental meanings of the terms are somewhat self explanatory. Available literature indicates that for BVP below 25 percent, the strength will be dominated by that of the matrix and BVP above 75 percent will be dominated by block strength. For intermediate values of BVP, the values may be interpolated. It may be noted that the overall strength of a bimrock is typically independent of the strength of the blocks themselves. Failure surfaces are always through the matrix or along the interfaces between blocks and matrices, and are, therefore, tortuous (going around blocks). The strength increases with tortuosity, which increases with increasing BVP and also with a range in block sizes and orientations.

Due to the size and character of this project, coupled with the potentially high variability of materials, it was not practical to have a meaningful site-specific investigation such as described above. We believe that additional investigation beyond that performed would not have substantially improved the quality of information. Therefore, a more simple, yet pragmatic approach was taken for this study, as described below.

For convenience, bimrocks at the site were classified as either "block-rich" or "block-poor." The classification was based on: (a) information from cut exposures or natural outcrops, wherever available; (b) information from boring logs and test pits; (c) geologic and geomorphic interpretation of subsurface conditions at specific locations. In general, the Franciscan Complex was classified as "block-rich" and the debris flow and landslide deposits and shear zone material were classed as "block-poor." Based on the above information, our geologist established

expected zones of block-rich and block-poor materials at several pertinent locations as discussed in appropriate subsequent sections. Design parameters were established for each zone.

An internal friction angle of 26 degrees was assigned to the block-poor material. The value appears reasonable based on the literature for the clay/shale matrix; it is also at the lower end of the range cited by Medley in a paper submitted for publication (in press). Finally, the steepest natural slopes within the project site are approximately 2H: 1V (e.g. 26 degrees).

An internal friction angle of 36-degrees was used for block-rich material. The 36-degree friction angle is well within the range cited by Medley for block-rich units. The friction angle is also in the lower bound of the relationship:

$$\tan(\varphi_{\text{weakest block}}) / \tan(\varphi_{\text{matrix}}) = 1.5 \text{ to } 2.0$$

A particular characteristic of bimrock materials is the extreme heterogeneity in terms of block volumetric proportions, block sizes and block hardness. All of these characteristics will have significant impacts during construction. Extreme heterogeneity in terms of block volumetric proportions may result in unexpected construction difficulties. Therefore, the prospective Contractor should be made aware of that variability. Large, hard blocks of intact rock may be encountered, which may not be excavatable by conventional excavators; jackhammers or blasting may be required to break up large hard rock blocks. Hard rocks may impose hard drilling for tiebacks and/or soldier piles. All these issues are covered in greater detail in the 'Construction Advisories' section.

GROUNDWATER

Groundwater was not encountered during drilling in any of the borings on the western side of Rte 101. However, groundwater was measured 4 feet below ground surface (Elevation 7.0 feet) in CPT-1. Additionally, presence of groundwater was inferred in the three other CPTs based on dynamic pore pressure profile. Also, various degrees of seepage were encountered in the test pits. Groundwater may be encountered in excavations, particularly those made in the flatter,

lower elevation areas. It is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface and subsurface flow, ground surface run-off, and other factors that were not existent at the time of investigation. Groundwater was encountered in boring A-09-109 on the eastern side of Rte 101 at a depth of 30 feet below ground surface (Elev. -3.5 feet). The boring is in the general vicinity of the proposed pipe jacking.

SURFACE WATER AND EROSION

Rte 101 is generally flanked by higher, steeper ground on the west and southwest. Surface runoff tends to flow eastward toward the Petaluma River. In addition, there are ten creeks or streams located within the project limits, which reach the highway and are conveyed into cross culverts below Rte 101. Surface water drainage, therefore, flows toward the highway and flows into the drainage inlets located along the highway. Subsurface drainage mitigation will be provided for other creeks as appropriate as part of the Interchange project.

Colluvial sandy soils are present in many locations near the surface and exposed in the slopes. Erosion due to surface water flow is therefore a potential concern, particularly since vegetation on many of these slopes is usually limited to natural grasses.

EARTHQUAKE CONSIDERATIONS

Faults in the vicinity of the project site with a moderate to high potential for surface rupture include the Rodgers Creek Fault, the Calaveras Fault and the San Andreas Fault Zone (north coast section). Significant earthquakes, which have occurred in the region, are generally associated with crustal movements along well-defined active fault zones. A Regional Fault Map (based on Caltrans, 2007), showing the project site location relative to the major active faults in the region, is presented on Plate 4. The major faults in the vicinity, their distances from the project site, fault types and the maximum credible earthquake magnitudes associated with each fault are summarized in the table below. These maximum earthquake magnitudes represent the

largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 3: SEISMIC SOURCES

Fault	Fault Type	Estimated Closest Distance to the Project Area (miles)	Mmax
Rodgers Creek Fault	RLSS	5.6	7.1
San Andreas Fault zone (North Coast section)	RLSS	14.5	7.9
Hayward Fault Zone (Northern Coast Section	RLSS	12.1	7.3
RLSS – Right Lateral Strike Slip Fault			

A report (Reference No. 7) has been released by the United States Geological Survey (USGS), which updates all previous results in the light of new information or understanding or by a necessity to conform to a uniform statewide approach and with the NSHMP (National Seismic Hazard Mapping Program) assessment. Per the report, there is a 63% probability that an earthquake of 6.7 magnitude or greater will be released from one of the active faults within San Francisco Bay Area during the next 30 years. The probability of an earthquake of magnitude 6.7 or greater over Northern California is 93 percent. Such an event will likely produce strong ground shaking at the project location. A table showing the 30-year probability of a magnitude 6.7 earthquake or greater occurring on each of the relevant faults, per Reference No. 7 is presented below.

Fault	WGCEP Mean Probability	Maximum / Minimum Probability
Hayward-Rodgers Creek Fault	31%	67% / 12%
North San Andreas Fault	21%	39% / 6%
Calaveras Fault	7%	22% / 1%

It should be noted that the Burdell Mountain Fault Zone is not identified in the 2007 Caltrans Deterministic PGA Map, a portion of which is presented in Plate 4. However, two traces of the Burdell Mountain Fault are shown on the geologic map by Wagner et al (2010), a portion of which is presented in Plate 3A. Where they cross the central portion of the project area, the faults are concealed (represented by a dotted line) beneath landslide deposits and have no identifiable geomorphic expression at the ground surface (Ford, 2007). Per the PGR by Caltrans, the fault is

considered active, unless proven otherwise. There are no studies completed or published to estimate the Mmax or the probability of strong shaking on this fault. Based on our discussions with Ford, it is not practically feasible to evaluate its specific location, potential offset or recurrence period.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of our investigation, it is our opinion that the site is feasible for the proposed aqueduct relocation provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed aqueduct relocation according to the plans and other related information provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials and conditions encountered at the site. Therefore, in the event conditions are changed, we should be notified so that we may modify or amend our recommendations.

Seismic Design

Recommendations for Seismic Design Criteria for the project are based on applicable sections of 'Seismic Guidelines for Water Pipelines' American Lifelines Alliance in I March, 2005 (Seismic Guidelines). As per NMWD decision, the subject 30-inch water line should be classified as Pipe Function Class III (critical pipeline serving large number of customers and present significant economic impact to the community or a substantial hazard to human life and property in the event of failure). The guidelines require that the pipeline be designed for: (a) transient ground movements; and (b) permanent ground movements due to: faulting; liquefaction, lateral spread and flow failure, slope movement and landslide, and settlement.

Transient Ground Movements

The Seismic Guidelines recommend that Probabilistic Seismic Hazard Analyses (PSHA) be used for defining the hazard for single pipes extending over relatively short distances, and therefore have been used for the present project. Per the Seismic Guidelines, that for PSHA analyses, near source factors such as directivity, fault normal, hanging wall or other such factors need not be considered since it is already included in the analyses. The output from PSHA was utilized to obtain values for Peak Ground Acceleration (PGA) and Peak Ground Velocity (PGV) for use in design, consistent with the Seismic Guidelines.

The PSHA was performed using USGS's interactive deaggregation web page at: http://eqint.cr.usgs.gov/deaggint/2008/index.php for performing site-specific PSHA. The site location (latitude/longitude) was entered for the two ends and the middle of the pipeline alignment. A return period of 975 years (e.g. 5 percent probability of exceedence in 50 years, a*s* recommended in the Seismic Guidelines for Pipe Function Class III.

The output from the PSHA was appropriate for Ground Class B (rock subsurface profile) and had to be modified for site-specific subsurface profile for the required design input. Based on the subsurface conditions, e.g. shallow rock) along the pipeline alignment, Ground Class C was established for the site. Amplification factors from the Seismic Guidelines were then applied to the PSHA output to obtain the following:

- Design Peak Ground Acceleration (PGA) = 0.6 g
- Design Peak Ground Velocity (PGV) = 26 inch/sec

Fault Movements

The Burdell Mountain Fault Zone is mapped as crossing a portion of Southwest Frontage Road (Sta.247+20 to Sta. 258+80 ("FR1" Line)). This fault is inferred in the area of the pipeline crossing at depth per recent studies by Ford (2007) and Wagner et al (2010). It is not practical to investigate this fault considering its regional implications and its depth. The potential for ground rupture due to movement of this fault is undetermined. Per the PGR by Caltrans, the fault is considered active, unless proven otherwise. The fault is a right-lateral strike-slip fault. Past

displacements have moved the ground located southwest of the fault toward the northwest relative to those on the northeast side of the fault. The fault consists of two surface traces, several hundred feet apart, with possible shearing between them. The fault plane is essentially vertical. Past movements included a vertical component as well, which resulted in the present elevation of the Burdell Mountain Andesite. The 30-inch NMWD waterline will cross this inferred zone. Therefore it is recommended that isolation valves be placed on either side of this zone, at Sta. 247+00 and Sta. 259+00 ("FR1" Line), whereby the line may be shut off in the event of a fault related movement.

Liquefaction

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004).

USGS Liquefaction Susceptibility maps published in 2006 indicate 'Moderate' liquefaction susceptibility for essentially the entire project (See Plate 5). A zone of 'Very High' liquefaction susceptibility is noted on the USGS map. However, soil characteristics interpreted for CPT-11-S1 performed within that zone indicated predominantly clay soils, and therefore, low liquefaction potential. Additionally, the 'Very High' zone is outside the limits of the proposed pipeline alignment. Groundwater was not encountered in any of the borings drilled on the west side of Rte 101. Groundwater was measured or inferred in the four CPTs. However, the soil conditions interpreted in the CPTs all indicate predominantly fine grained soils: silts and clays. There is no

indication of any significant layer of loose or medium dense sands below the groundwater table. The potential for liquefaction is therefore considered low for the proposed pipeline alignment.

Seismic Settlements

Since potential for liquefaction along the proposed pipeline alignment is low, the potential for settlements occurring during an earthquake is also considered low.

Unstable Soil Zones

In addition to the Burdell Mountain Fault Zone, potentially the pipeline alignment crosses two other zones with potential for movement, as discussed below:

Shear Zone approximately at Sta. 345+75 ("RLF" Line)

As noted earlier, a shear zone was noted during the field observations (see Photo No. E-3 in Appendix E). The shear Serpentine material was also noted within the shear zone. The shear zone reflects an ancient fault with no evidence of recent movements. Nevertheless, it is recommended that isolation valves be placed on either side of the shear zone, whereby the line may be shut off in the event of a soil movement in the shear zone. It is recommended that the isolation valves be placed at Sta. 345+25 and Sta. 346+25 ("RLF" Line) or further away from the shear zone. This allows foe 25 feet of buffer zone beyond the shear zone on either side.

Landslide Deposit between Sta. 353+00 and Sta. 361+00 ("RLF" Line)

Per geologic mapping, the pipeline alignment cuts through the toe of a mapped landslide deposit. This is also in the area where Retaining Wall No. 7 is proposed. Per our geomorphic interpretation, the toe of the landslide deposits extends to the western edge of Rte 101. From our cross-sectional interpretations, the slide plane is probably 50 feet deep beneath the proposed wall location. However, the depth of the slide plane was not confirmed by our field investigations. It may be noted that the present waterline crosses this landslide mass.

Analyses were performed to investigate if the potential for slope instability in the landslide mass was exacerbated by the introduction of the cut for the retaining wall. Based on the terrain

contours and other pertinent field observations, our Geologist developed an initial (preslide) section and a zone for possible location for the slide plane. Analyses were first performed for this initial condition to establish the slide plane and the shear strength characteristics of the slide plane material. Subsequently, the established failure plane and the strength characteristics were used to analyze (a) the existing profile at the wall location; and (b) the profile after the introduction of the wall. The factor of safety was found to be essentially unchanged due to the introduction of the wall. All analyses were performed using the SLOPE/W computer program.

For the proposed pipeline, the potential for soil movement due to the landslide and consequent pipeline movement, however, cannot be ruled out. Future movements of the existing landslide deposits can be expected to be toward the downhill direction. However, test pits at the location revealed slide planes dipping into the hillside reflecting occurrence of past up-thrusting in the toe of the landslide mass, typical of large landslides being pushed nto relatively level ground. Therefore it is recommended that isolation valves be placed on either side of the potential landslide mass, at Sta. 352+75 and Sta. 361+25 ("RLF" Line), whereby the line may be shut off in the event of such movement. This allows for a buffer zone of 25 feet on either side of the inferred landslide limits.

Cut Slopes along Pipeline Alignment

Two segments of the proposed pipeline alignment will run along the vicinity of significant cut slopes. The stability of the slopes and their potential impact on the pipeline are discussed below.

Southwest Frontage Road between Sta. 256+50 and Sta. 261+97 ("FR1" Line): The pipeline alignment for this segment is located on the eastern side of the 34-ft wide Southwest Frontage Road pavement, under a flat or 4H : 1V slope. A 2H : 1V cut slope is present on the western side of the Southwest Frontage Road. The maximum slope height is 32 feet at Sta. 259+00. The eastern side the Frontage Road slopes down at a 4H : 1V slope or flatter and intersects the existing 2H :1V cut slope on the edge of Rte 101. The existing cut slope has a maximum height of approximately 35 feet at Sta. 259+00. Per the location of the pipeline alignment, except for a deep slide, instabilities of adjacent slopes should have little effect on the pipeline.

The area was primarily mapped as a large landslide. However, except for a few slumps, the existing slope on Rte 101 appears to be relatively stable over the years. Caltrans has indicated only surficial slumping at the highway. Five soil borings were drilled over the area to characterize the subsurface conditions at the cut location. A deep landslide deposit was not identified at the cut location from the borings. Boring R-10-162 drilled near the top of the proposed cut slope indicated clay containing rounded blocks of dark gray andesite (similar to those strewn on the ground surface) to a depth of 8 feet. The clay layer was inferred to be a landslide deposit. Medium dense to dense Tertiary Sandstone was encountered below the landslide deposit to a depth of 33 feet, where a 2-foot thick layer of sandy clay and gravel was encountered. Hard Franciscan greenstone was found below the sandy clay and gravel layer to 60-ft depth, the maximum depth explored. Landslide deposits were not identified in Borings A-10-163, 164, and 165 drilled at the base of the existing cut slope along the highway shoulder. Each boring encountered Tertiary Sandstone underlain by a thin layer of silty clay with Franciscan rocks underlying it at various depths. A deep landslide deposit with a potential for movement was therefore ruled out.

To further analyze the potential for a deep slide, slope stability analyses were performed for the proposed cut slope section at Sta. 259+00. As noted above, a 1- to 2-ft thick layer of sandy clay was encountered below the Tertiary sandstone, separating the sandstone from the Franciscan rock beneath the entire area of the proposed cut. A ‘wedge’ method of analysis was performed to force the failure plane through the sandy clay layer. Input strength characteristics of the sandy clay layer were based on Consolidated Undrained (CU) triaxial tests were performed on two samples of this clay. The analyses yielded a factor of safety of 3.07 using total stress strength parameters and a factor of safety of 3.27 using effective stress strength parameters for the sandy clay layer. Similar analyses were also performed for the existing slope, which yielded factors of safety of 2.66 and 2.87 using total and effective stress parameters, respectively. The potential for a deep slide at this location is therefore considered as low.

Bike Path between Sta. 328+91 and Sta. 334+37 (“BK” Line) and Southbound On-Ramp between Sta. 328+06 and Sta. 334+96 (“RL4” Line): The pipeline alignment in this segment will

be located on the west side of the new 12-ft wide Bike Path, and below the toe of a 2H : 1V cut slope west of the pipeline alignment. The maximum height of the cut slope is approximately 19 feet (at Sta. 330+50). Two test pits (TP-159 and TP-160) were excavated within this segment of the proposed cut. The test pits indicate a 2-ft layer of topsoil (sandy silt), underlain by clayey gravel or sandy gravel to the maximum depths excavated (6 to 8 feet). The clayey and sandy gravels were identified as debris flow material, which concurs with the geologic mapping. Per our analyses, 2H : 1V cut slopes in block-poor bimrocks, e.g. debris flows should have a factor of safety of 1.5 up to a height of 20 feet. Cut slopes, 2H : 1V or steeper are present in the northwest corner of the bridge adjacent to the subject cut. Based on this observation and the limited heights of the cut slopes (less than 20 feet), the slopes are considered globally stable. Relatively shallow slumps are present on the slope, which are attributed to seepage. The cut slope on the west side of the pipeline will potentially be subject to surface flows and erosion from upslope. Appropriate erosion protection and subsurface seepage mitigation measures are recommended in the GDMR to maintain the stability of the slope.

New Embankments along Pipeline Alignment

Several segments of the proposed pipeline alignment run along locations where new embankment fill will be placed as part of the Interchange project. The pipelines will be installed near the top of the embankment towards the outside edge of the new pavement. See Typical Sections provided by the Designer (Plates 6A and 6B). Following discussions on fill areas, embankment settlements, monitoring and waiting periods are included from the project GDMR. It is assumed that the fill placement and the pavement grading will be completed prior to installation of the pipelines. This discussion is provided to maintain consistency between the grading and installation of the pipeline.

The approximate maximum fill thicknesses at the embankments and ramps and are summarized in the table below for fills greater than 10 feet.

TABLE 4: SUMMARY OF MAXIMUM FILL THICKNESS

Fill Area No.	Proposed Construction	Approx. Max Fill Thickness (ft)	Relevant Boring(s)
1	Southwest Frontage Road (Line "FR1")	15 ft @ Sta. 255+50	A-10-167
2	Southwest Frontage Road (Line "FR1")	10 ft @ Sta. 262+00	A-10-165
3	Northwest Frontage Road (Line "RLF")	28 ft @ Sta. 353+00	A-09-133, 134

Subsurface Soil Conditions

No distinct layers of soft clay (e.g. Bay Mud) were encountered of the reference borings for the proposed fill areas noted above. Also, groundwater was not encountered in the above referenced borings. Additional subsurface conditions beneath each fill area, where fill thickness exceeds 10 feet are discussed below.

Fill Area No. 1

Fill Area No. 1, proposed for the Southwest Frontage Road extends from Sta. 251+00 to Sta. 257+00 ("FR1" Line). The pipeline segment in this location will be outside the eastern edge of the pavement. The boring data (Boring A-10-167) indicate that the subsurface soil conditions underneath the proposed fill embankment consist of a surficial layer of very stiff clay to a depth of approximately 4 feet, underlain by hard clay and very dense sand to a depth of 20 feet, the maximum depth drilled.

Fill Area No. 2

Fill Area No. 2, proposed for the Southwest Frontage Road extends from Sta. 261+00 to Sta. 264+50 ("FR1" Line). The pipeline segment in this location will be outside the eastern edge of the pavement. The boring data (Boring A-10-165) indicate that the subsurface soil conditions underneath the proposed fill embankment consist of a surficial layer of very stiff clay to a depth of approximately 4 feet, underlain by hard clay, very dense sand and very dense clayey gravel to a depth of 20 feet, the maximum depth drilled.

Fill Area No. 3

Fill Area No. 3, proposed for the Northwest Frontage Road north of Retaining Wall No. 4, extends from Sta. 347+00 to Sta. 359+50 ("RLF" Line). The pipeline segment in this location

will be outside the eastern edge of the pavement. Per the boring data (Borings A-09-133, 134), the subsurface soil conditions underneath the proposed fill embankment consist of very stiff clays. Sandstone (Franciscan Complex) was encountered at depths ranging from 8 to 12 feet.

Embankment Settlements

Settlements generally occur due to self weight of the fill, in addition to compression settlements of the underlying clays (native soils). An evaluation was made of the range of settlements for all the three significant fill areas noted above.

The following were included in the settlement computations for each fill area:

- Maximum Height of Fill for the specific fill area
- Subsurface condition as indicated by the relevant boring(s) for the fill area
- Contact area of the loading (e.g. equivalent width of the loaded area)

Settlement of Fill due to Self Weight

Based on available field information, settlement of fill due to self-weight will be on the order of 0.5 to 0.75 percent of the height of fill. Some settlement will occur concurrently with the fill placement, depending on the characteristics of the fill and the rate of placement. It is expected that the settlement will be rapid and 90 percent of the settlement should occur by the end of fill placement.

Settlement of the Underlying Native Soil

Subsurface conditions considered for the analyses of settlement of the native soils included:

- Thickness of the soils overlying the rock
- Location and thicknesses of the clay layers (only clay layers were considered for compression)
- Shear strength of the clay layers

As indicated in the subsurface conditions for each fill area, there was no indication of groundwater in any of the relevant borings. It was inferred that

groundwater is unlikely to rise above the rock into the overlying soils. Compression of the soil by expulsion of the water (e.g. consolidation settlements) was therefore deemed unrealistic. Compression of the clays and consequent settlements in the native soil would therefore be due to immediate (elastic) compression and would essentially be instantaneous.

Settlements were calculated based on immediate (elastic) compression of the underlying layers due to the load from the fill. Modulus of Elasticity of the various clay layers were based on existing correlations. The existing correlations considered the shear strength of the soils and the soil plasticity characteristics. The calculations are presented in Appendix C. A table summarizing the settlements is presented below.

Fill Area No.	Relevant Boring	Maximum Fill Height (ft)	Compressible Layer Thickness (ft)	Fill Settlement (inches)[1]	Native Soil Settlement (inches)
1	A-10-167	15	8	0.9 to 1.35	0.12
2	A-10-165	10	12	0.6 to 0.9	0.15
3	A-09-133 A-09-134	28	12	1.7 to 2.5	0.55
Notes: 1) 0.5 to 0.75 percent of Fill Height					

Waiting Period

The primary consideration from engineering and design standpoint is the settlement that would occur subsequent to construction of the pavement, underground utilities including the NMWD pipeline, foundations and other settlement critical improvements. It is desirable that settlement be essentially complete prior to inception of such construction. It is therefore suggested that a waiting period be established and a settlement monitoring program be instituted to verify that the settlement has occurred.

For planning purposes, for proposed new embankments greater than 15 feet high, a waiting period of 60 days is proposed prior to construction of foundations,

utilities and pavements. For embankments less than 15 feet high, the Caltrans standard practice of a 30-day waiting period should suffice. The proposed 60-day settlement monitoring and waiting period reflects the variabilities of the various factors contributing to the settlement.

The final waiting period should be established, based on a proposed monitoring program per Caltrans Test Method 112, which will be included in the Construction Plans for the project. The monitoring program is discussed below.

Monitoring Program

Two types of monitoring instruments are proposed: (a) conventional survey monuments to measure the total settlement from the top of the embankment; and (b) fluid settlement cells to measure the settlement of the underlying native soils due to fill placement. Proposed locations for instrumentation for settlement monitoring are presented in the table below. The locations are also presented on the plans (relevant EX sheets) in Appendix F. Additional information can also be found in the GDMR for the project.

No.	Approx. Station	Control Line	Offset	Fill Area No.
Survey Monument (Type A)				
H-12	347+50	"RLF"	20' Lt.	3
H-13	350+15	"RLF"	20' Lt.	
H-14	351+50	"RLF"	20' Lt.	
H-15	353+50	"RLF"	20' Lt.	
H-16	355+00	"RLF"	20' Lt.	
H-17	357+00	"RLF"	20' Lt.	
H-18	254+00	"FR1"	19' Lt.	1
H-19	255+00	"FR1"	19' Lt.	
H-20	256+00	"FR1"	19' Lt.	
H-21	262+00	"FR1"	19' Lt.	2
Settlement Platform				
SP-5	350+00	"RLF"	@ Centerline	3
SP-6	354+00	"RLF"	@ Centerline	
Note: The numbers for the monitoring locations (e.g. H-13 and SP-6) are identical with those used for the overall roadway project as noted in the GDMR.				

Survey Monuments should be installed after completion of fill placement. Proposed hub locations are presented in the table above. The monuments should be located on top of the embankments near the outer edge, so that monitoring may continue beyond end of construction, if desired. Details for installation of the monuments should be per the Special Provisions for the project. Readings should be taken every two weeks by qualified personnel designated by the Resident Engineer, continuing to the end of the designated settlement period. The readings should be furnished to the Resident Engineer who will evaluate the results to determine if the settlement is essentially complete or if the waiting period should be extended.

Fluid Based Settlement Cells should be installed at 6 specified locations shown in the table above. A settlement platform consisting of a standpipe mounted on a plywood platform will be installed at the bottom of the fill area prior to inception of fill placement. Plastic tubing from the standpipe will be connected to a transparent site tube mounted vertically in a protected box outside the limits of the embankment. Qualified personnel designated by the Resident Engineer will take readings at the transparent site tube once a week, until the fill reaches its full height and twice a week after that for post-construction monitoring. The readings should be furnished to the Resident Engineer who will evaluate the results to determine if the settlement is essentially complete or if the waiting period should be extended. Post construction monitoring should extend to the end of the waiting period, unless the Resident Engineer decides otherwise.

Evaluation of Embankment Stability

The maximum height of embankment at locations along the proposed pipeline alignment will be on the order of 28 feet along the Northwest Frontage Road near the overcrossing structure. The gradient of the slopes is 2(H): 1(V) or flatter. The underlying soils are stiff to very stiff clays overlying bedrock. The maximum thickness of the clay is approximately 15 feet. Groundwater was not encountered at the embankment locations. Slope stability analysis performed for this slope using the SLOPE/W computer program indicated a factor of safety of 1.87, which is

greater than the required factor of safety of 1.5 for satisfactory slope stability under static conditions.

Pipeline Trench

It is anticipated that cut and cover construction method will be used for the construction of the new pipeline. Water may be encountered in the trench, and therefore construction dewatering may be required. Per the Preliminary Design Report, a minimum of 4 feet and a maximum of 8 feet of cover will be provided, unless otherwise approved by NMWD.

Pipe Zone Material

Pipe Zone Material (more commonly known as Bedding Material) should conform to the requirements Standard Specifications of NMWD. Applicable Standard Specifications are presented in Appendix C. The Pipe Zone Material should also be free of organics and other deleterious materials and should be approved by the Geotechnical Engineer. Placement and compaction of the Pipe Zone Material should be in accordance with the NMWD Specifications unless specifically indicated otherwise in the Construction Drawings.

Per the requirements of the Specifications, the Pipe Zone Material should extend from four inches below the pipe to 12 inches above the pipe. The subgrade for the backfill should be prepared as discussed in the "Subgrade Preparation" Subsection of this report. Also, the pipe zone material should extend to the top of the manholes. More detailed specifications will be developed by the pipeline designer.

Trench Zone Material

Trench Zone Material (more commonly known as Backfill Material) should conform to the Standard Specifications of NMWD. Additionally, we recommend that the material be free of organic materials, materials larger than 3 inches, and other deleterious materials. Placement and compaction of the Trench Zone Material should be in accordance with the NMWD Specifications unless specifically indicated otherwise in the Construction Drawings.

Trench Zone Material should extend from the top of the pipe zone to the finish grade in unpaved areas or to the bottom of the pavement section in paved areas. The materials should be placed by methods that will not disturb or damage the pipes. Before using heavy compaction or construction equipment directly on the pipes, adequate thickness of Trench Zone Material should be placed on the pipe to prevent damage, excessive deflections or other disturbances to the pipes. Field and laboratory testing of backfill materials should be performed to see that the applicable requirements have been met.

Subgrade Preparation

The subgrade should be prepared to provide uniform bearing throughout the entire length of the pipe segments. Where hard unyielding materials (such as rocks larger than 3 inches) are encountered in the trench bottom, which may cause local stresses, they should be excavated out and backfilled with bedding material or they should be bridged with at least six inches of bedding material. Soft or loose soils should be over-excavated to firm soils or to a maximum depth of 12 inches below the planned pipe subgrade and backfilled with Pipe Zone Material.

Check Dams and Drains

The proposed pipeline alignment will cross existing drainage areas and proposed hillside cuts. As discussed earlier, groundwater seepage should be expected in these areas which may collect in the relatively granular "Pipe Zone" material. This water could travel along the pipeline alignment and depending on its profile may create subsurface erosion of the trench walls and ponding. Therefore it is recommended to install "Check dams" along the pipeline alignment to slow down the flow of water. Check dams are recommended every 200 to 300 feet, depending on the trench profile.

Temporary Excavation and Shoring

It is anticipated that the improvements for the Interchange project including Frontage Roads and Bike Path will be complete before start of installation of the pipeline and that a cut and cover construction technique will be used to install majority of the pipelines. The contractor should verify the site conditions and right-of-way/easement limits to see where shoring will be required.

All excavations should be made and supported in accordance with Cal OSHA Safety Standards. Groundwater will likely be encountered during excavations from natural conditions or from seasonal hillside seepages. Some of the test pit excavations indicated trench failures from seepages.

Open (unshored) excavation with back slopes may be considered on a site specific basis and only in limited areas. The variability of the soil/rock conditions may require shoring at all locations. Even apparent rocky conditions could be large boulders that could fall into the trench. Cal OSHA guidelines of slope ratios for unshored excavations are for temporary, unsurcharged slopes. Traffic and surcharge loads should be kept back at least 10 feet from the top of the excavations. It is assumed that the cut slopes are adequately dewatered. Groundwater should be maintained at least two feet below the bottom of the excavation at all times.

In our opinion, conventional equipment could be used to excavate on-site soil materials. The materials to be excavated will be stiff to hard lean clays and dense silty sands; weathered Franciscan mélange rock may be encountered along the proposed cuts. It is highly likely that hard rock, boulders, block-in-matrix or unknown old buried facility and/or objects are located across the alignments. It might require special equipment and additional efforts to mitigate these conditions. Also, when such blocks of rock or boulders are encountered, it may result in excavations that are significantly larger than planned. This could result in additional efforts and costs.

The contractor should verify existing utility lines within proximity of the proposed pipelines. Depending on relative locations of the existing lines and proposed lines, open cut with sloping sides might extend beyond/undercut existing utilities. In such cases, shoring will be necessary for the trench excavation.

Selection of Shoring

The shoring system should be designed to be relatively rigid and with as many supports or struts as necessary to prevent excessive straining and deformation of the supported soils. This is important with regard to protection and movement of the existing utilities and the new pavements constructed as part of the Interchange Project. Trench shield (boxes) or similar passive shoring systems are not

recommended as a "Shoring System" unless it can be demonstrated by the contractor through field monitoring (inclinometer) that lateral soil creep will not affect existing facilities and utilities. Trench shields generally do not provide support to the excavations as its primary function is to provide worker safety.

The designed shoring systems considered may include bracing system (such as "speed shoring") with continuous support of the side walls, continuous interlocking sheet pile, or combination of the above depending on specific site conditions. A properly designed and constructed dewatering operation is required regardless the construction method used. Any traffic load and surcharge (such as stockpile material) within 10 feet of the trench should be considered in shoring design. The selection and design of the shoring system should be the contractor's responsibility. The contractor should have the shoring system designed and signed by a California Registered Engineer. An apparent lateral earth pressure diagram for internally braced shoring system is presented on Plate 5.

Sheeting should be driven to a sufficient depth below the excavation to prevent trench bottom instability (bottom heave, piping and blow out). The required depth should be determined by the contractor/shoring designer. The type of driving equipment (vibratory or impact hammers) employed for sheet pile installation should be chosen for drivability by the shoring contractor. "Unconventional" methods of driving such as hitting with backhoe bucket are not recommended. Removal of sheeting should be done in a manner that does not adversely affect the bedding or pipe.

Working Platform

Due to the variability in the subsurface conditions, clay and silt are anticipated at the planned depths of trench excavations, which would be sensitive to moisture and disturbance from equipment. In such cases, working conditions at the bottom of the excavation may become difficult, and equipment at the bottom of the trench may lose mobility. The contractor should take adequate measures to minimize the disturbance of the trench subgrade. The contractor can mitigate soft/loose ground conditions by constructing a working platform at the bottom of the trench.

The working platform may be installed as follows:

(1) Over-excavating minimum 12 inches below the planned bedding subgrade;

(2) Placing a stabilizing geotextile fabric such as Mirafi 600X or equivalent at the bottom of the resulting excavation;

(3) Backfilling with predominantly granular fill such as crushed rock (1½ inch by 3/4 inch nominal size coarse aggregate conforming to Section 90-3.02 of the Caltrans Standard Specifications) or other such bridging material.

The imported bridging material should be approved by the Geotechnical Engineer prior to importing and placing the materials on the project site. The top of the bridging layer may be densified by vibratory compaction equipment prior to placing the pipe bedding. The contractor's method of compacting the bridging layer should be reviewed by the Geotechnical Engineer. The minimum required thickness of this treatment may be increased depending on the site conditions. The contractor may use other methods of subgrade stabilization.

Construction Dewatering

Groundwater should be expected in the excavations during pipeline construction. Groundwater will cause instability of trench walls (piping, erosion, etc.), instability of the trench bottom (blow-outs, piping, etc.) and will also result in difficult working conditions at the trench bottom. Unstable trench walls and bottom may cause slope failures, damage the shoring system, etc., causing excessive settlements of surrounding ground, damage to adjacent underground utilities and excessive long-term differential settlements in the pipelines. Excessive water in the trench will also result in difficult working conditions causing subsequent delays in work and/or additional efforts during construction.

The contractor should implement a dewatering system to mitigate these conditions if groundwater is encountered in the excavations. All dewatering schemes proposed by the contractor should be submitted to the District Engineer prior to implementation. However, developing and implementing an effective dewatering program should be the contractor's responsibility. The contractor should

install a dewatering system that will lower the groundwater level at least two feet below the bottom of the excavation and maintain it dry. In some areas that are difficult to obtain a dry bottom, it may be necessary to maintain the groundwater at a deeper depth to minimize wet and spongy bottom conditions.

All dewatering systems should be properly designed to prevent pumping soil fines with the discharge water. The contractor should sample and test the groundwater for soil fines content from the discharge, as needed. If soil fines are pumped, the contractor should revise his dewatering operations. Otherwise, failure of shoring, partial instability of trench bottom resulting in intolerable ground settlement/ movement of existing utilities and unsafe working conditions may occur. The contractor should provide discharge sampling locations for each pump. The contractor is encouraged to perform their own investigation, test program, etc. prior to construction in order to satisfy their design requirements for an effective dewatering program.

An investigation for subsurface environmental contamination for the water drawn during dewatering was beyond the scope of our services.

Corrosion

During our investigation, twenty two corrosion tests were performed on samples collected from various locations within project limits. The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. A summary of the corrosion test results is presented in the table below.

SUMMARY OF CORROSION TEST RESULTS

Sample No.	Station (ft.) "N2R" Line	Offset (ft.)	Depth (ft)	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
A-09-117	321+00	65 Lt.	4.5	2680	3.72	18.2	31.8
A-09-124	342+95	45 Lt.	0-5	2470	7.74	43.5	21.5
A-09-126	341+40	135 Lt.	9.5	1310	6.48	28.1	28.3
A-09-128	346+45	45 Lt.	0-5	5360	6.76	16.9	15.4
A-09-129	334+95	295 Lt.	4.5	5360	5.18	1.9	13.4
A-09-134	345+35	215 Lt.	4.5	2570	5.47	15.9	20.2
A-09-135	349+45	215 Lt.	9.5	2680	4.23	6.4	57.1
A-09-137	355+15	180 Lt.	4.5	1050	6.73	23.2	56.1
A-09-140	372+35	10 Lt.	0-5	3480	5.97	11.0	17.2
A-09-143	384+55	140 Lt.	9.5	1880	6.15	4.9	19.5
A-09-145	401+50	100 Lt.	0-5	4020	5.58	4.4	9.7
A-09-146	407+10	75 Lt.	4	290	7.80	813.7	245.1
A-09-147	228+50	65 Lt.	0-5	910	7.53	47.7	51.6
A-09-149	250+35	65 Lt.	4.5	540	6.78	109.7	137.2
A-09-151	270+50	0.	9.5	940	6.09	37.5	42.9
A-09-152	279+05	110 Lt.	0-5	3220	7.19	20.7	16.9
A-09-154	299+05	80 Lt.	0-5	1340	6.76	25.6	18.2

It is our understanding that the Designers will use the above corrosion information to determine the corrosion protection requirements for the pipe.

MATERIAL DISPOSAL

Project may require off-haul of some of the excavated material that cannot be used on site. Prior to excavating, materials should be tested for contamination in accordance with the recommendations of the environmental report. Asbestos, if encountered, will require special handling and disposal. Disposal of ADL and other contaminated material (if any) is beyond the scope of this project.

CONSTRUCTION CONSIDERATIONS

Construction Advisories

These sections are written primarily for the engineer responsible for the preparation of plans and specifications so that the construction advisories can be incorporated into the appropriate plans

and specifications. Since these sections identify potential construction issues related to the project, it may also be of use to the Agency's representatives involved in monitoring of construction activity. The field investigation performed by us primarily addresses design issues and was not planned specifically to identify construction issues.

A significant portion of the construction will involve excavation of 'bimrocks' (see Section on bimrocks for additional discussion). The Contractor should be prepared to deal with the very high degree of heterogeneity, both spatial and lithological, in the bimrock formations. He should in particular be prepared for very large and/or very hard blocks, which may not be easily excavatable using conventional equipment. Hoe rams, jackhammers or even controlled blasting may be required to excavate some of the anticipated rocks. Contractor should also be prepared for the high probability of encountering potentially unstable formations such as block-poor bimrocks with weak matrix material, sheared zones and serpentines during excavation and take appropriate precautions. Trapped water sources in the rock formations may suddenly be exposed during excavation and adequate, timely measures will be required. Serpentines are also often associated with naturally occurring asbestos (NOA), which is considered hazardous. Appropriate mitigation measures should be implemented, if it is encountered.

Prospective contractors for the project must be directed to evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other areas, or on the basis of field investigation on the site performed by them, taking into account their proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and State regulatory agencies.

Construction Consideration that Influence Specifications

The above construction advisories should be used to supplement the specifications. The contractor should verify the conditions of the existing utility lines. These locations should not be used for stockpiling of borrow materials. Any utility conflicts with proposed construction should also be reviewed prior to construction.

Hazardous Waste Considerations

The project environmental study report should be referred to for further details about any potential hazardous materials within the project site. The presence of serpentinite in the shear zone at around Sta. 345+75 ("RLF" Line) indicates the significant probability of the presence of naturally occurring asbestos (NOA) at the site.

Differing Site Conditions

The soil conditions described in this report are based on available exploration data. It should be noted that these depict subsurface conditions only at the locations explored. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface soil conditions could change between the explored locations. Due to the predominant presence of bimrocks at the project site, a high degree of variability in the subsurface than is generally encountered should be expected and planned for.

Early communication should be made between the Resident Engineer, the Contractor and the Geotechnical Engineer as soon as conditions that differ from those established in this report are recognized by any of the parties. Additional recommendations could thereby be provided if such conditions arise.

RECOMMENDED MATERIALS SPECIFICATIONS

Standard Specifications

All materials specifications should conform to the appropriate section(s) of the Standard Specifications of NMWD, including, but not limited to Pipe Zone Granular Material (bedding) and Trench Zone Material (backfill). A copy of the NMWD Standard Specifications Section 02223 (Trenching, Excavation, Backfilling and Compacting) is presented as Appendix D. Compaction should conform to the Standard Specifications unless noted otherwise in the Construction Drawings.

Excavated spoil from the trenches may be suitable for the trench zone (Above the trench zone material and below any pavement) provided it meets the above criteria and approved by the District Engineer.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed "North Marin Water District Aqueduct Relocation, Marin-Sonoma Narrows, Contract B-1" as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the Designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,

PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E., C54619
Senior Engineer

Gary Parikh, P.E., G.E., 666
Project Manager

James Baker, C.E.G., 1021 exp 10/12/11
Engineering Geologist

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-11
GEOTECHNICAL
STATE OF CALIFORNIA

REFERENCES

1. Blake, Jr., M.C.; Graymer, R.W.; and Jones, D.L.; 2000: "Geologic Map and Map Database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California"; U. S. Geological Survey Miscellaneous Field Studies Map MF-2337 (1:75,000 scale)
2. California Department of Transportation, May 2006, Standard Plans.
3. California Department of Transportation, May 2006, Standard Specifications, Sections 1 through 95.
4. California Department of Transportation, Highway Design Manual, September 2006.
5. California Department of Transportation, Caltrans Deterministic PGA Map and ARS Online Report (2009)
6. Ford, E. W. (2007): "Burdell Mountain Stratigraphy and Implications for Long-term Slip along the East Bay Fault System, California", M.S. Thesis at San Francisco State University.
7. Rice, S.J., 1975: "Geology for Planning, Novato Area, Marin County, California", California Division of Mines and Geology; Open-File Report 75-1 (Plate 1 - West: Geology Map, western part of the Novato Area; 1:12,000 scale)
8. United States Geological Survey (USGS), 2008: "The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2), by 2007 Working Group of Earthquake Probabilities", USGS Open File Report 2007-1437
9. Wagner, D..; Rice, S.R.; Bezore, S.; Randolph-Loar, C.E.; Allen, J.; and Witter, R.C.; 2002: "Geologic Map of to Petaluma River 7.5' Quadrangle, Marin and Sonoma Counties, California", A Digital Database (1:24,000 scale)

AERIAL PHOTOGRAPHS

US Geological Survey Library; 7-3-1965; MRN 66-131, 132, and 133.

US Geological Survey Library; 5-3-1981; SCS – CHH – 1B – 155, 156, and 157.

US Geological Survey Library; 9-25-1973; SFB – 2 – 52 thru 55 (color).

PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

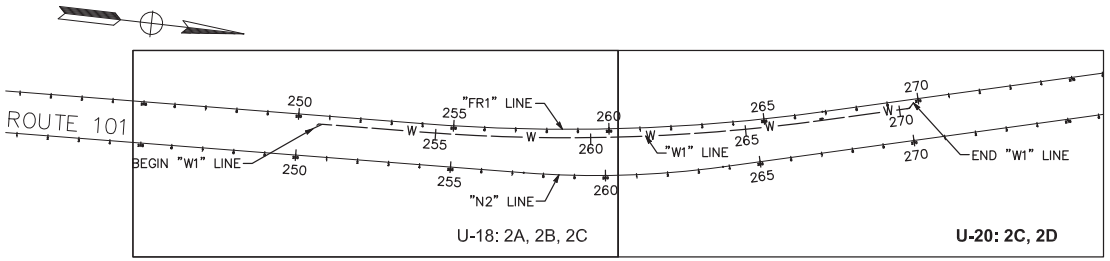
JOB NO.: 208140.MWD | PLATE NO.: 1

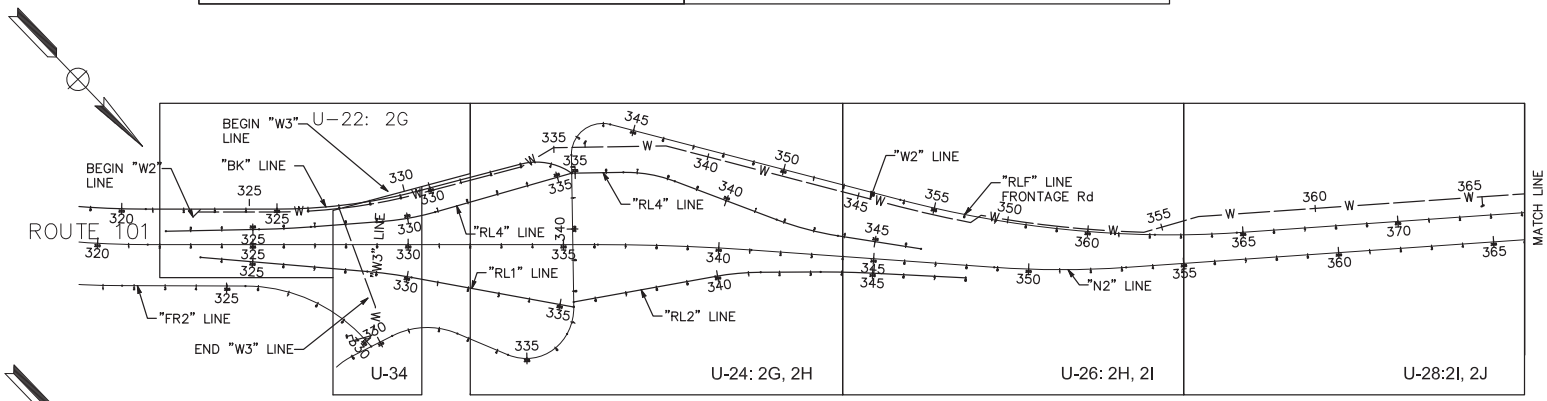
UTILITY PLAN
NORTH MARIN WATER DISTRICT
AQUEDUCT RELOCATION
KEY MAP AND LINE INDEX

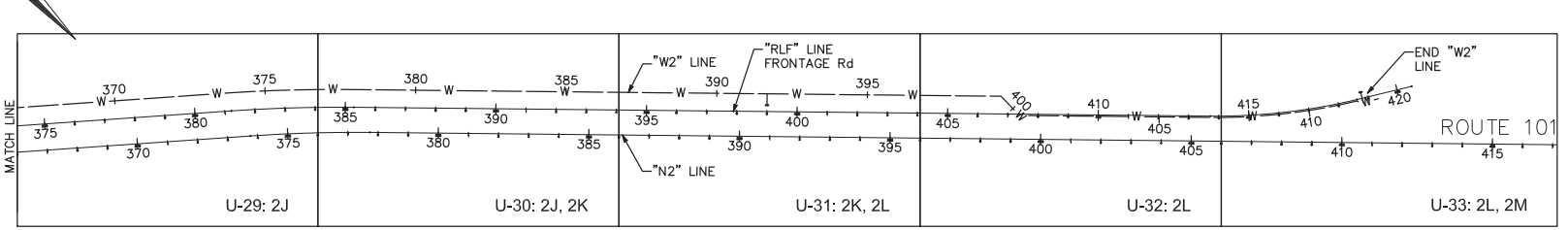
NO SCALE

INDEX TO INDIVIDUAL SITE PLAN

U–18–PLATE NOs: 2A, 2B, 2C
U–20–PLATE NOs: 2C, 2D
U–22–PLATE NO : 2G
U–24–PLATE NOs: 2G, 2H
U–26–PLATE NOs: 2H, 2I
U–28–PLATE NOs: 2I, 2J
U–29–PLATE NO: 2J
U–30–PLATE NOs: 2J, 2K
U–31–PLATE NOs: 2K, 2L
U–32–PLATE NO : 2L
U–33–PLATE NOs: 2L, 2M







LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

—W— Proposed Water Line (Blue Line)

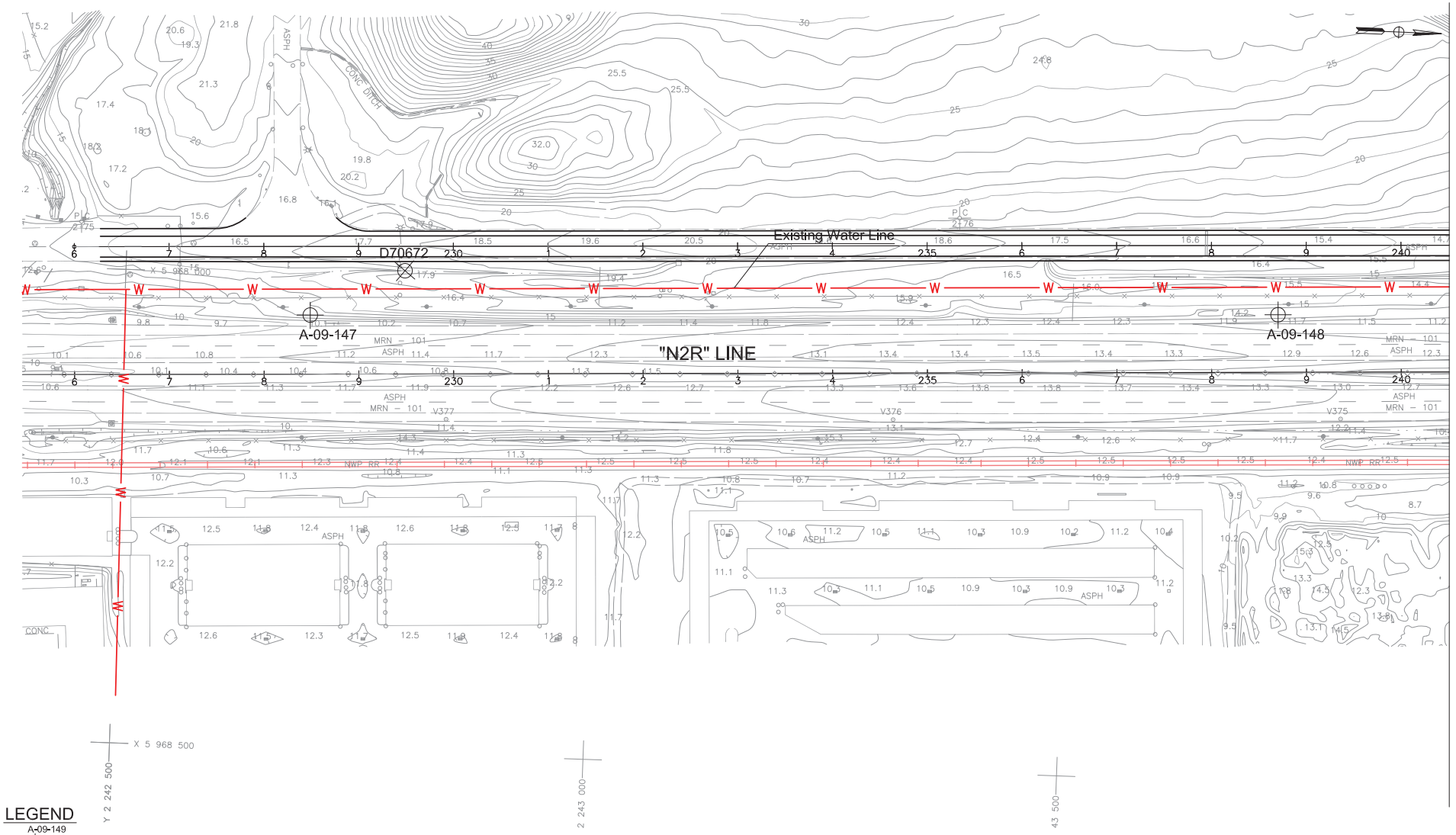
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN - KEY MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2



LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

D70672 — Approx. R-Value Boring Location (Caltrans Memo 2005)

w — Existing Water Line (Red Color)

W — Proposed Water Line (Blue Color)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

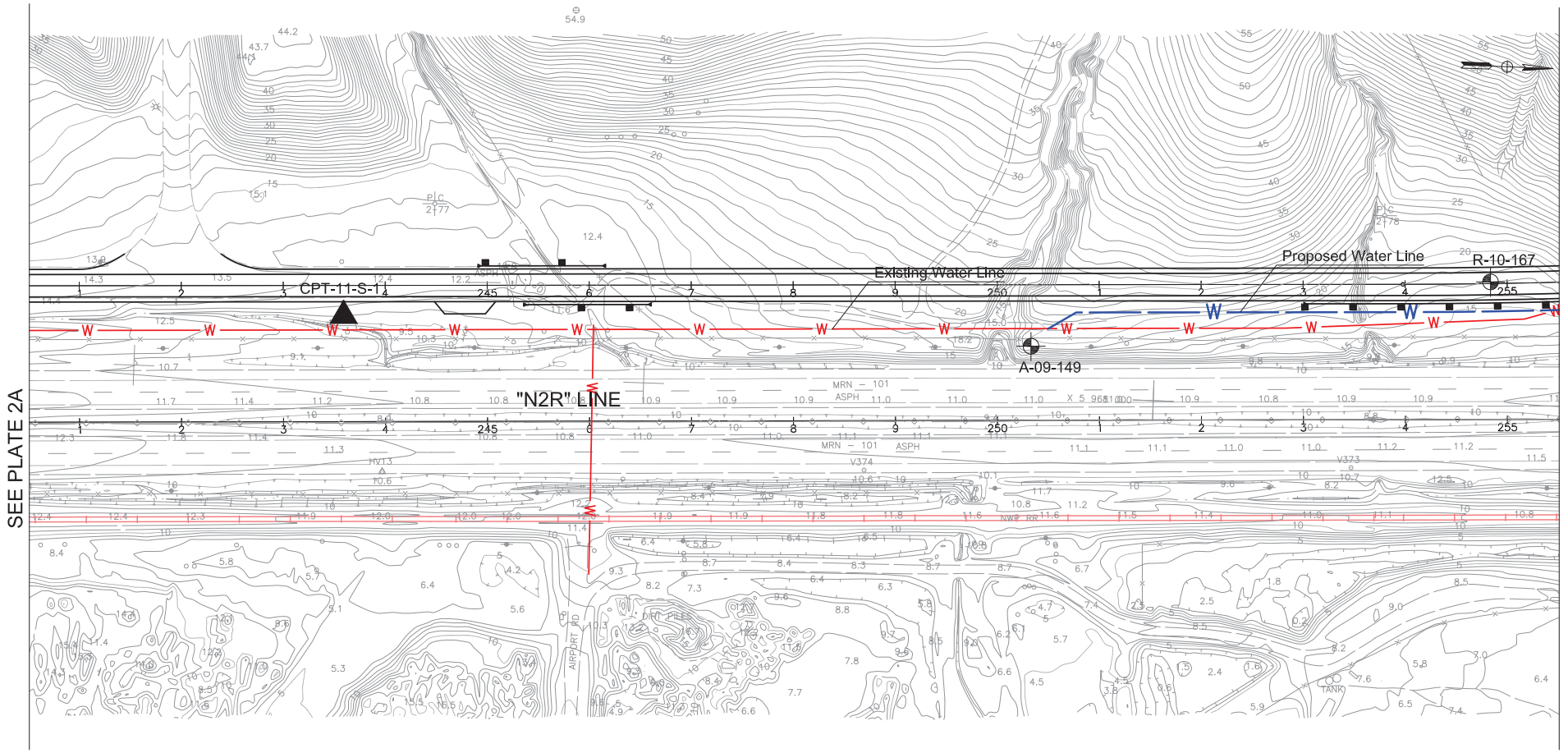
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO: 2A



LEGEND

- A-09-149 — Approx. Boring Location
- A-09-147 — Approx. R-Value Boring Location
- CPT-09-117 — Approx. CPT Location
- w — Existing Water Line (Red Color)
- W — Proposed Water Line (Blue Color)

SCALE 1 inch = 100 feet

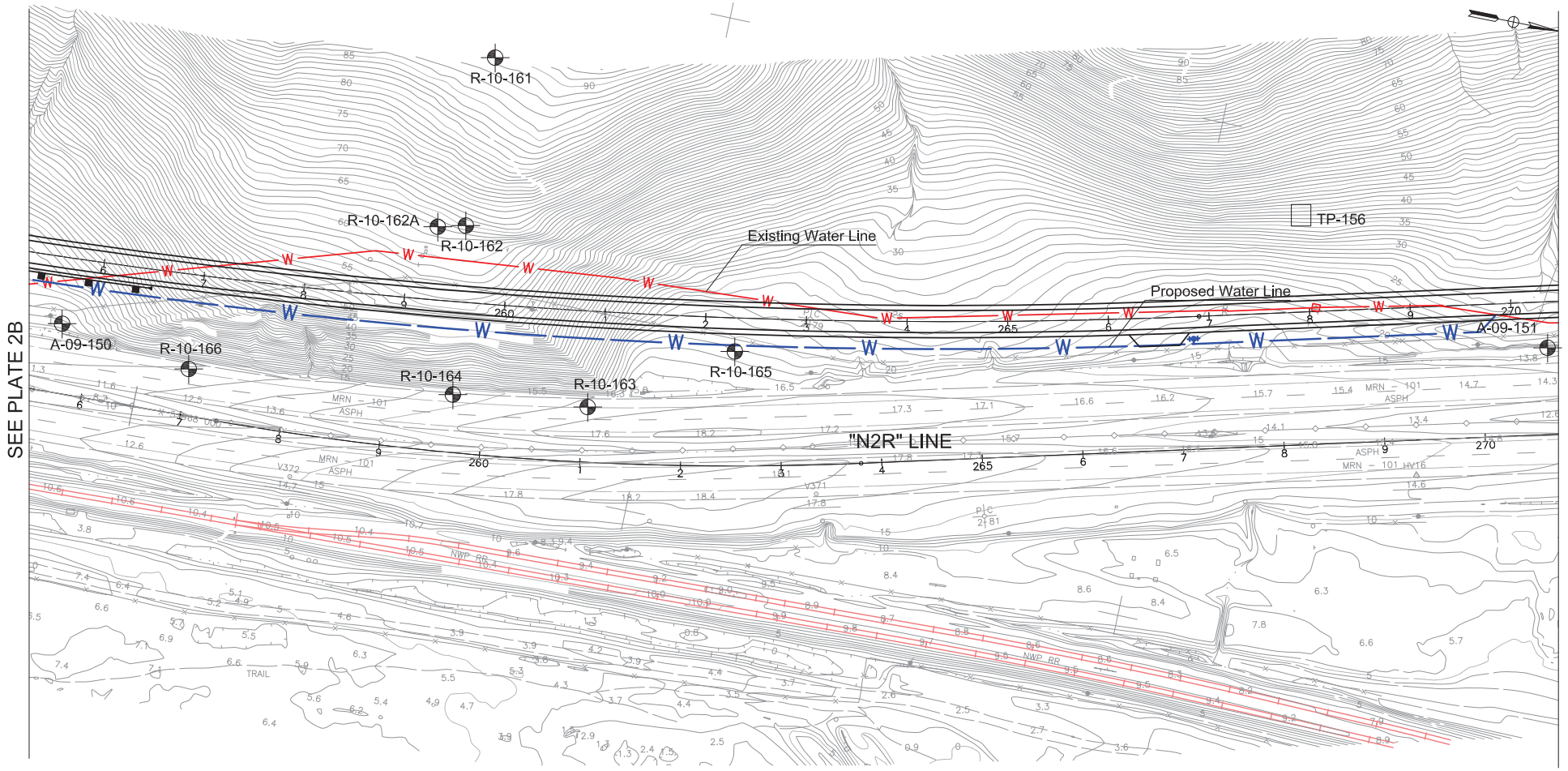
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2B



LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

Test Pit Location

w — Existing Water Line (Red Line)

W — Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

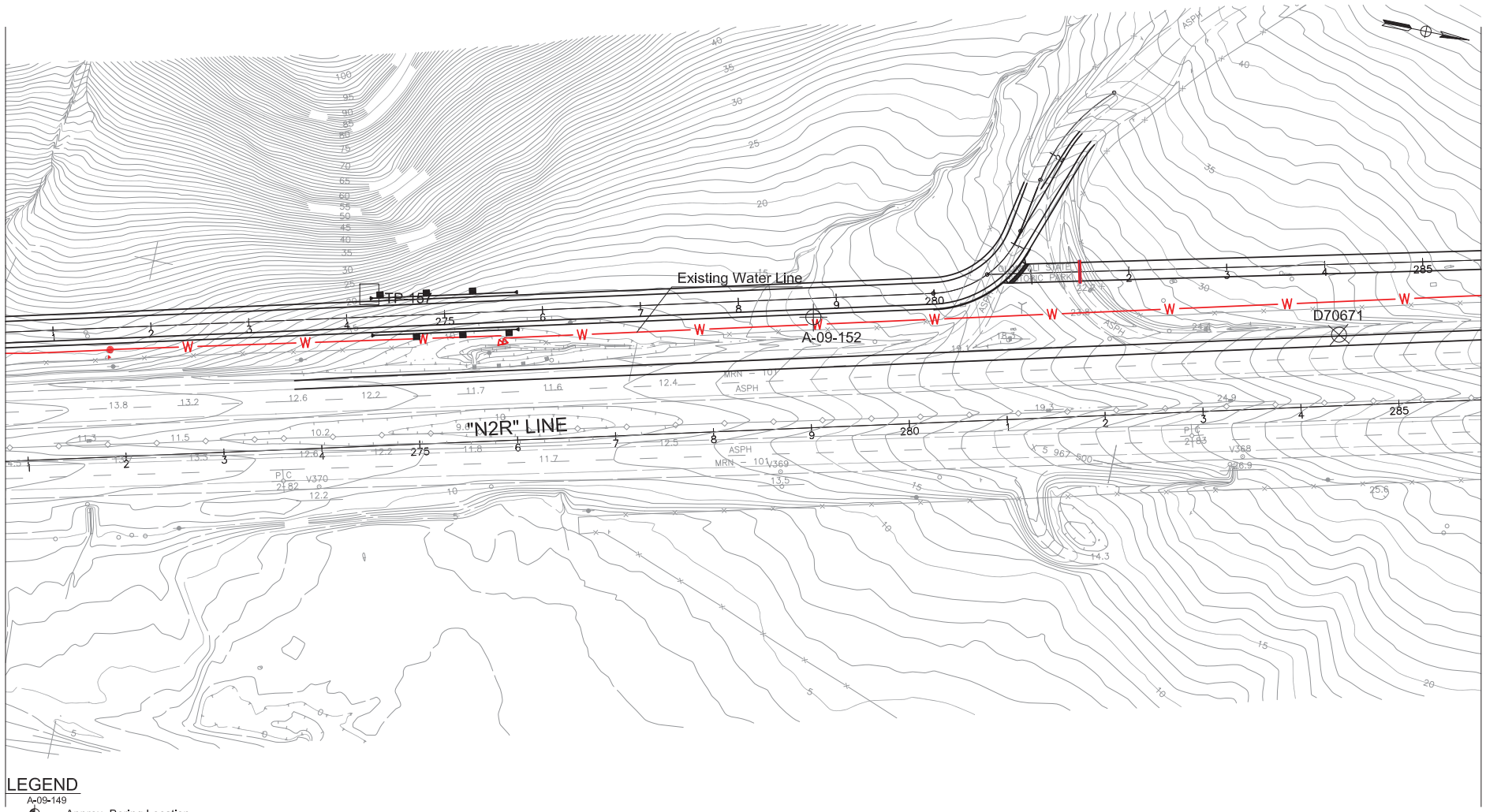
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO: 2C



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

Test Pit Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

w Existing Water Line (Red Line)

W Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

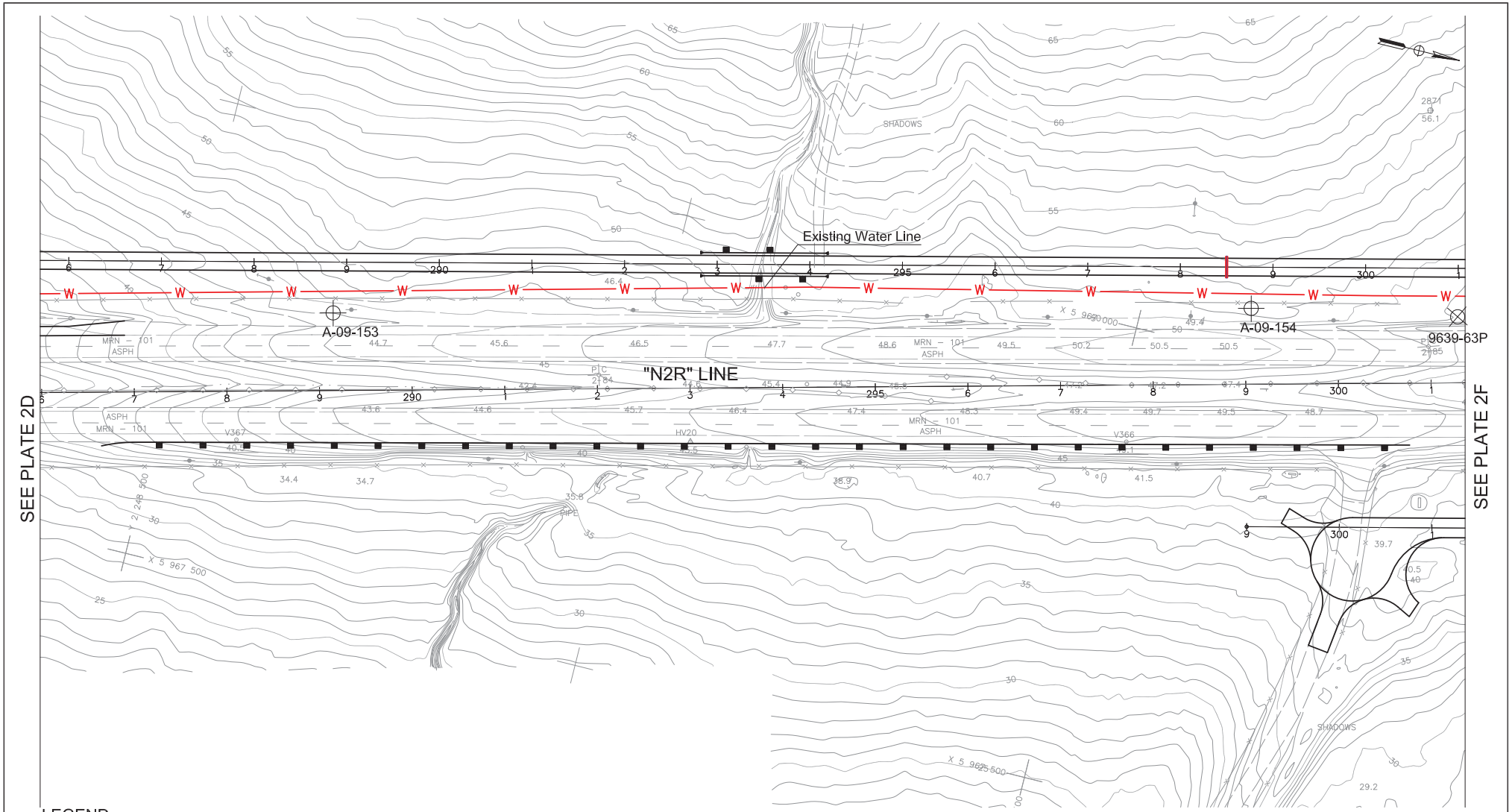
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2D



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

w — Existing Water Line (Red Line)

W — Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

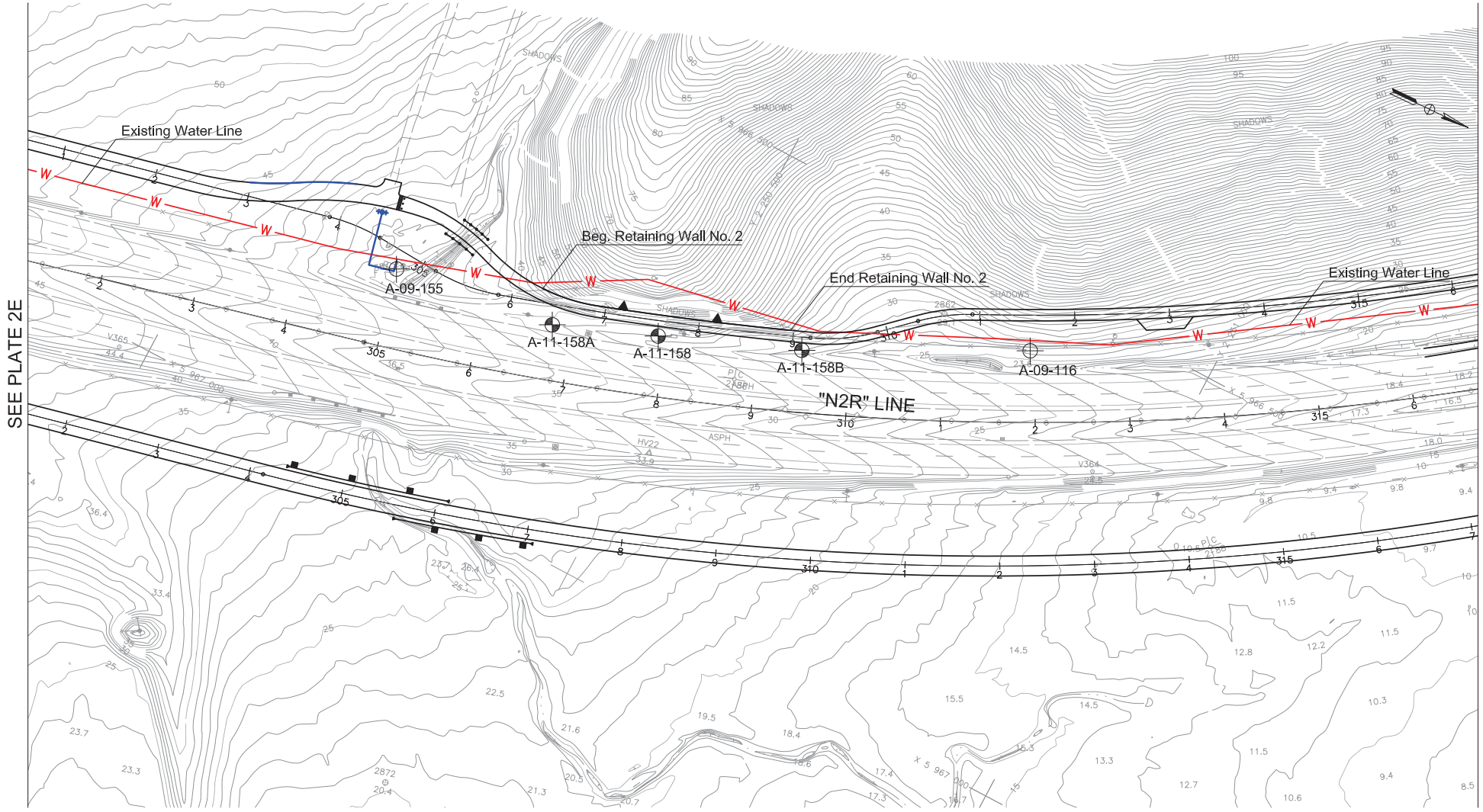
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO: 2E



SITE PLAN

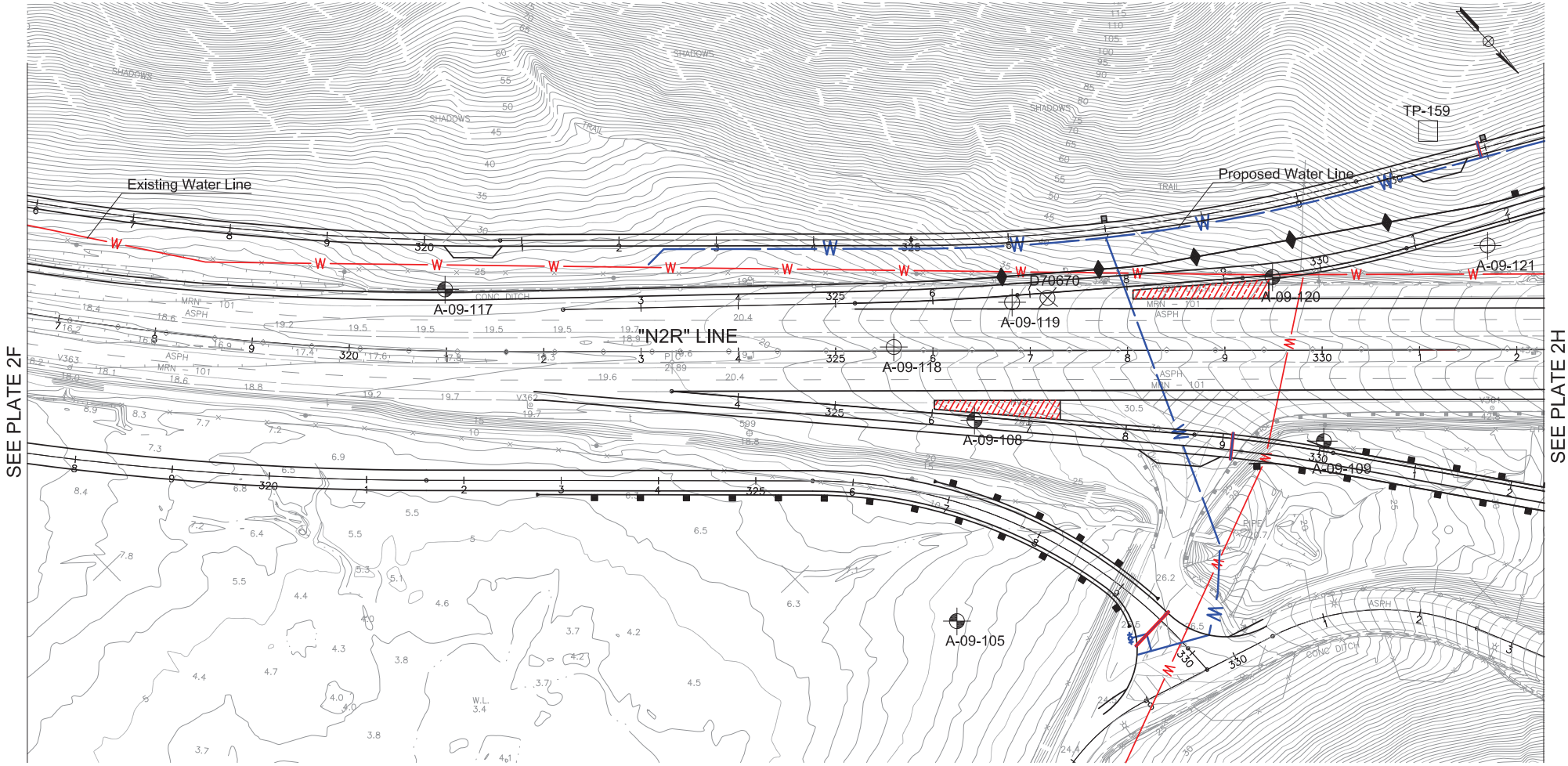
SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2F



LEGEND

A-09-149 — Approx. Boring Location

A-09-147 — Approx. R-Value Boring Location

Test Pit Location

9639-70P — Approx. R-Value Boring Location (Caltrans Memo 2005)

w — Existing Water Line (Red Line)

W — Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

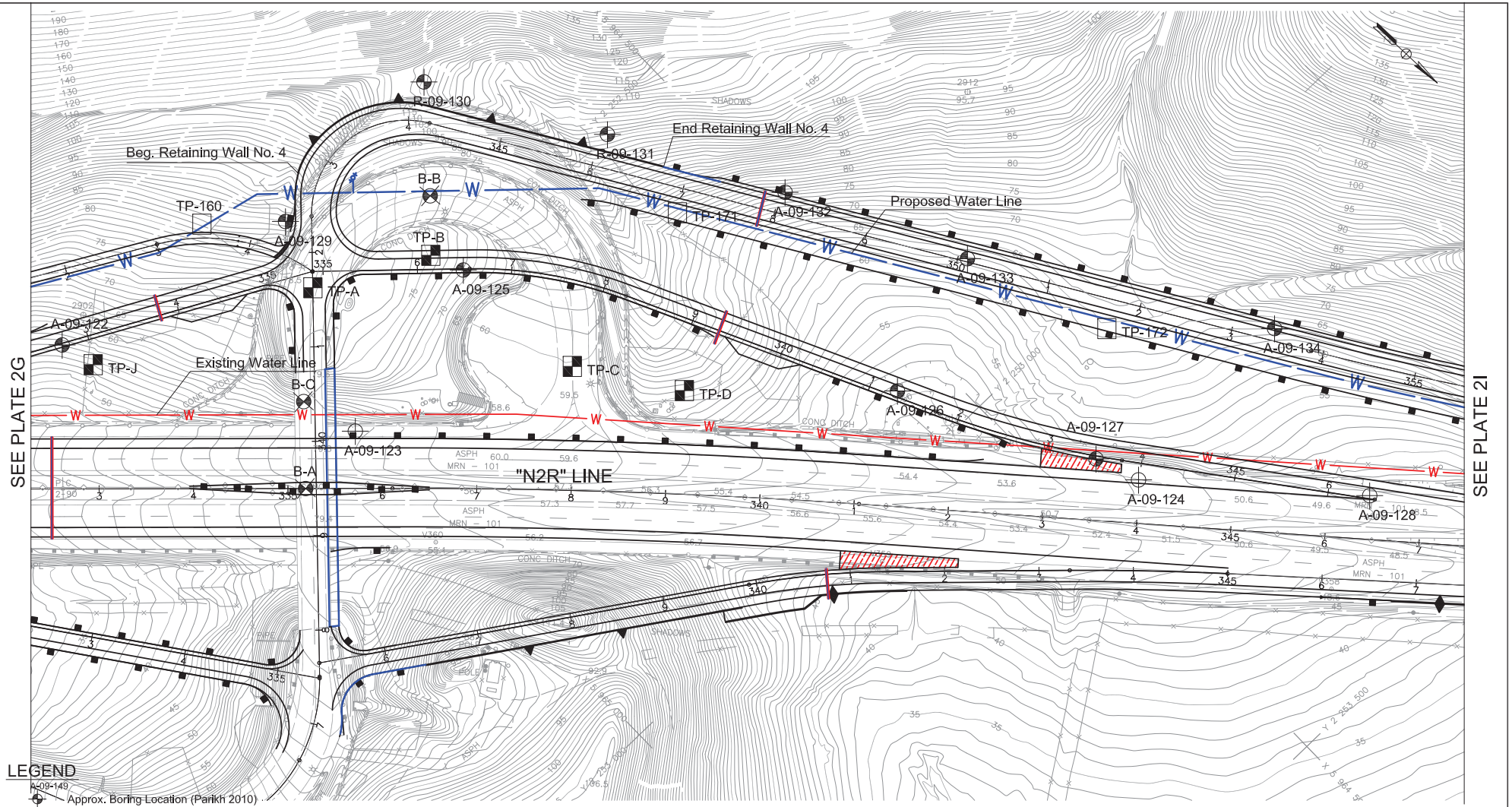
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2G



LEGEND

- A-09-149 — Approx. Boring Location (Parikh 2010)
- B-B — Approx. Boring Location (Miller Pacific Engineering Group 2002)
- A-09-147 — Approx. R-Value Boring Location (Parikh 2010)
- 9639-70P — Approx. R-Value Boring Location (Caltrans Memo 2005)
- Test Pit Location (Parikh 2010)
- Test Pit Location (Miller Pacific Engineering Group-2002)
- w — Existing Water Line (Red Line)
- W — Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

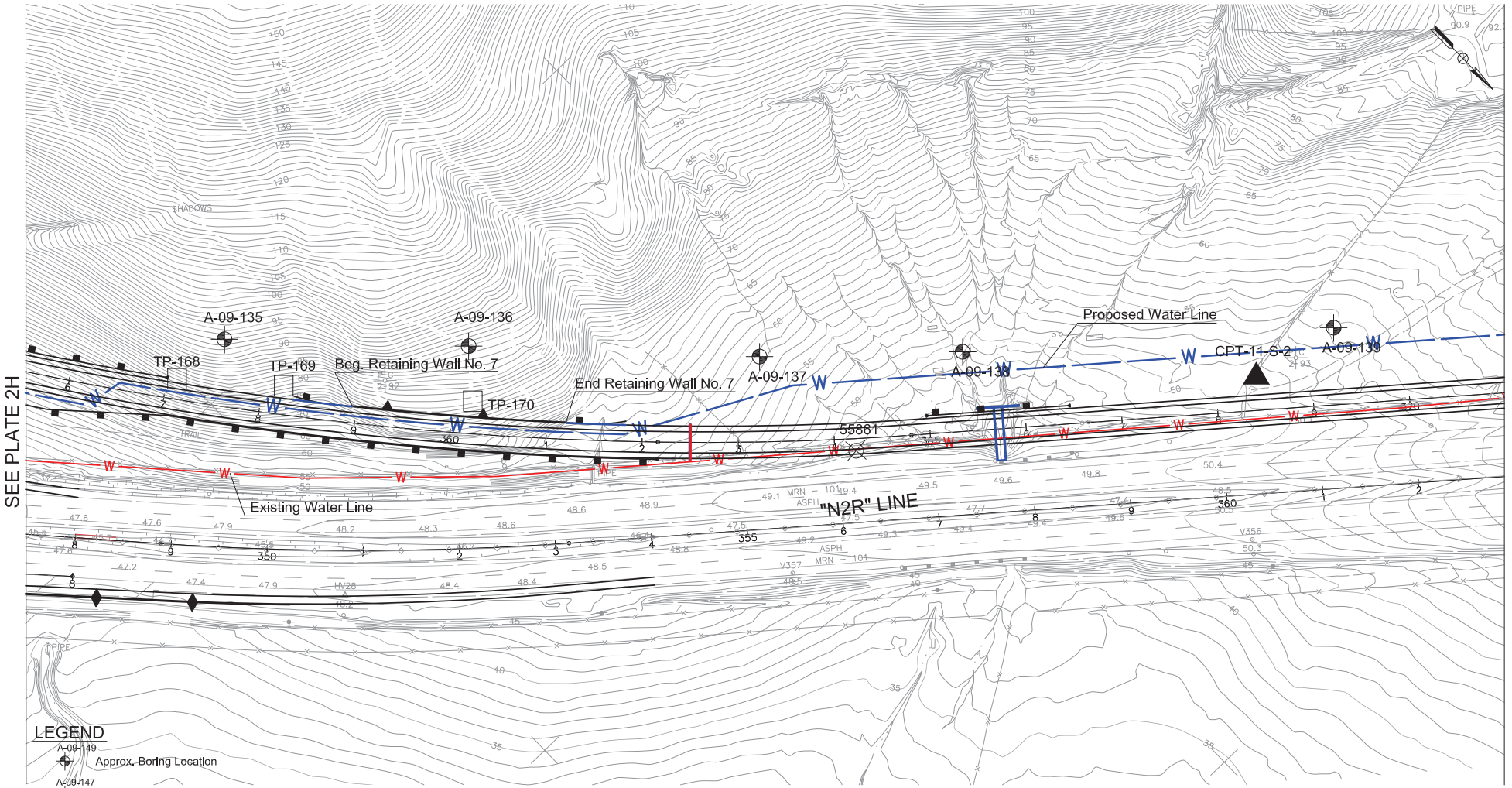
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2H



LEGEND

A-09-149 Approx. Boring Location

A-09-147 Approx. R-Value Boring Location

Test Pit Location

9639-70P Approx. R-Value Boring Location (Caltrans Memo 2005)

CPT-09-S-2 Approx. CPT Location

w Existing Water Line (Red Line)

W Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

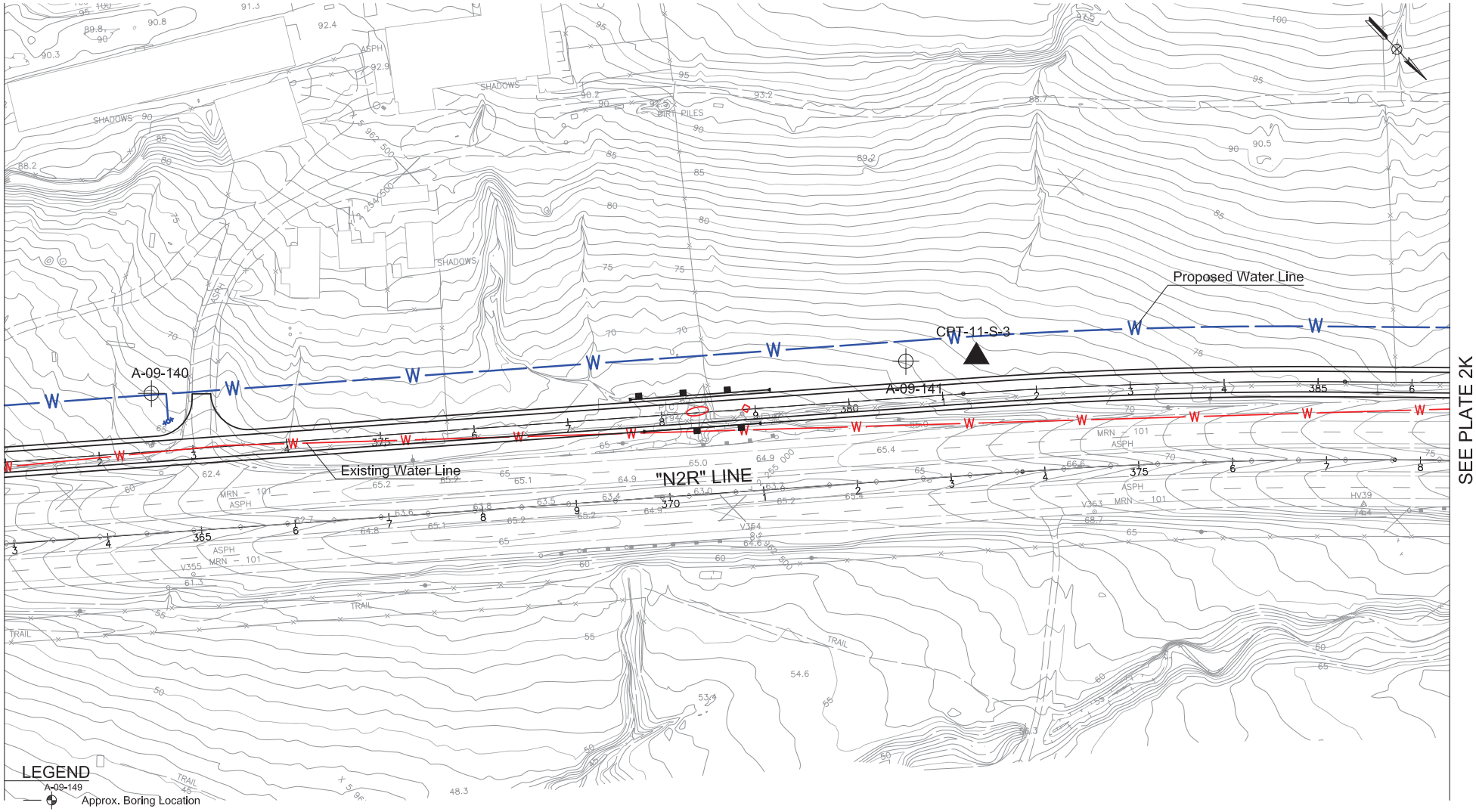
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO: 2I



SCALE 1 inch = 100 feet

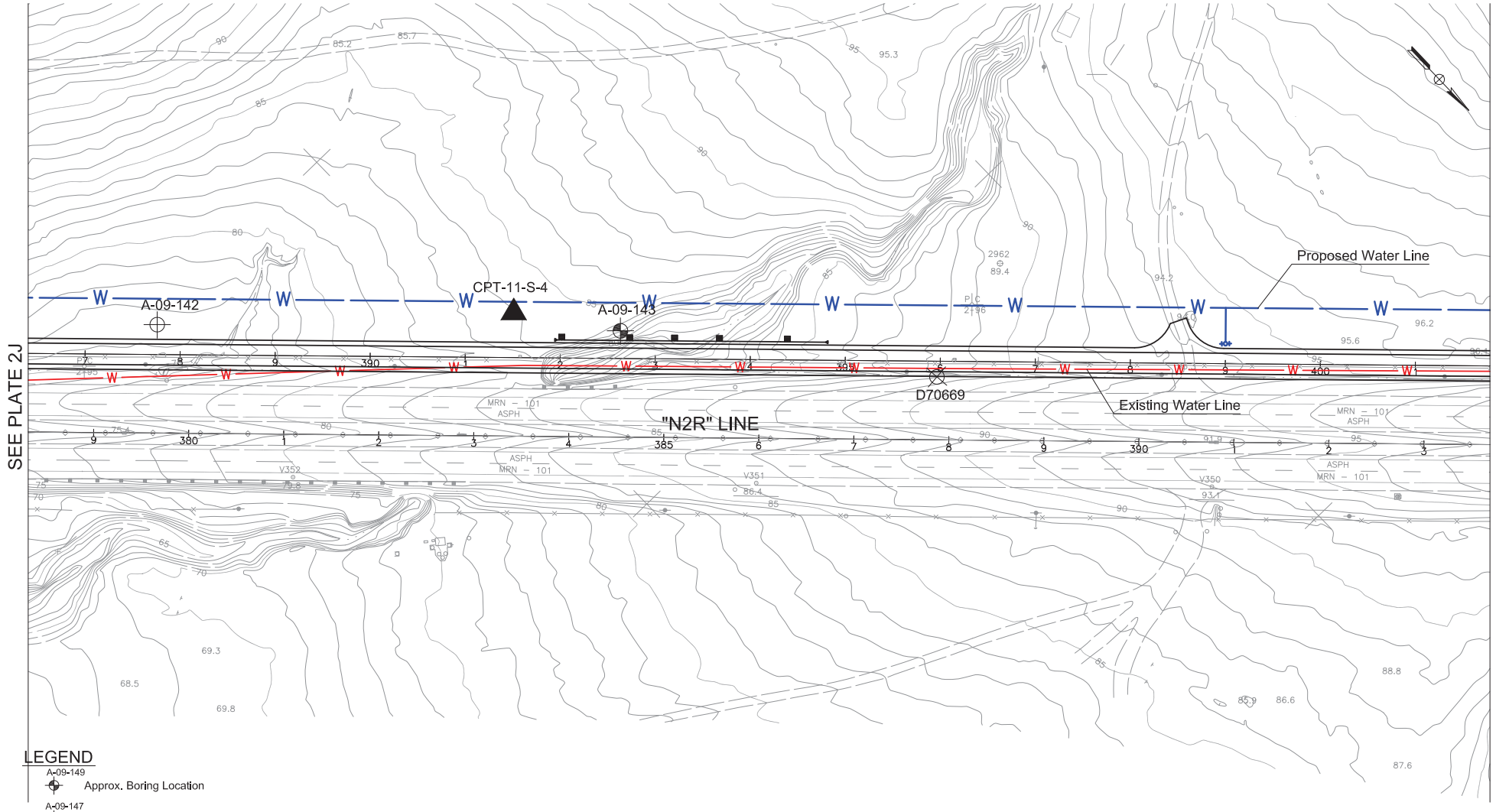
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2J



LEGEND

- A-09-149 — Approx. Boring Location
- A-09-147 — Approx. R-Value Boring Location
- 9639-70P — Approx. R-Value Boring Location (Caltrans Memo 2005)
- CPT-11-S-4 — Approx. CPT Location
- w — Existing Water Line (Red Line)
- W — Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

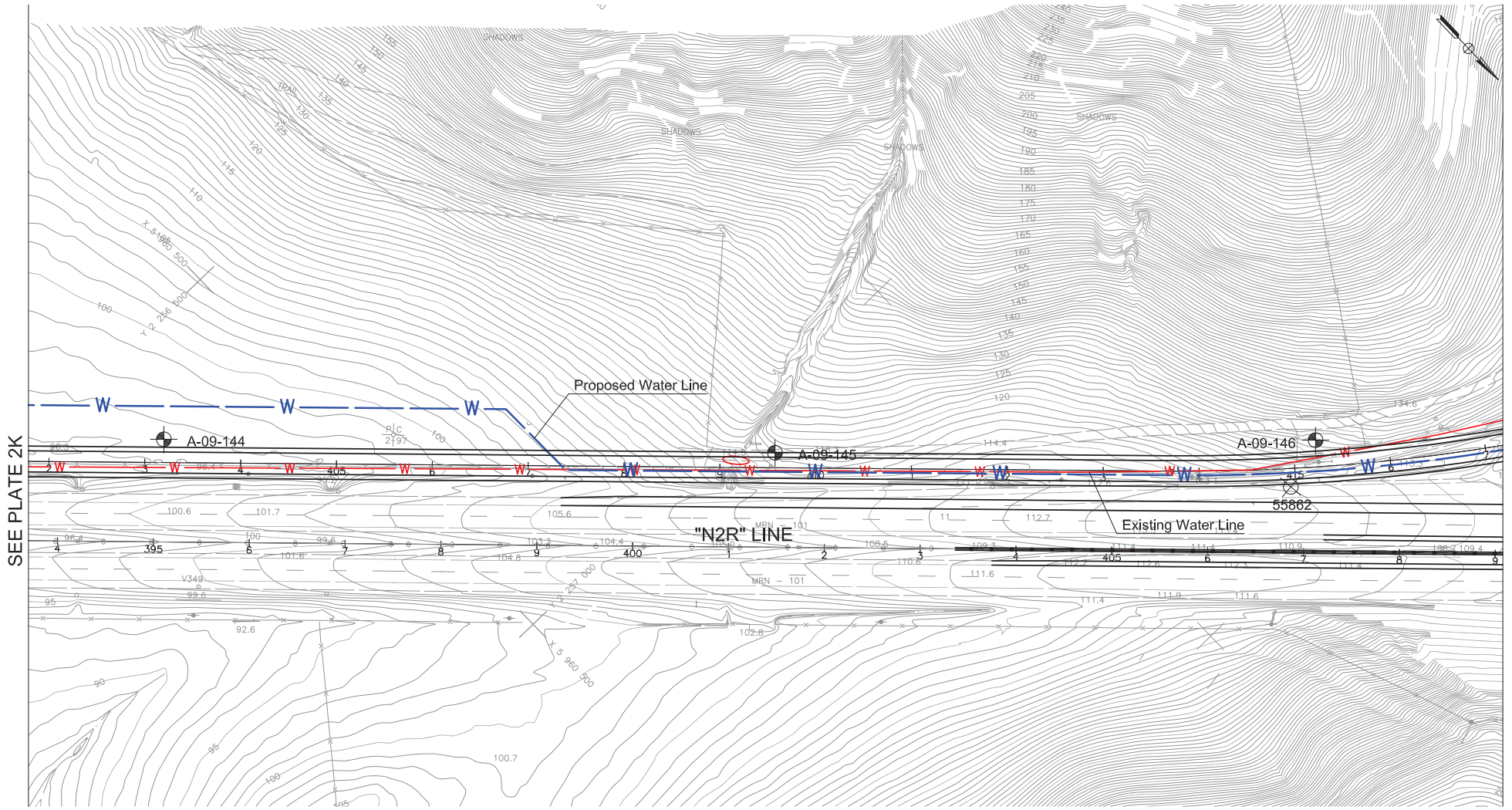
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2K



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

9639-70P
Approx. R-Value Boring Location (Caltrans Memo 2005)

w Existing Water Line (Red Line)

W Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

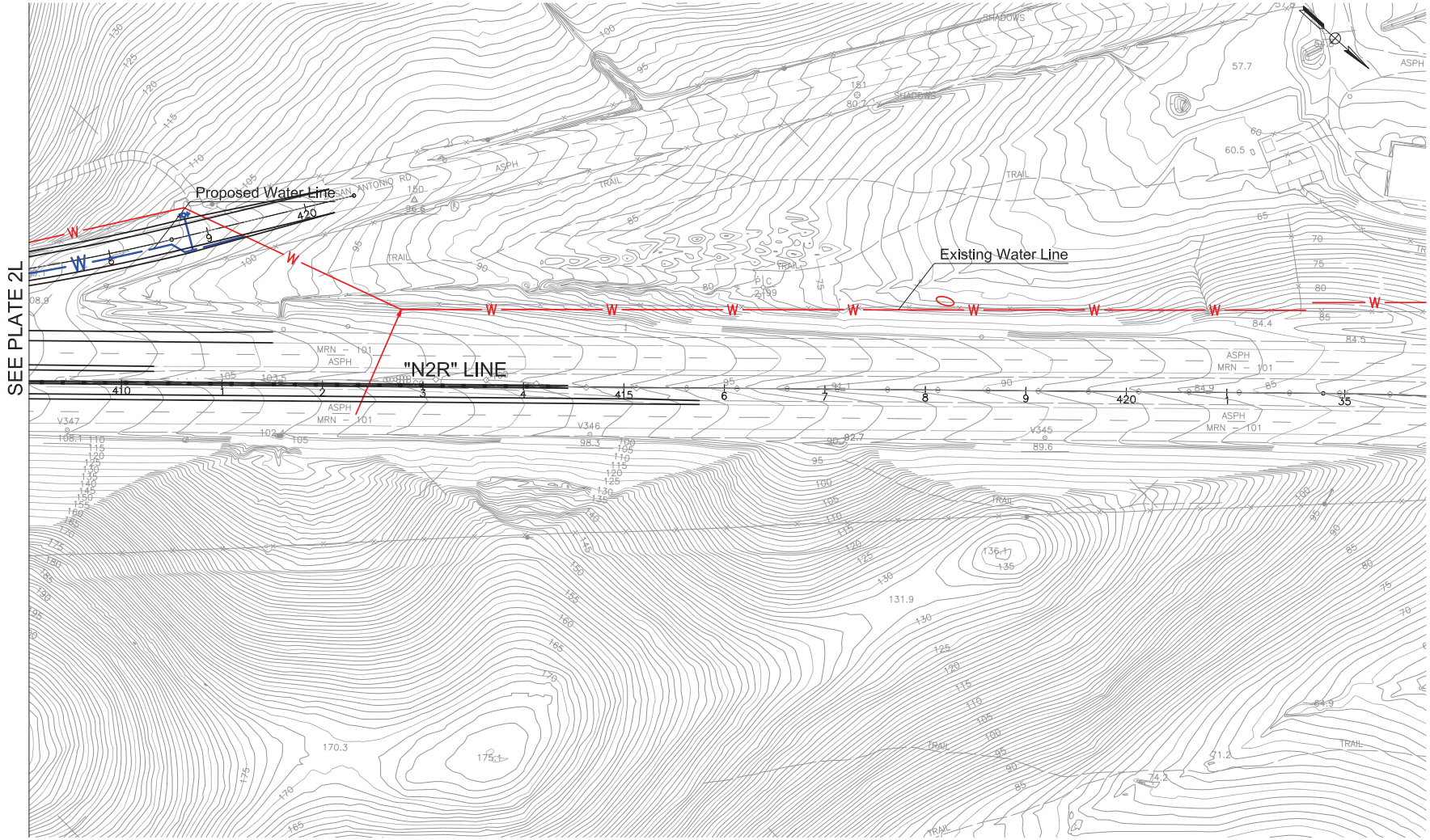
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2L



LEGEND

A-09-149
Approx. Boring Location

A-09-147
Approx. R-Value Boring Location

w — Existing Water Line (Red Line)

W — Proposed Water Line (Blue Line)

SCALE 1 inch = 100 feet

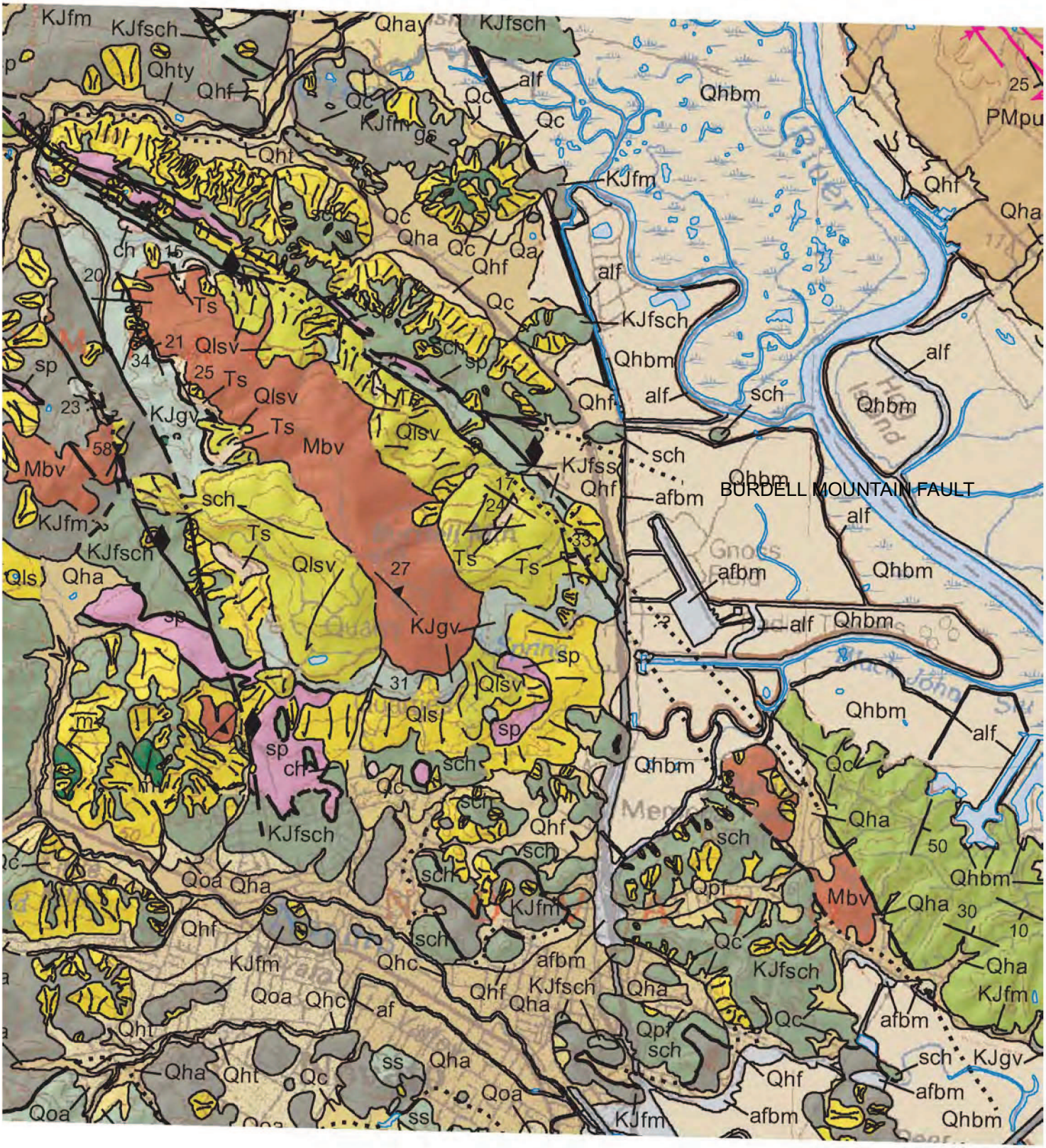
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO: 2M

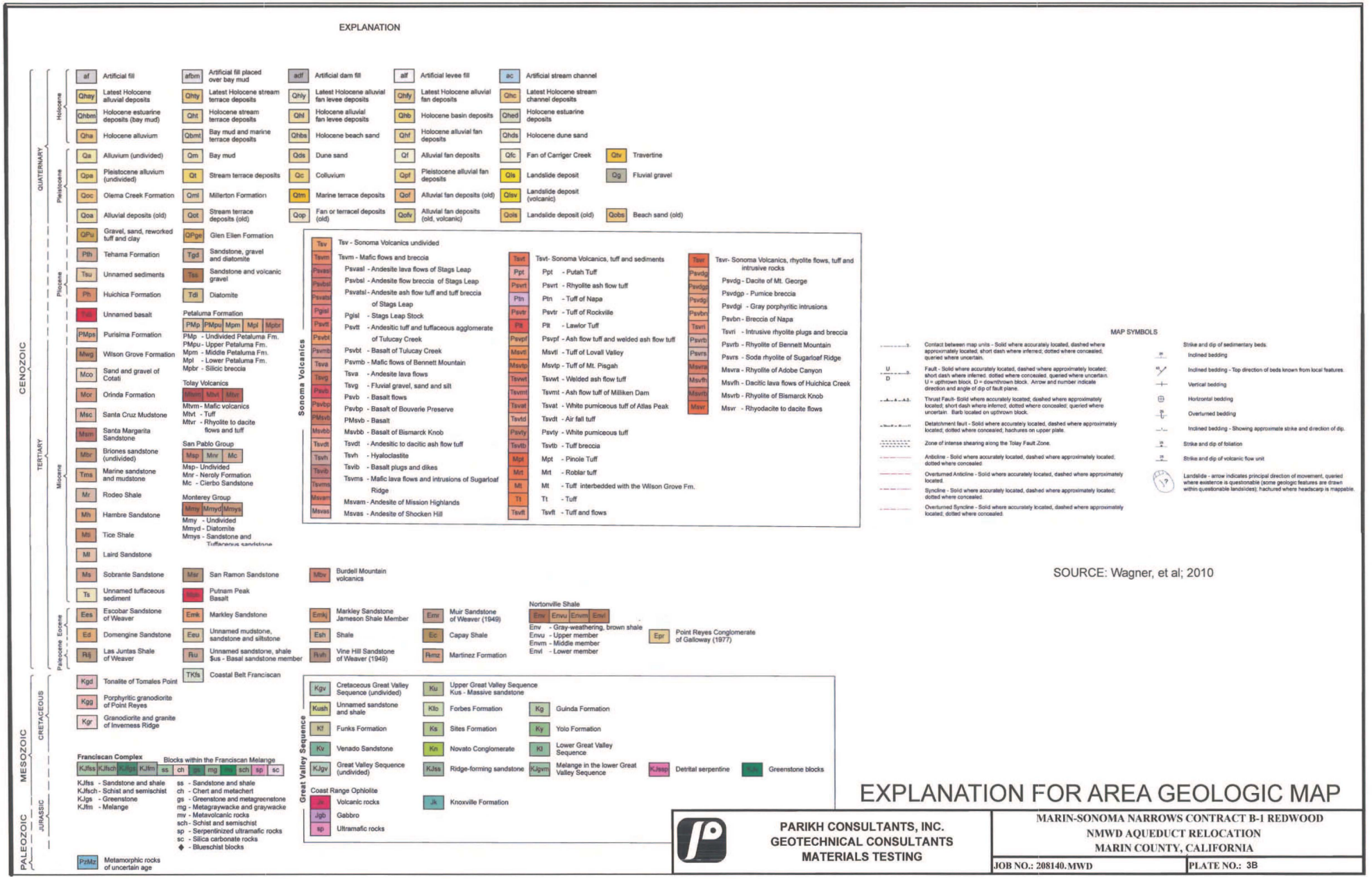


0 1,000 2,000 4,000 6,000 8,000 10,000 Feet

SOURCE: Wagner, et al; 2010

See Plate 3B for Explanation

PARIKH CONSULTANTS, INC. **GEOTECHNICAL CONSULTANTS** **MATERIALS TESTING**	**MARIN-SONOMA NARROWS CONTRACT B-1** **NMWD AQUEDUCT RELOCATION** **MARIN COUNTY, CALIFORNIA**	
	JOB NO.: 208140.MWD	**PLATE NO.:** 3A



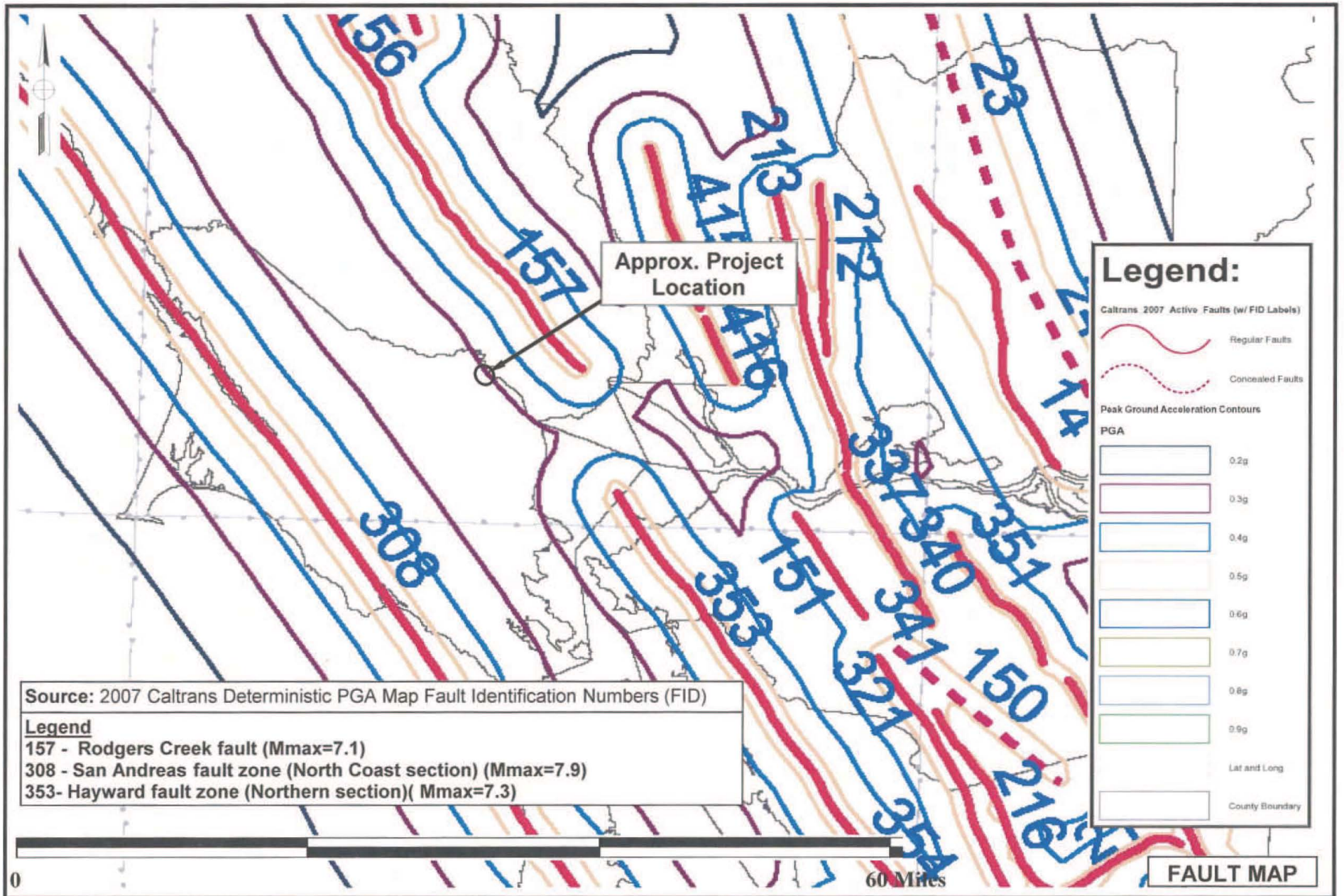
SOURCE: Wagner, et al; 2010

EXPLANATION FOR AREA GEOLOGIC MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1 REDWOOD
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: 3B

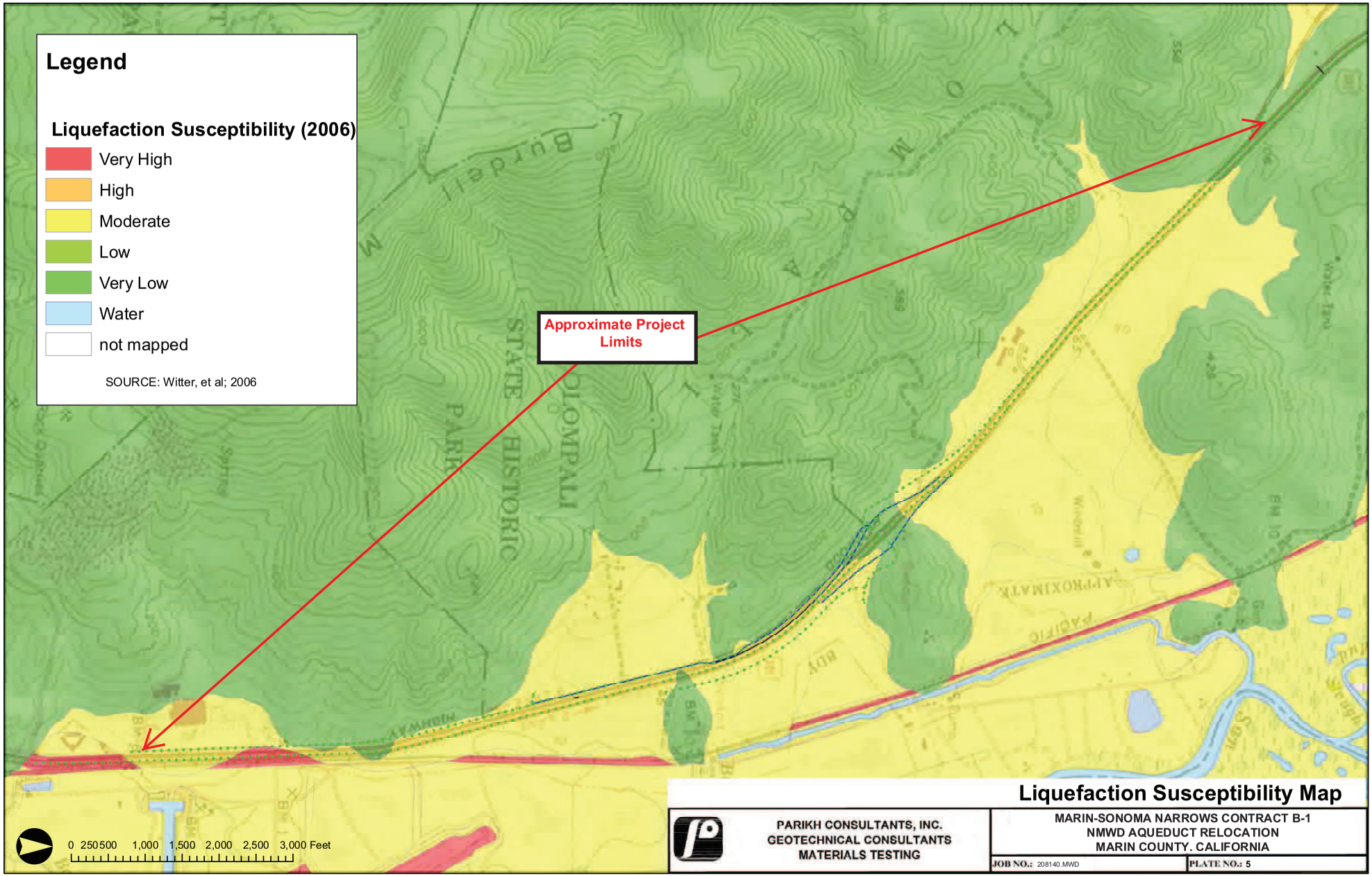


PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

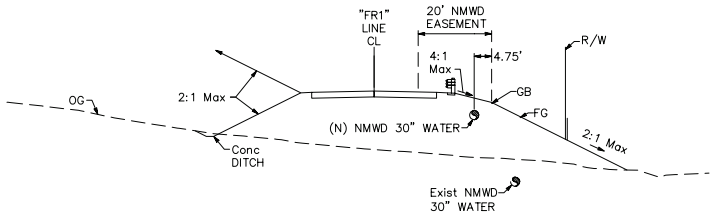
JOB NO.: 208140.MWD

PLATE NO.: 4


Legend
Liquefaction Susceptibility (2006)
Very High
High
Moderate
Low
Very Low
Water
not mapped
SOURCE: Witter, et al; 2006
Approximate Project Limits
0 250 500 1,000 1,500 2,000 2,500 3,000 Feet
Liquefaction Susceptibility Map
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING
MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY. CALIFORNIA
JOB NO.: 208140.MWD
PLATE NO.: 5

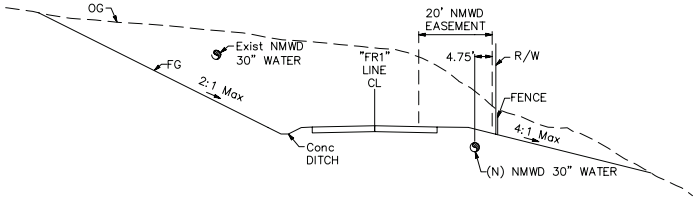
NOTES:

LOCATIONS AND DEPTHS OF NEW NMWD WATER IS TYPICAL. ACTUAL LOCATIONS PER PLANS.



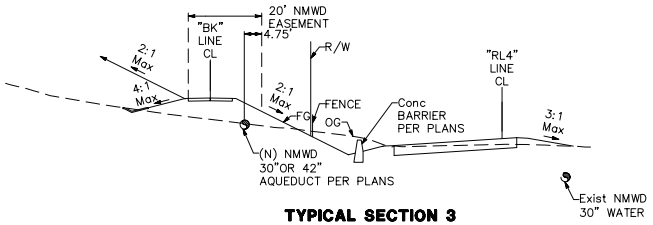
TYPICAL SECTION 1

"W1" 251+03.53 to 257+33.33 and
"W1" 261+52.45 to 270+54.24



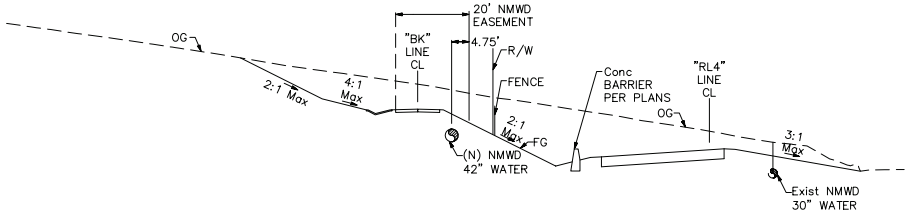
TYPICAL SECTION 2

"W1" 257+33.34 to 261+52.44



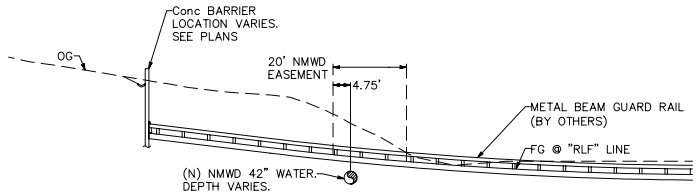
TYPICAL SECTION 3

"W2" 323+00.50 to 330+05.99



TYPICAL SECTION 4

"W2" 330+06.00 to 335+23.52



TYPICAL SECTION 5

"W2" 335+39.06 to 335+83.98

UTILITY DETAILS

NORTH MARIN WATER DISTRICT

"W1" AND "W2" AQUEDUCT RELOCATION

TYPICAL SECTIONS

NO SCALE

UD-1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

Al Cornwell — REGISTERED CIVIL ENGINEER — 10/3/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Al G. Cornwell — No. 27577 — Exp. 12/31/11 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

CSW/ST2
45 LEVERONI COURT
NOVATO, CA 94949

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

CALCULATED–DESIGNED BY	JEFFREY SHU	REVISED BY	JS
CHECKED BY	EMILY DEAN	DATE REVISED	10/3/11
CONSULTANT FUNCTIONAL SUPERVISOR	ALAN G. CORNWELL		

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION — Caltrans

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET U–16

THIS PLAN FOR UTILITY (WATER) WORK ONLY

DATE PLOTTED => Oct 05 2011
TIME PLOTTED => 6:00 pm

LAST REVISION 10–3–11

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

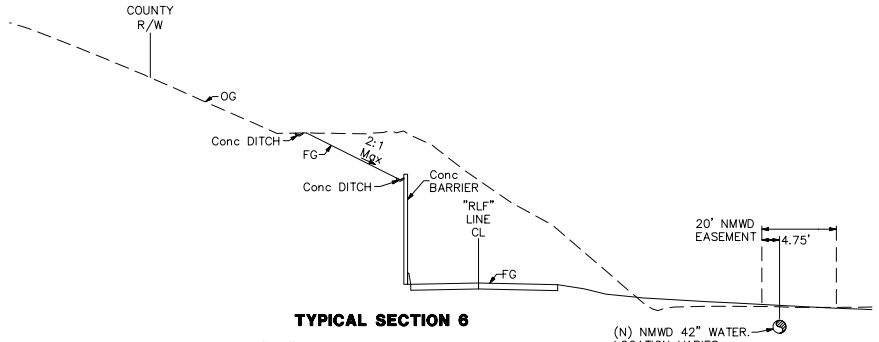
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: 6A

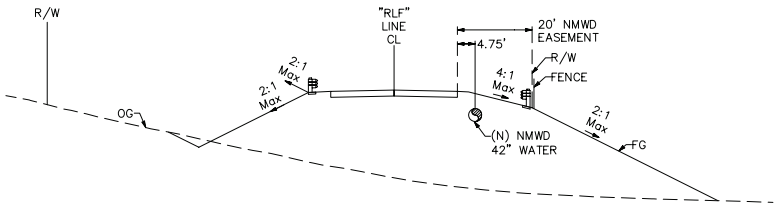
NOTES:

LOCATIONS AND DEPTHS OF NEW NMWD WATER IS TYPICAL. ACTUAL LOCATIONS PER PLANS.



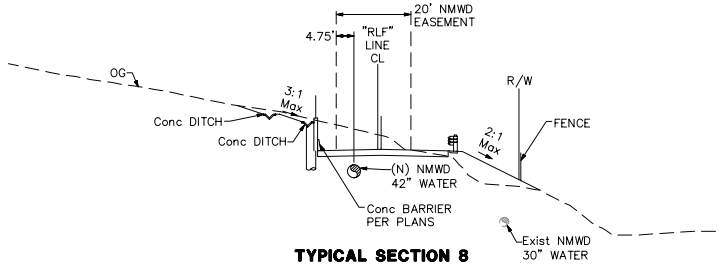
TYPICAL SECTION 6

"W2" 335+83.99 to 338+80.33



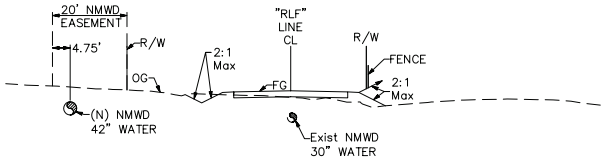
TYPICAL SECTION 7

"W2" 338+80.34 to 348+77.00



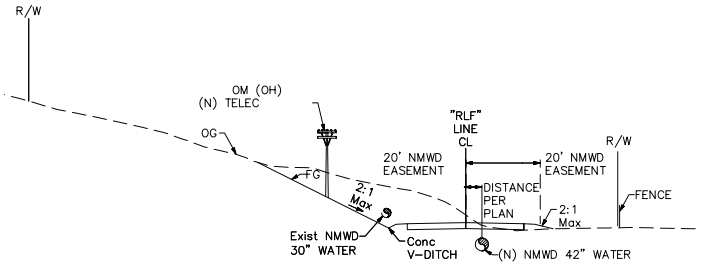
TYPICAL SECTION 8

"W2" 348+77.01 to 354+46.12



TYPICAL SECTION 9

"W2" 354+46.13 to 400+32.25



TYPICAL SECTION 10

"W2" 400+32.26 to 412+31.49

UTILITY DETAILS
NORTH MARIN WATER DISTRICT
"W2" AQUEDUCT RELOCATION
TYPICAL SECTIONS

NO SCALE

UD-2

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET U-16

THIS PLAN FOR UTILITY (WATER) WORK ONLY

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — 10/3/11 DATE

Al G. Cornwell No. 27577 Exp. 12/31/11 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

CSW/ST2
45 LEVERONI COURT
NOVATO, CA 94949

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED
JS	10/3/11

JEFFREY SHU
EMILY DEAN

CALCULATED/DESIGNED BY
CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
ALAN G. CORNWELL

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 10-3-11 | DATE PLOTTED => Oct 05 2011 | TIME PLOTTED => 6:01 pm

BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 0400000733

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: 6B

APPENDIX A

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

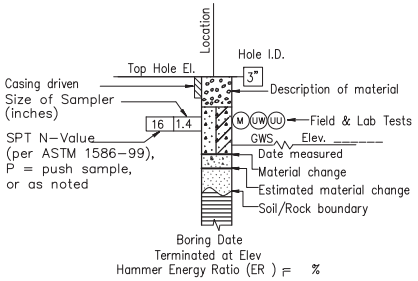
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	TP	Test Pit

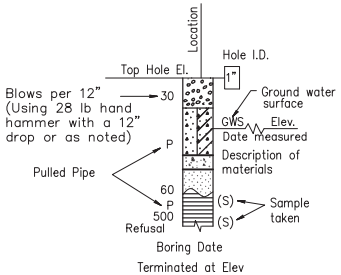
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

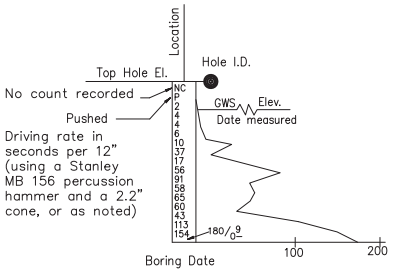
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



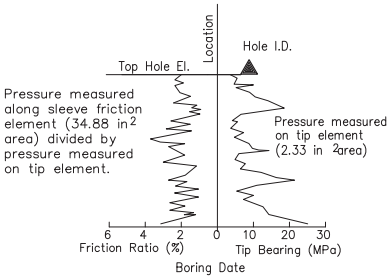
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) / Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY L. TRAN

CHECKED BY P. SIRCAR

L. BHANGOO / V. SANTOS
FIELD INVESTIGATION BY:
DATE: JUNE 2009 – NOVEMBER 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION

LOG OF TEST BORINGS

CU 03240
EA 04-264071

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

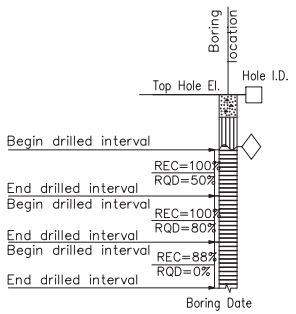
OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

PERCENT CORE RECOVERY (REC) + ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4"}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 – 30,000
Strong	7,000 – 14,500
Medium Strong	3,500 – 7,000
Weak	700 – 3,500
Very Weak	150 – 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3–5/8" to 1 ft
Thinly bedded	1–1/4" to 3–5/8"
Very thinly bedded	3/8" to 1–1/4"
Laminated	Less than 3/8"

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features: Chemical Weathering–Discoloration and/or oxidation: Body of Rock	Chemical Weathering–Discoloration and/or oxidation: Fracture Surfaces	Mechanical Weathering–Grain boundary conditions (disaggregation) primarily for granitics and some coarse–grained sediments	Texture and Solutioning: Texture	Texture and Solutioning: Solutioning	General Characteristics
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe–Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe–Mg minerals are altered to clay to some extent; or chemical alteration produces in–situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe–Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY L. TRAN

CHECKED BY P. SIRCAR

L. BHANGOO / V. SANTOS
FIELD INVESTIGATION BY:
DATE: JUNE 2009 – NOVEMBER 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO. –

POST MILES –

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION

LOG OF TEST BORINGS

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

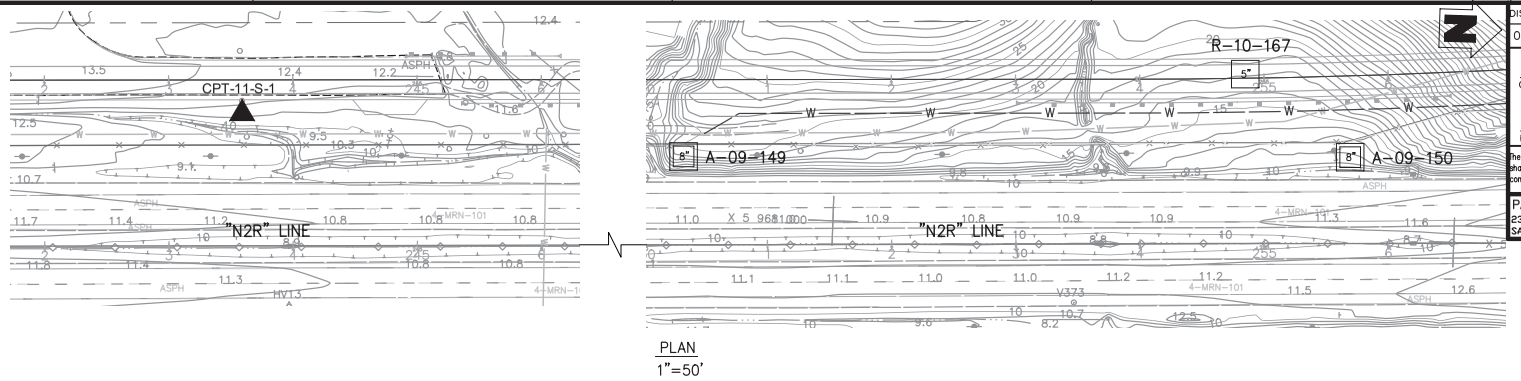
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

LEGEND :

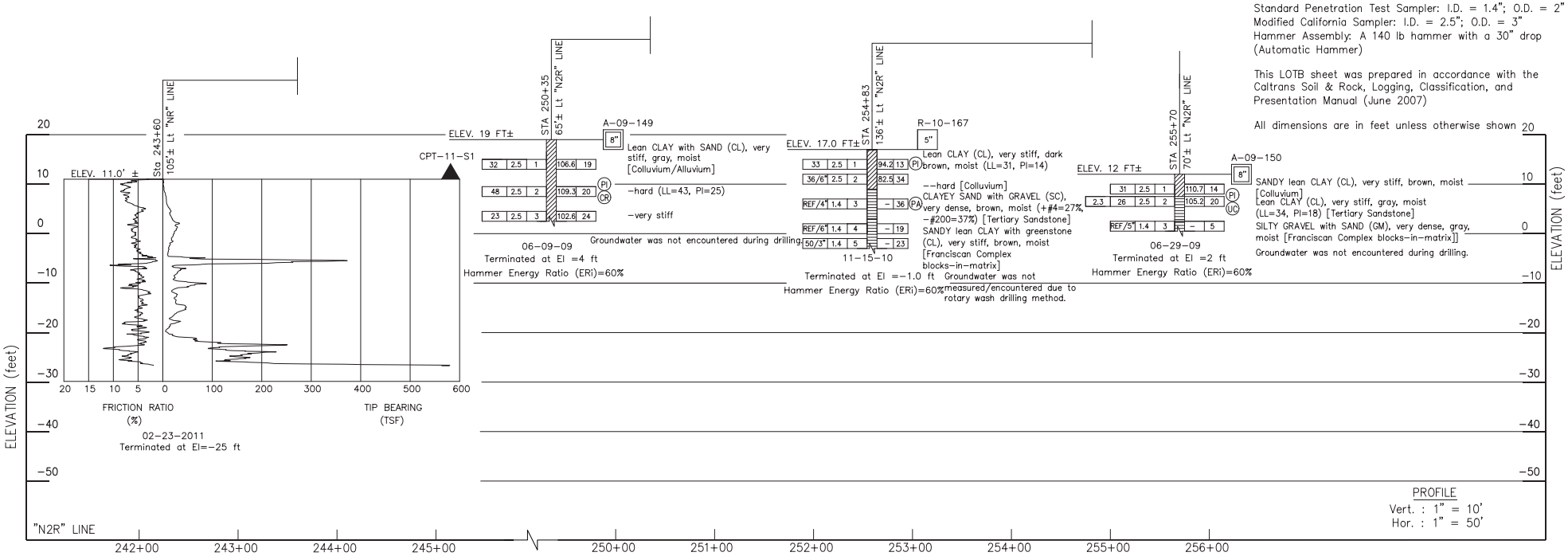
—— W —— Existing Water Line (Red Color)

—— W —— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:47am S:\AD\D\208140.GSR\North Marin Waterline Site Plan\LOTB (North Waterline Lotb).dwg

Engineer

USERNAME => $USER

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

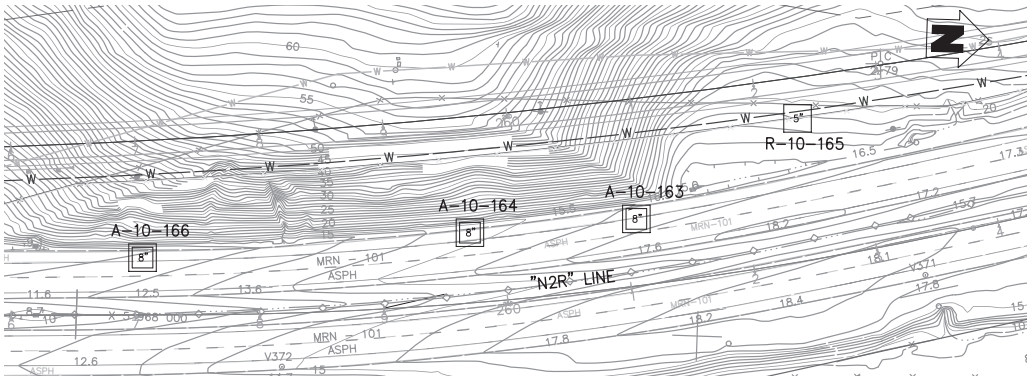
GEOTECHNICAL PROFESSIONAL — 10/28/11 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

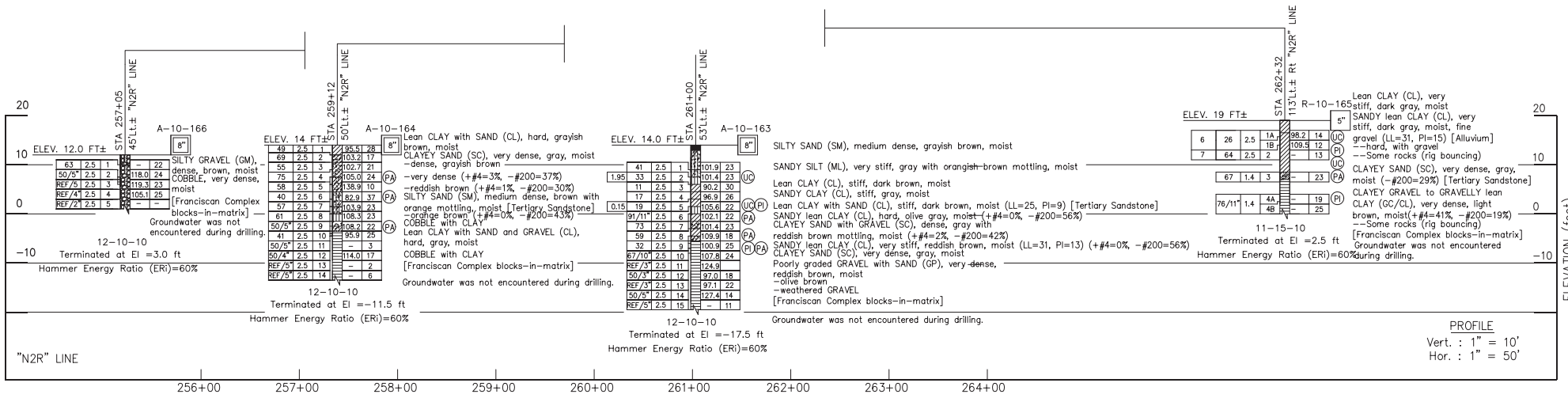
—— W ——Existing Water Line (Red Color)

—— W ——Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

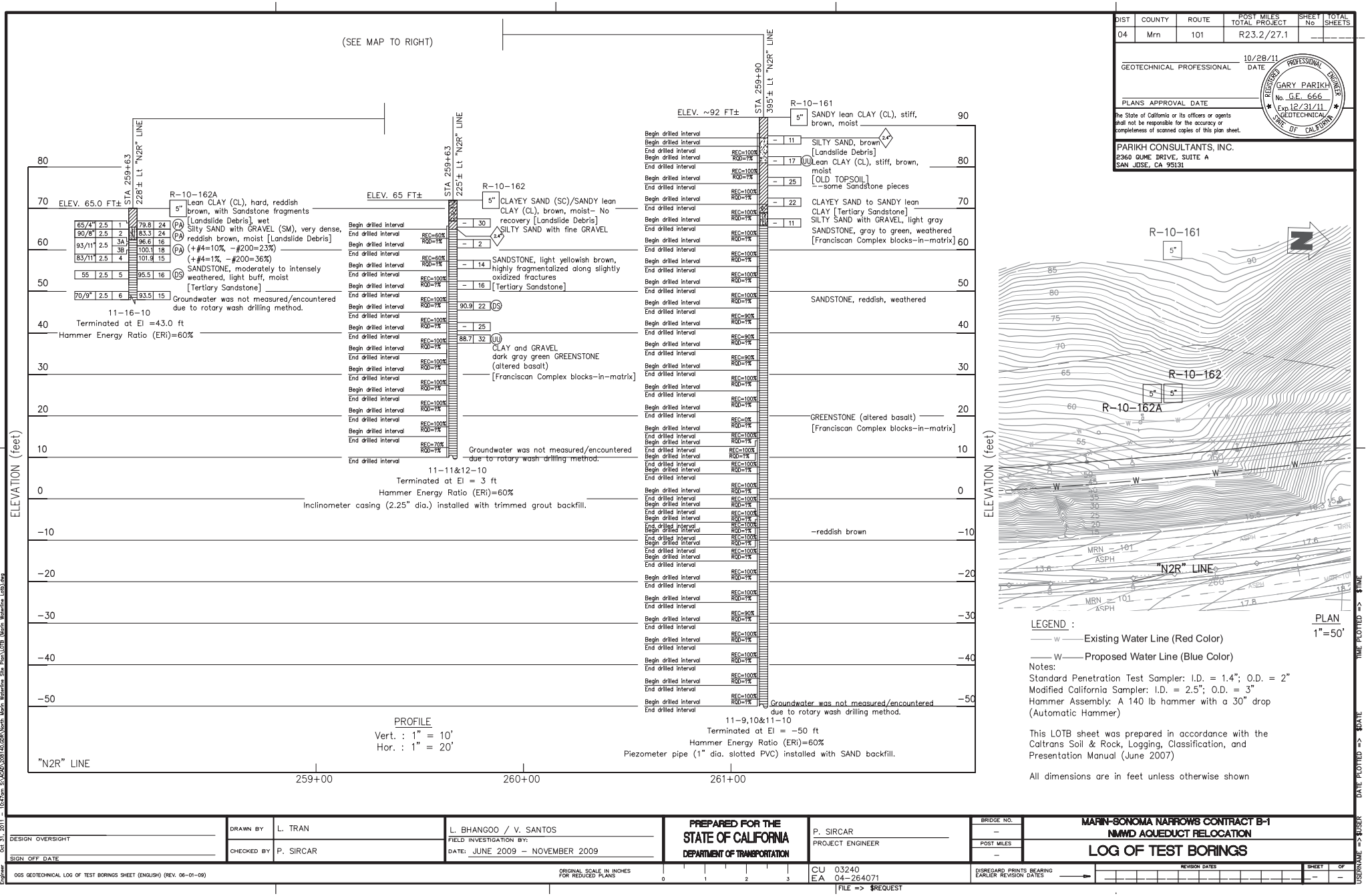
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME
USERNAME => $USER
Oct 31, 2011 – 10:47am S:\AD\D\208140.GSR\North Mrin, Waterline Site Plan\LOTB (North Waterline Lath).dwg
Engineer



LEGEND :

W Existing Water Line (Red Color)

W Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

GEOTECHNICAL PROFESSIONAL 10/28/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp.12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

DATE PLOTTED => $DATE TIME PLOTTED => $TIME USERNAME => $USER

Oct 31, 2011 – 10:47am S:\AD\D\208140.GSR\North Mrn\ Waterfline Site Plan\LOTB (North Waterfline Lath).dwg

Engineer

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

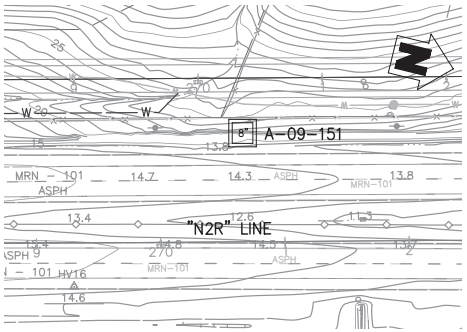
GEOTECHNICAL PROFESSIONAL — 10/28/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

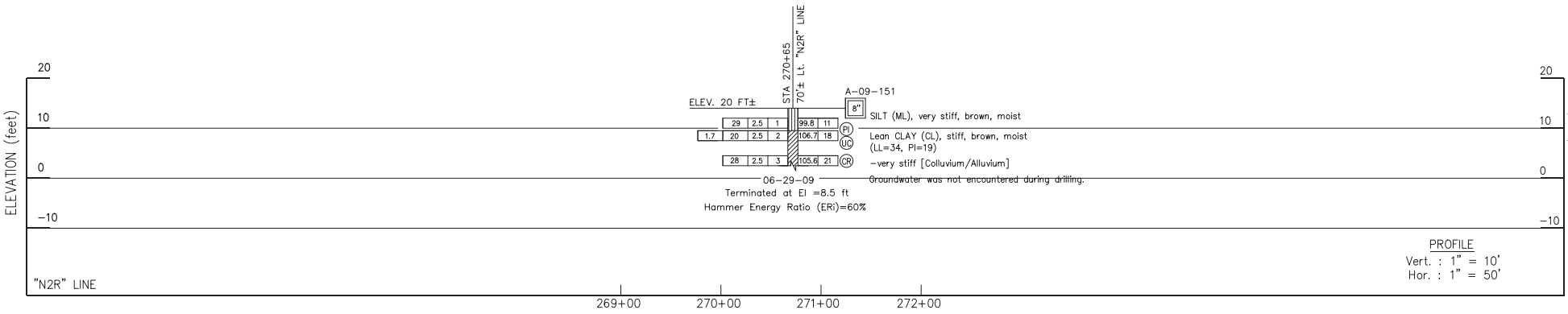
—— W ——Existing Water Line (Red Color)

——W——Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:47am S:\AQD\209140.GSR\North Mrn\ Waterline Site Plan\LOTB (North Waterline Lotb).dwg

Engineer

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

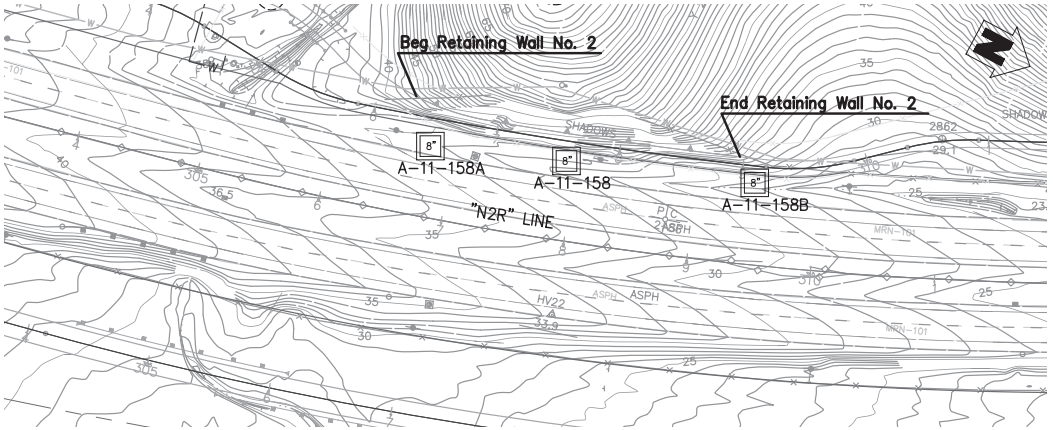
GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



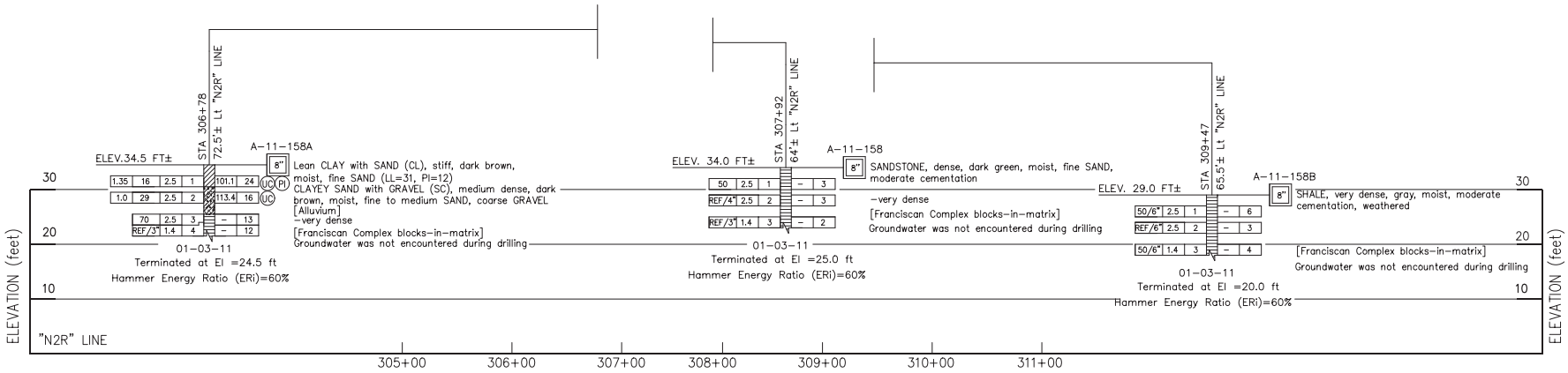
PLAN
1"=50'

LEGEND :
W Existing Water Line (Red Color)
W Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY L. TRAN / CHECKED BY P. SIRCAR	L. BHANGOO / V. SANTOS — FIELD INVESTIGATION BY: — DATE: JUNE 2009 – NOVEMBER 2009	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR — PROJECT ENGINEER	BRIDGE NO. – / POST MILES –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:47am S:\AD\D\208140.GSR\North Mrin, Waterline Site Plan\LOTB (North Waterline Lath).dwg

Engineer

USERNAME => $USER

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

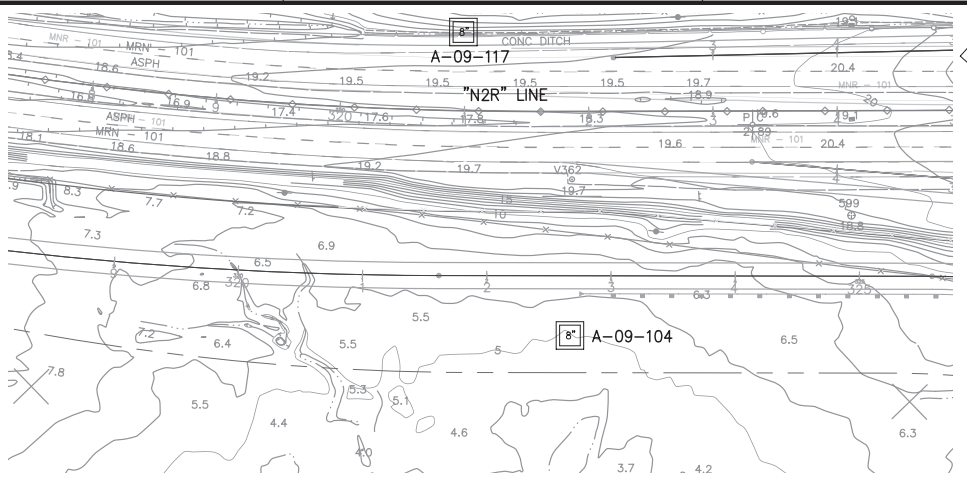
GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

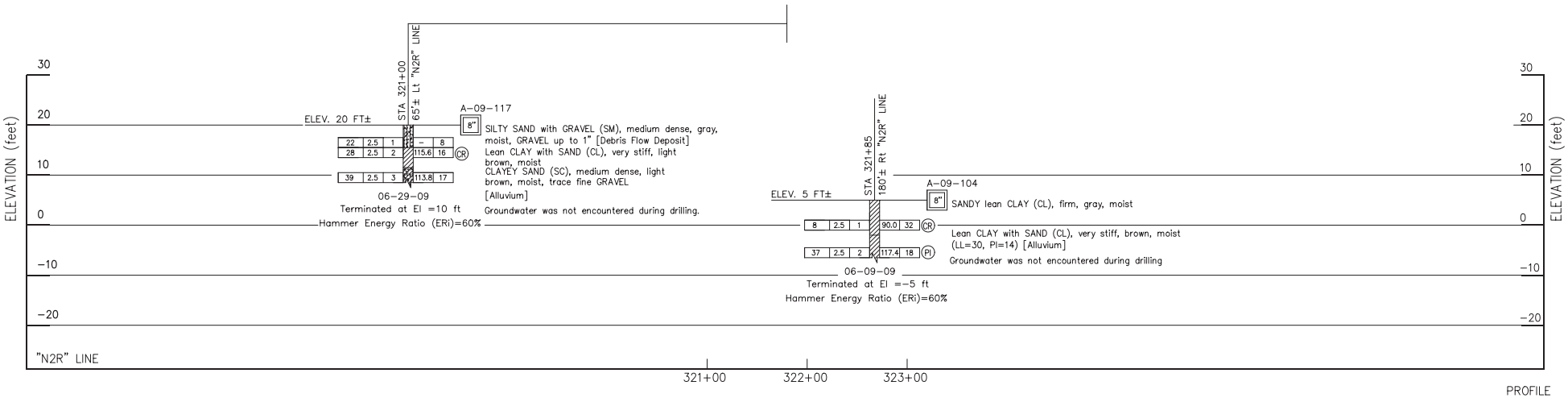
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :
—— W ——Existing Water Line (Red Color)
—— W ——Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)
All dimensions are in feet unless otherwise shown
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:48am S:\AQD\209140\GSR\North Mrn, Waterfline Site Plan\LOTB (North Waterfline Lath).dwg

Engineer

USERNAME => $USER

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

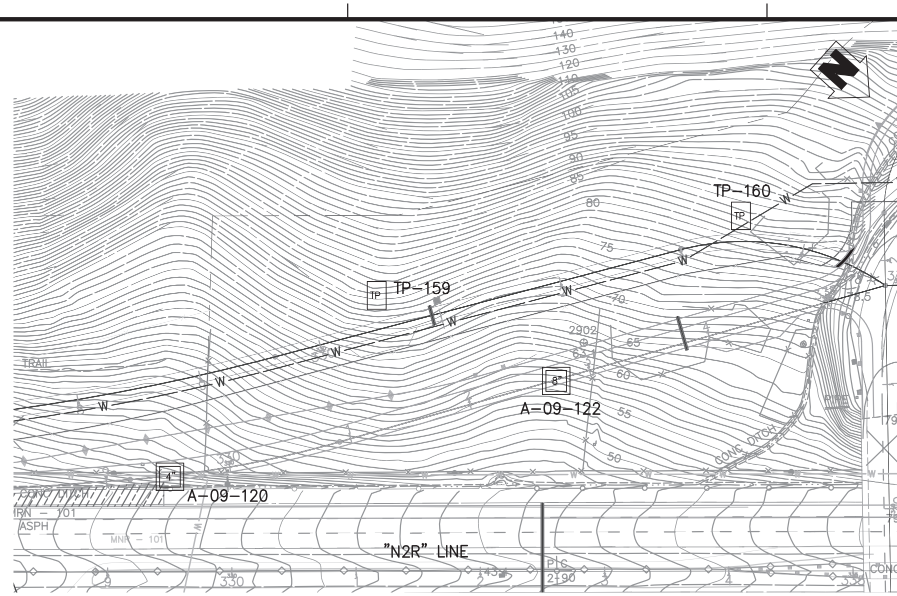
GEOTECHNICAL PROFESSIONAL 10/28/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

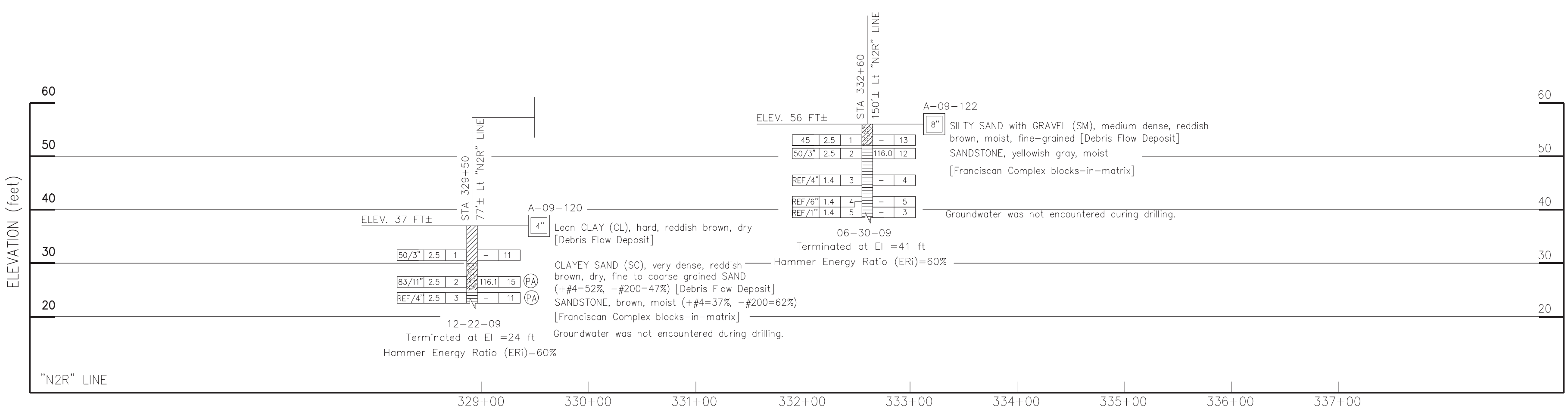
LEGEND :
—w— Existing Water Line (Red Color)
—W— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pits TP-159 & TP-160 at the end of Appendix A.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS FIELD INVESTIGATION BY: DATE: JUNE 2009 - NOVEMBER 2009
SIGN OFF DATE	CHECKED BY	P. SIRCAR	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION

LOG OF TEST BORINGS

SHEET – OF –

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Engineer Oct 31, 2011 - 10:48am S:\ACAD\208140.GDR\North Marin Waterline Site Plan\LOTB (Marin Waterline Lotb).dwg

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

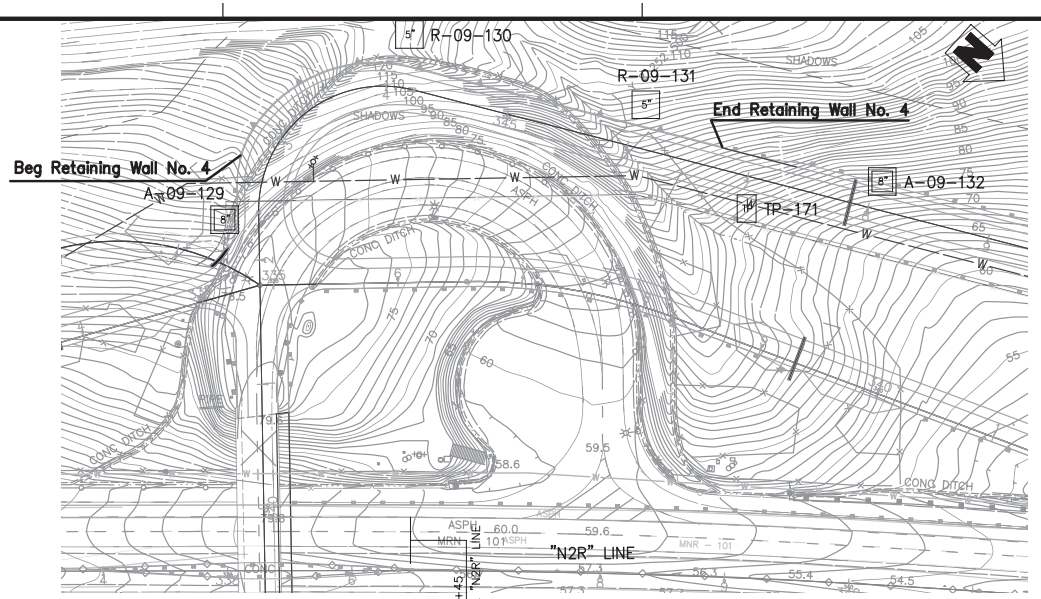
GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

—— w —— Existing Water Line (Red Color)

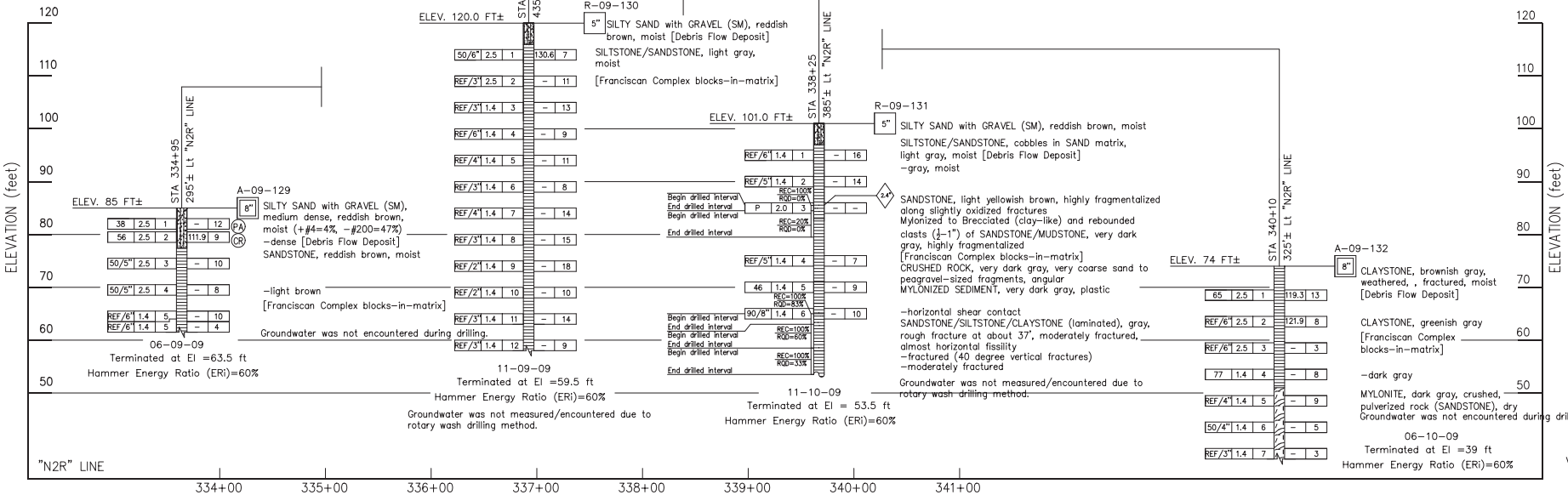
—— W —— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless shown otherwise

Log of Test Pit TP-171 at the end of Appendix A.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:45am S:\AQD\209140.GSR\North Mrn\ Waterline Site Plan\LOTB (North Waterline Lath).dwg

Engineer

USERNAME => $USER

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

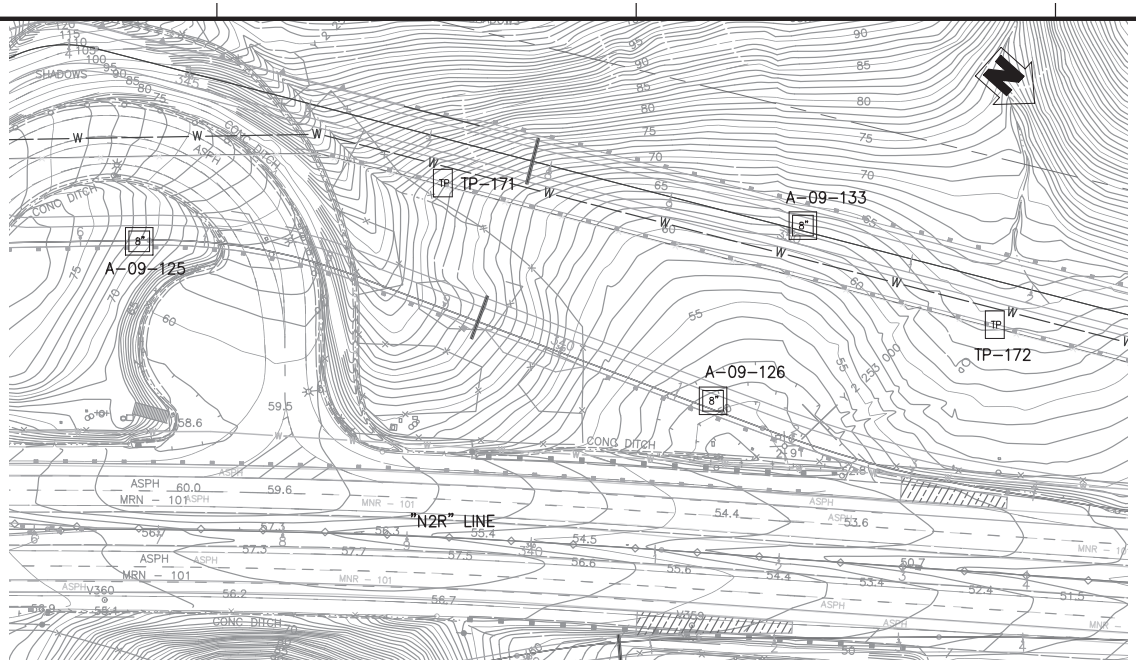
GEOTECHNICAL PROFESSIONAL — 10/28/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

——W—— Existing Water Line (Red Color)

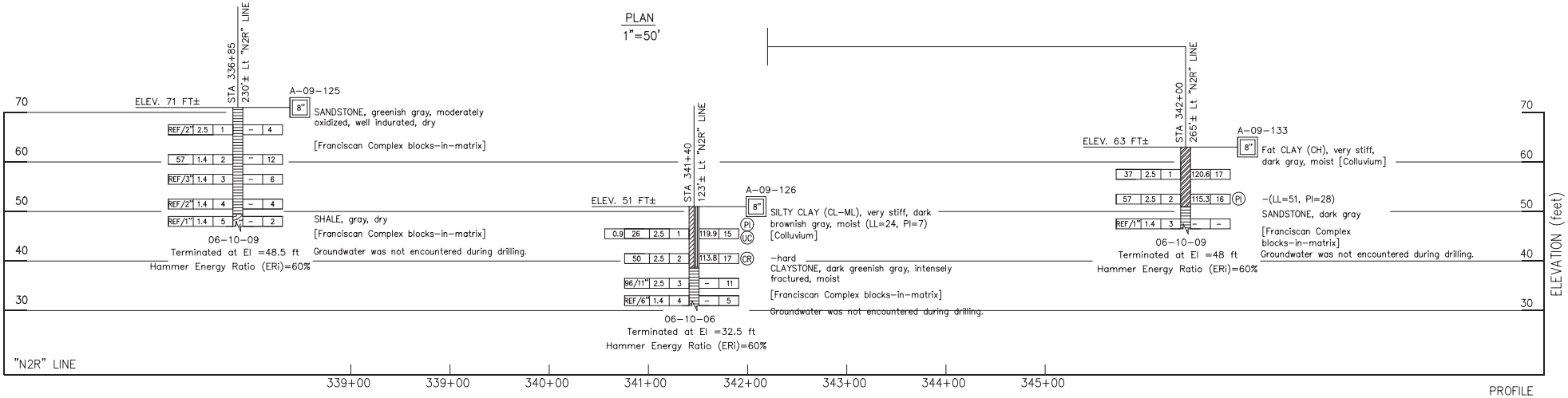
——W—— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pits TP-171 & TP-172 at the end of Appendix A.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:45am S:\V2\D\208140.GSR\North Mrrn, Waterline Site Plan\LOTB (North Waterline Lath).dwg

Engineer

DATE PLOTTED => $DATE TIME PLOTTED => $TIME

USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

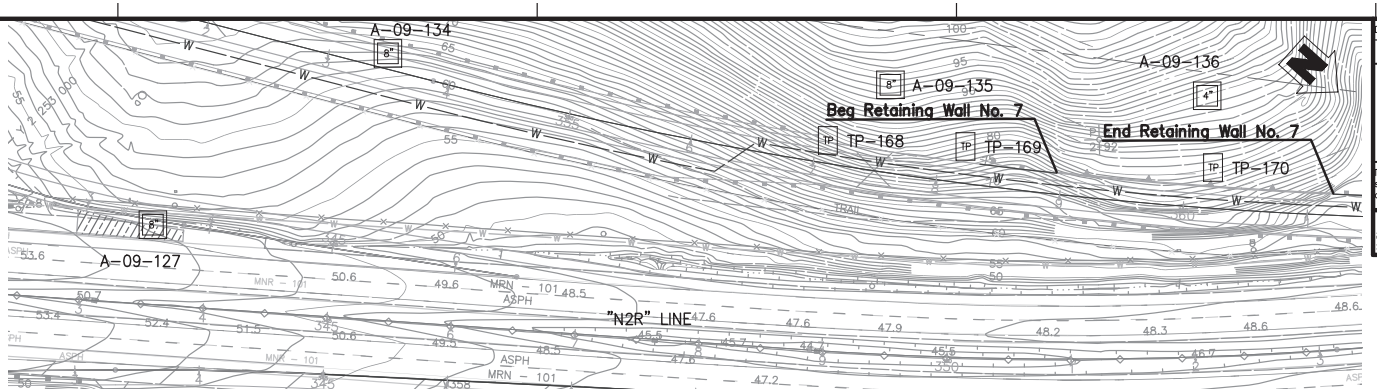
GEOTECHNICAL PROFESSIONAL — 10/28/11 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

——w—— Existing Water Line (Red Color)

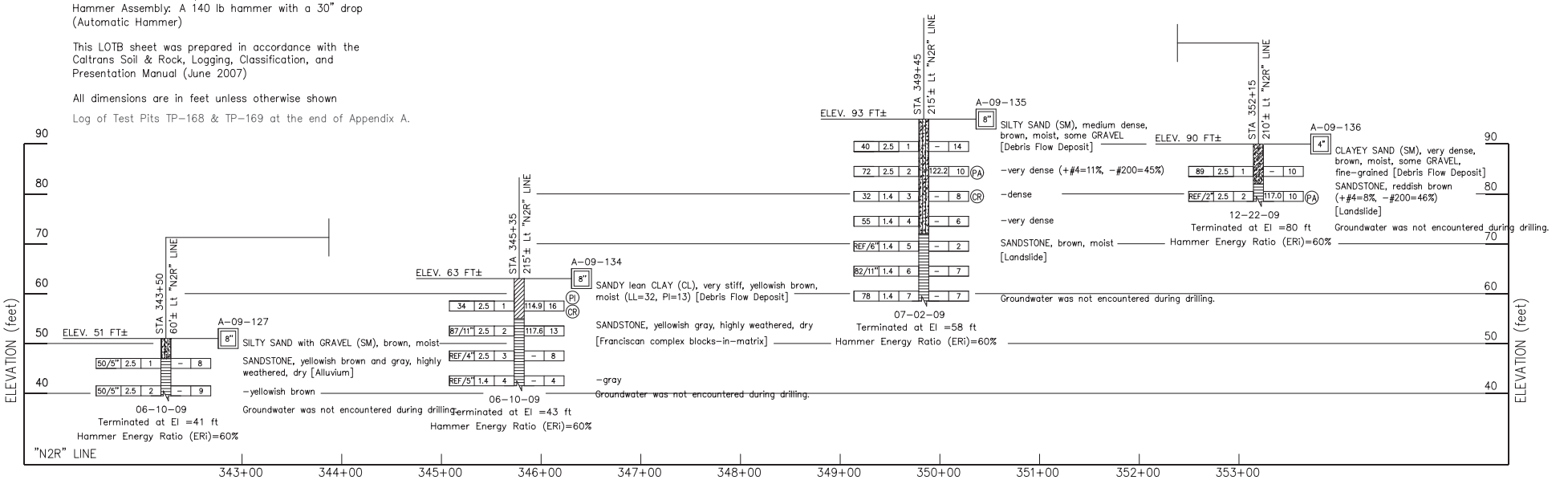
——W—— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown

Log of Test Pits TP-168 & TP-169 at the end of Appendix A.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:48am S:\AQD\208140.GBR\North Mrn\ Waterline Site Plan\LOTB (North Waterline Lath).dwg

Engineer

USERNAME => $USER

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

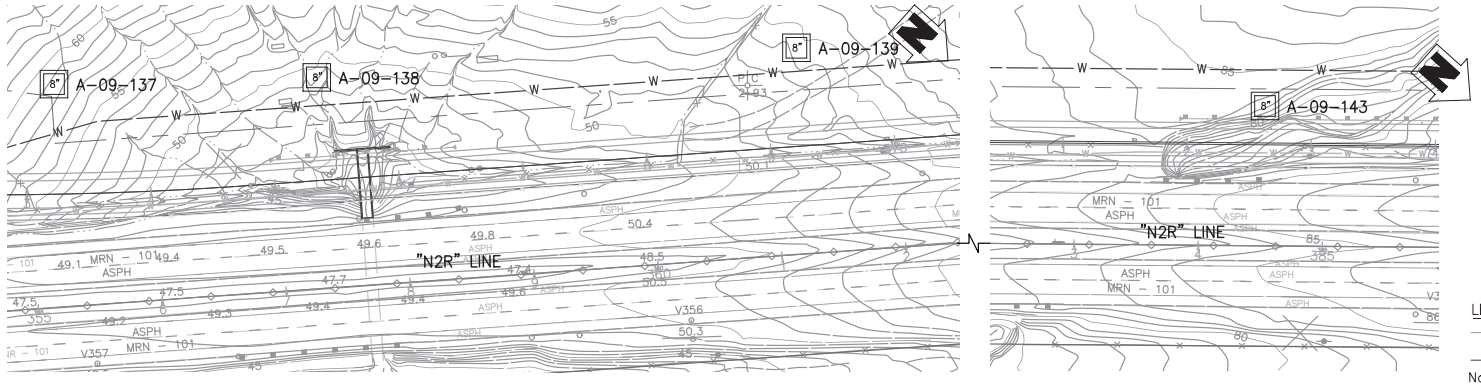
GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

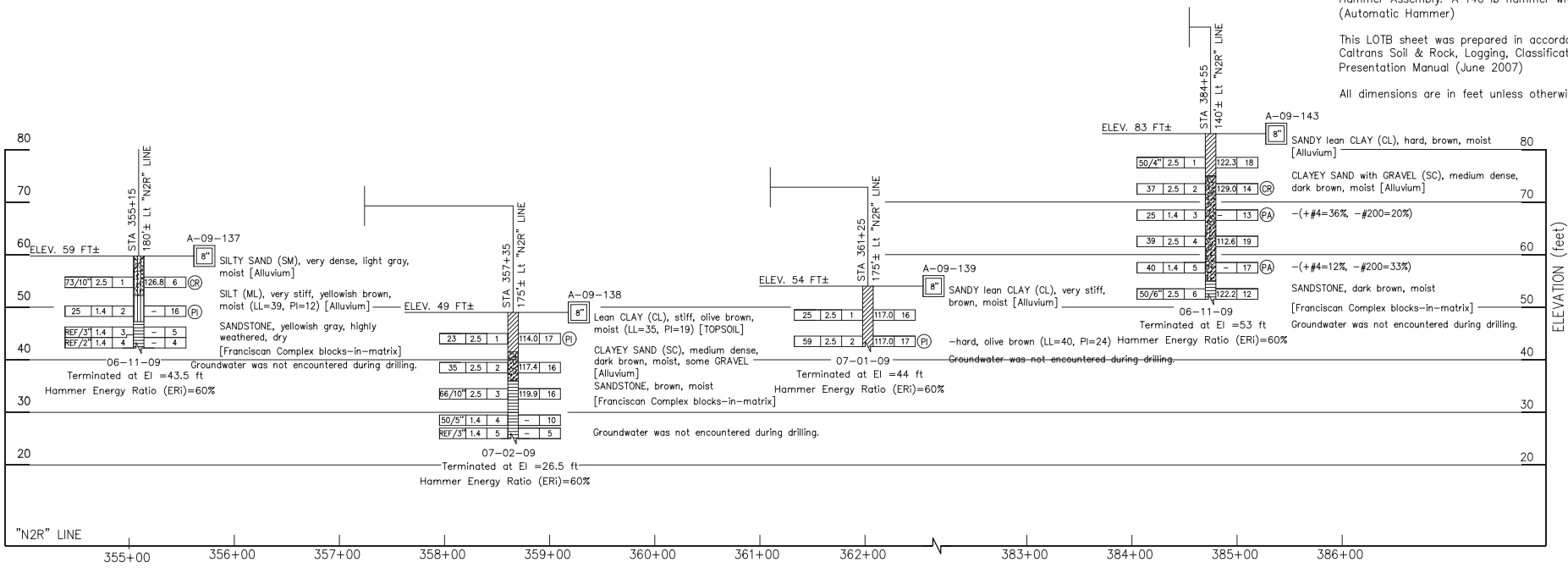
—— W —— Existing Water Line (Red Color)

—— W —— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 – 10:48am S:\AQD\209140\GSR\North Mrn. Waterline Site Plan\LOTB (North Waterline Lath).dwg

Engineer

USERNAME => $USER

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

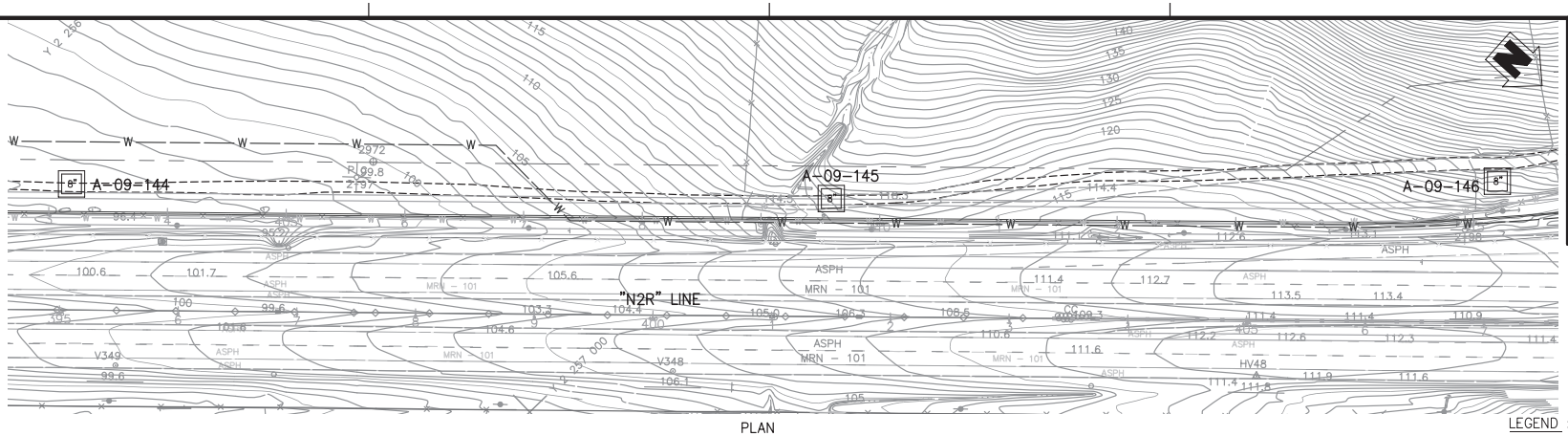
GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/11 — GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

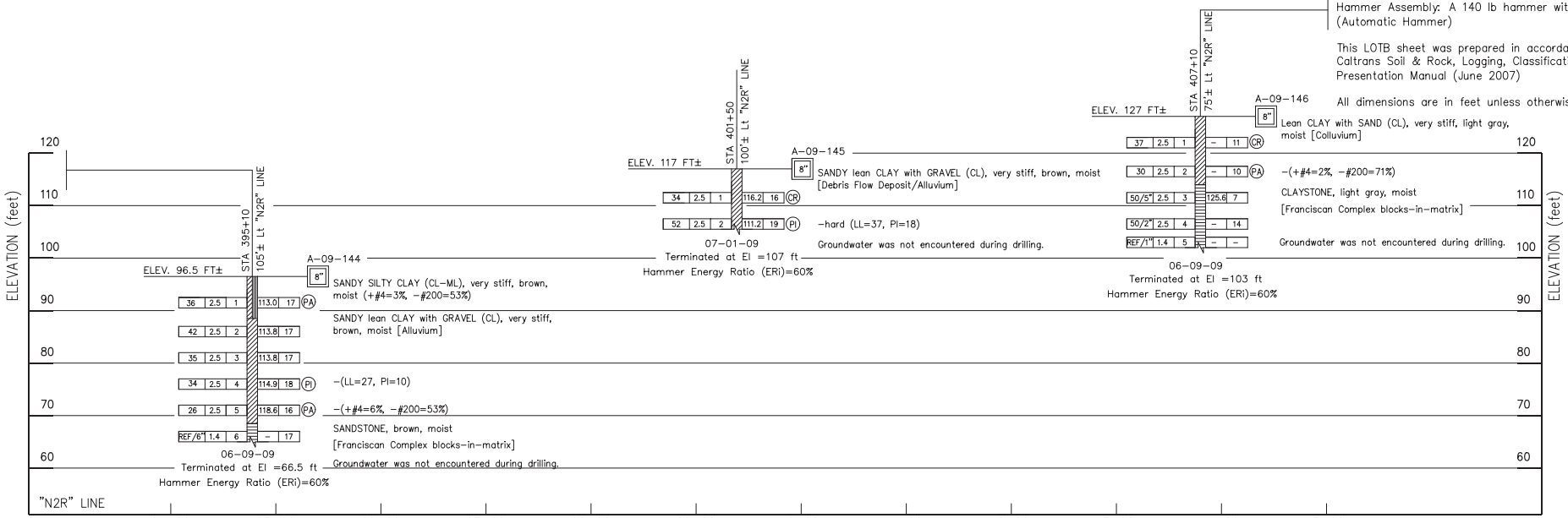
—— W —— Existing Water Line (Red Color)

—— W —— Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. –	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION	
SIGN OFF DATE	CHECKED BY P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 – NOVEMBER 2009		PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS	

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET – OF –

FILE => $REQUEST

Oct 31, 2011 — 10:48am S:\AQD\208140.GSR\North Mrn\ Waterline Site Plan\LOTB (North Waterline Lotb).dwg

Engineer

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

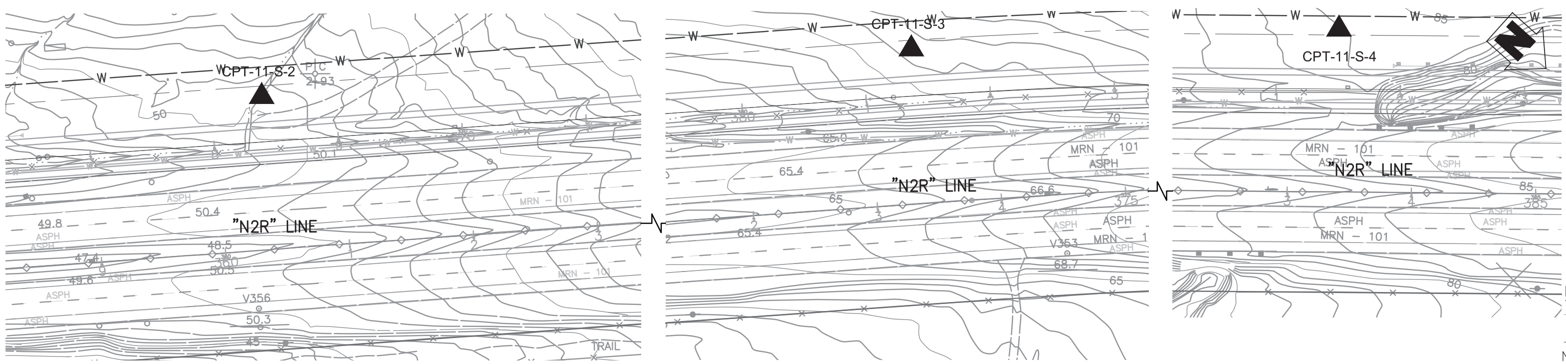
GEOTECHNICAL PROFESSIONAL 10/28/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

LEGEND :

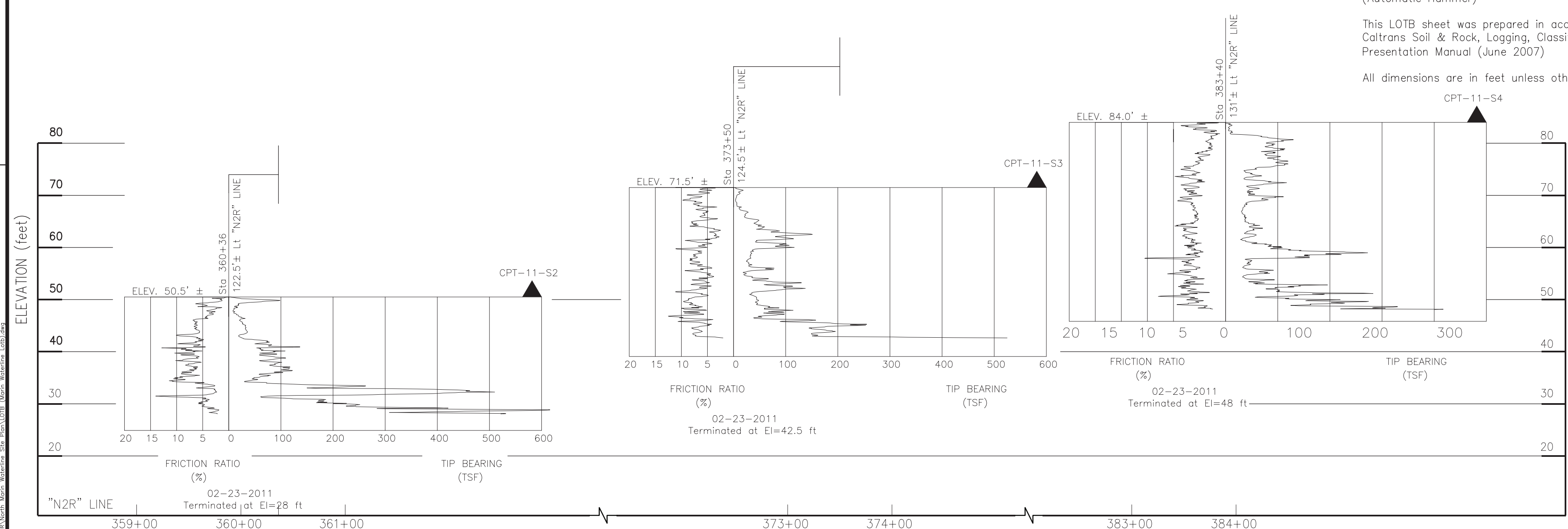
— w — Existing Water Line (Red Color)

— W — Proposed Water Line (Blue Color)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR	BRIDGE NO. —	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION
SIGN OFF DATE	CHECKED BY	P. SIRCAR	FIELD INVESTIGATION BY: DATE: JUNE 2009 - NOVEMBER 2009		PROJECT ENGINEER	POST MILES —	LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 04-264071

FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET — OF —

Oct 31, 2011 - 10:49am S:\ACAD\208140.GDR\North Marin Waterline Site Plan\LOTB (Marin Waterline Lotb).dwg

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

SHALLOW BORINGS FOR PAVEMENT DESIGN

Boring No.	Station (ft.) "N2" Line	Offset (ft.)	Approx. Ground Elev. (ft)	Soil Description
A-09-147	228+50	65 Lt.	13	Lean Clay with some Gravel
A-09-148	238+70	60 Lt.	14	Lean Clay
A-09-152	279+05	110 Lt.	16	Lean Clay with some Gravel
A-09-153	289+15	85 Lt.	44	Silty Sand
A-09-154	299+05	80 Lt.	48	Lean Clay with traces of Gravel
A-09-155	305+05	90 Lt.	35	Silty Sand
A-09-103	311+65	115 Rt.	27	Sandy Silt
A-09-116	312+00	75 Lt.	27	Sandy Lean Clay with some Gravel
A-09-107	324+30	65 Rt.	20	Sandy Lean Clay
A-09-118	325+65	5 Lt.	23	Sandy Lean Clay with some Gravel
A-09-119	326+80	45 Lt.	28	Sandy Silt
A-09-124	344+00	45 Lt.	52	Sandy Silty with some Gravel
A-09-128	346+45	45 Lt.	48	Sandy Lean Clay with some Gravel
A-09-115	346+80	40 Rt.	48	Silty Sand with Gravel
A-09-140	364+50	150 Lt.	66	Sandy Lean Clay with Gravel
A-09-141	372+65	125 Lt.	69	Silty Sand
A-09-142	379+65	113 Lt.	76.5	Sandy Lean Clay
Note: All borings are 5 feet deep. Groundwater was not encountered in any of the borings.				

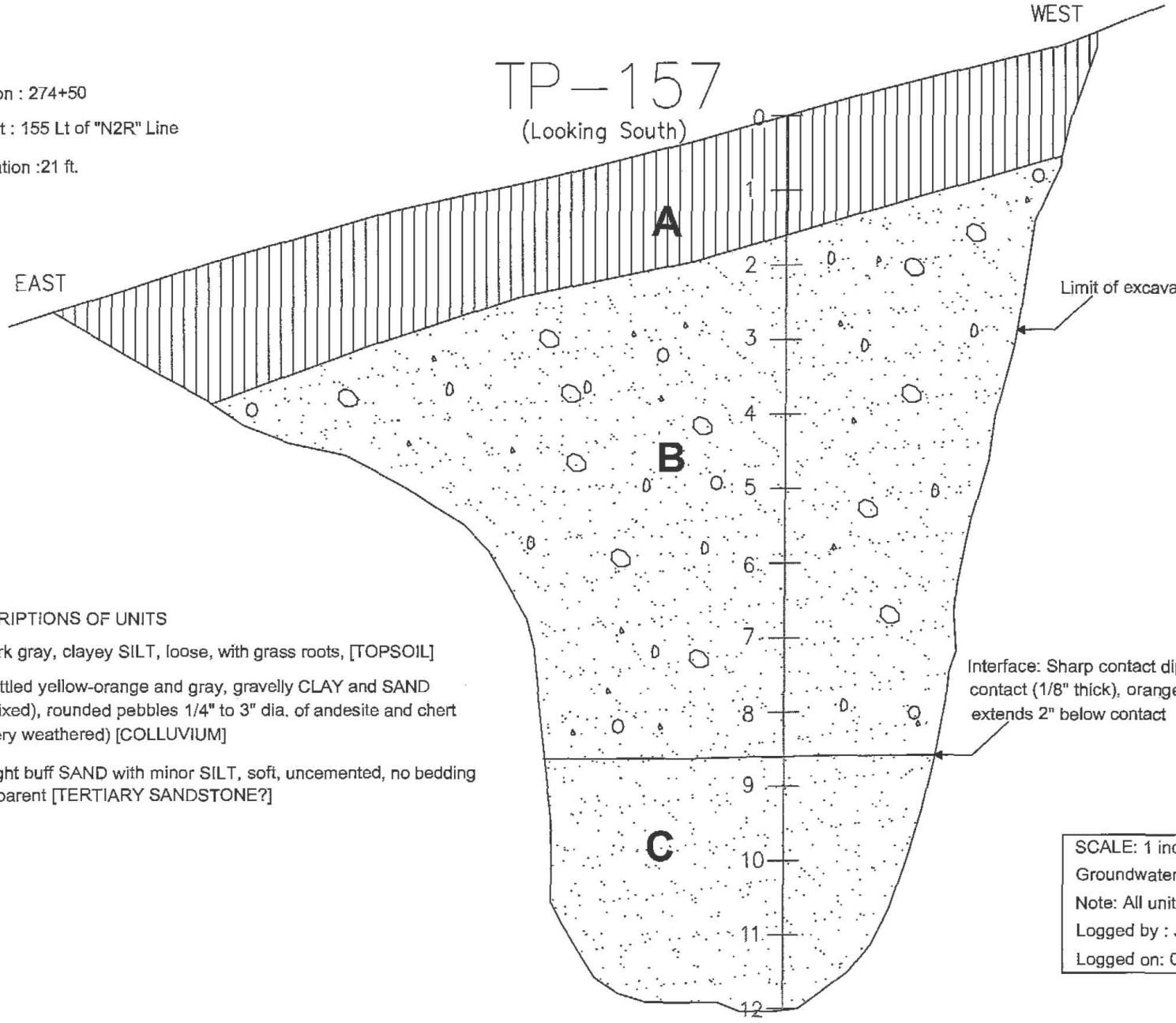
TP–157

(Looking South)

Station : 274+50

Offset : 155 Lt of "N2R" Line

Elevation :21 ft.



DESCRIPTIONS OF UNITS

A : Dark gray, clayey SILT, loose, with grass roots, [TOPSOIL]

B : Mottled yellow-orange and gray, gravelly CLAY and SAND (mixed), rounded pebbles 1/4" to 3" dia. of andesite and chert (very weathered) [COLLUVIUM]

C : Light buff SAND with minor SILT, soft, uncemented, no bedding apparent [TERTIARY SANDSTONE?]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

LOG OF TEST PIT TP-157

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

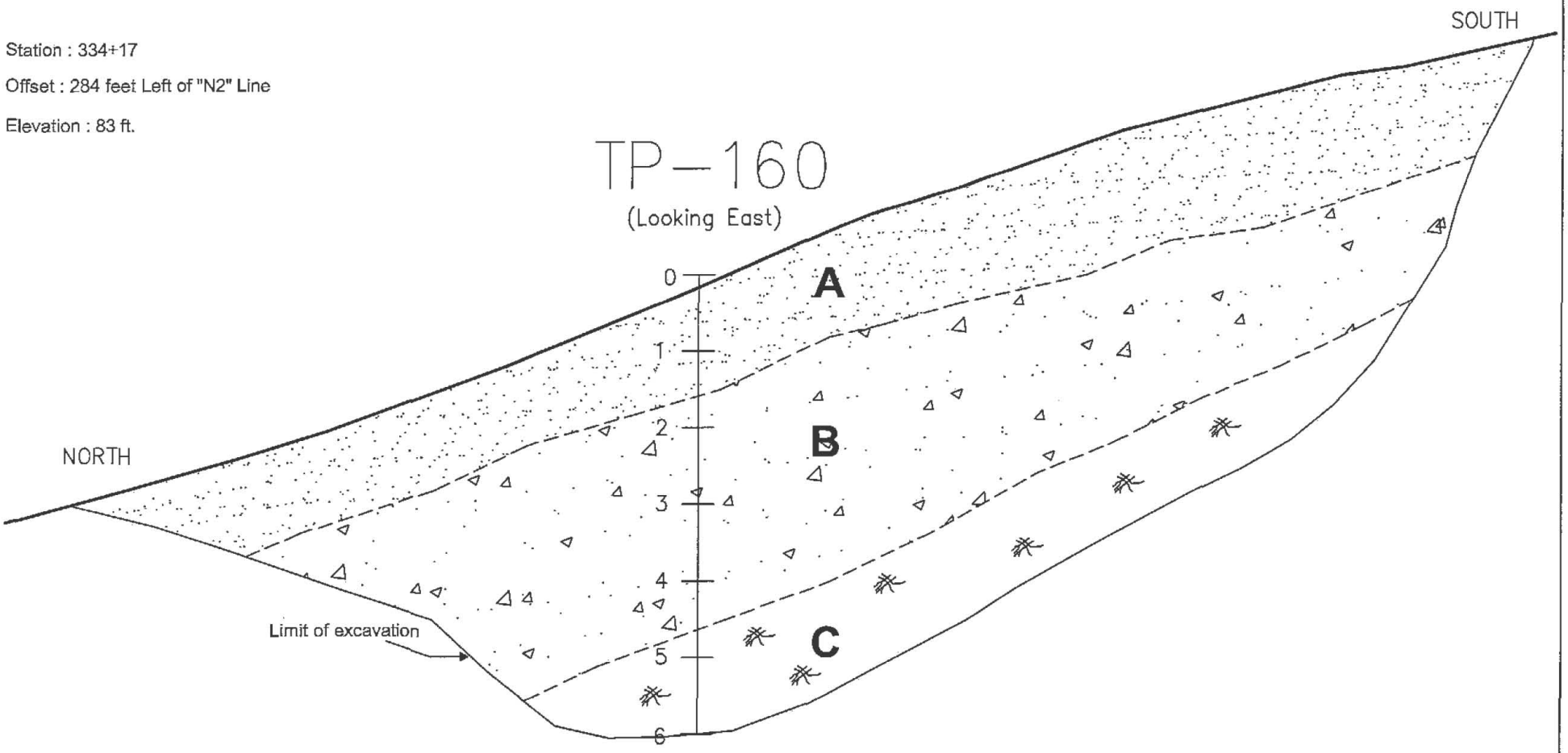
JOB NO.: 208140.MWD

PLATE NO.

Station : 334+17

Offset : 284 feet Left of "N2" Line

Elevation : 83 ft.



DESCRIPTIONS OF UNITS

A : Medium brown, sandy SILT with some gravel, [TOPSOIL]

B : Yellow-orange, sandy GRAVEL, damp (2"-4" dia.) [Debris Flow Deposit]

C : Dark yellow-orange, SANDSTONE, hard to very hard, dry, fractured [FRANCISCAN graywacke]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

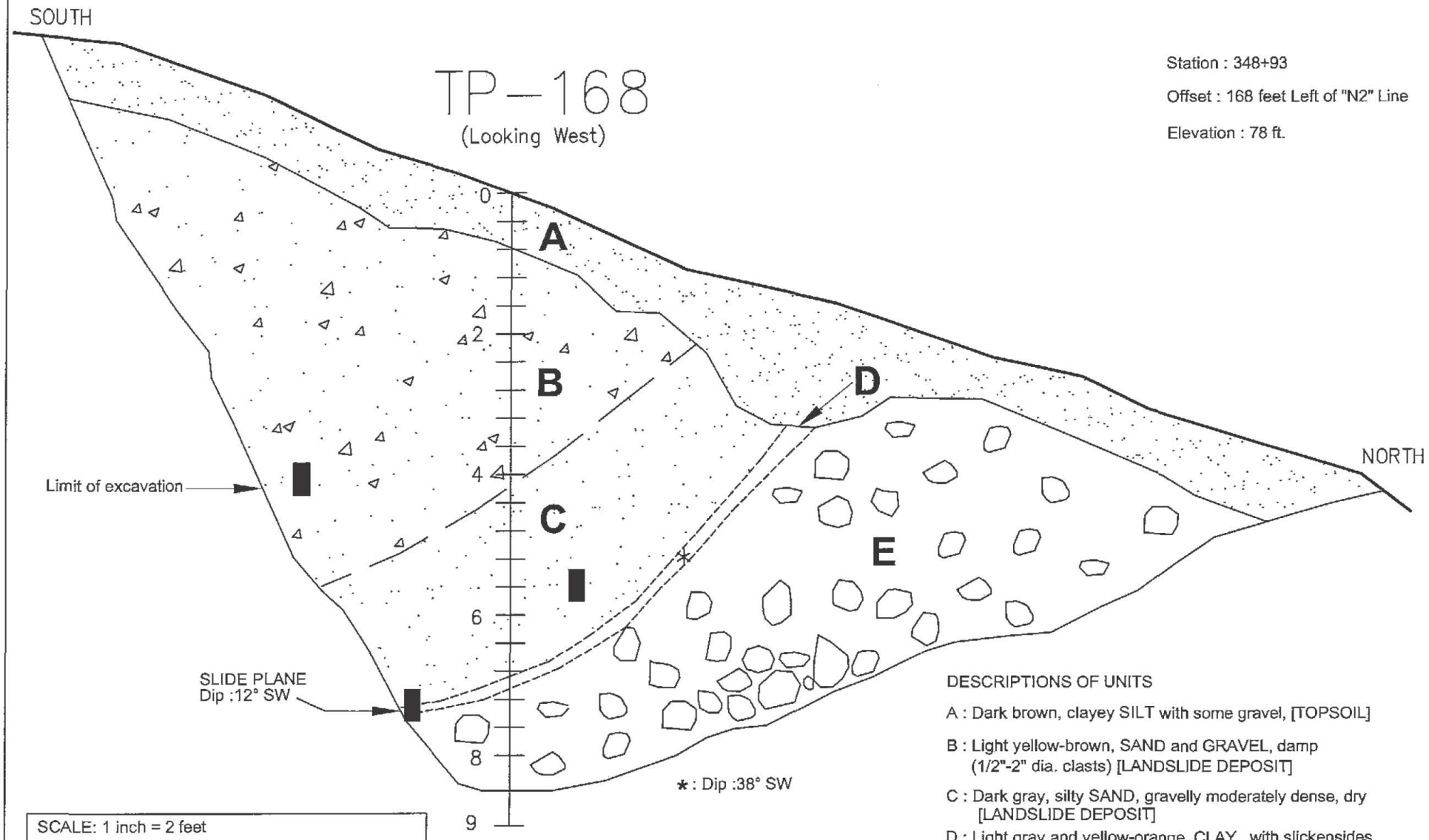
LOG OF TEST PIT TP-160

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.



DESCRIPTIONS OF UNITS

A : Dark brown, clayey SILT with some gravel, [TOPSOIL]

B : Light yellow-brown, SAND and GRAVEL, damp (1/2"-2" dia. clasts) [LANDSLIDE DEPOSIT]

C : Dark gray, silty SAND, gravelly moderately dense, dry [LANDSLIDE DEPOSIT]

D : Light gray and yellow-orange, CLAY, with slickensides [Slide Plane gouge]

E : Light yellow-orange, silty SANDSTONE boulders (6"-30" dia.), very hard in CLAY matrix [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet
Groundwater was not encountered
Note: All units are in feet unless otherwise specified
Logged by : J. Baker, CEG
Logged on: 12-02-2010

LEGEND
■1 Sample Location

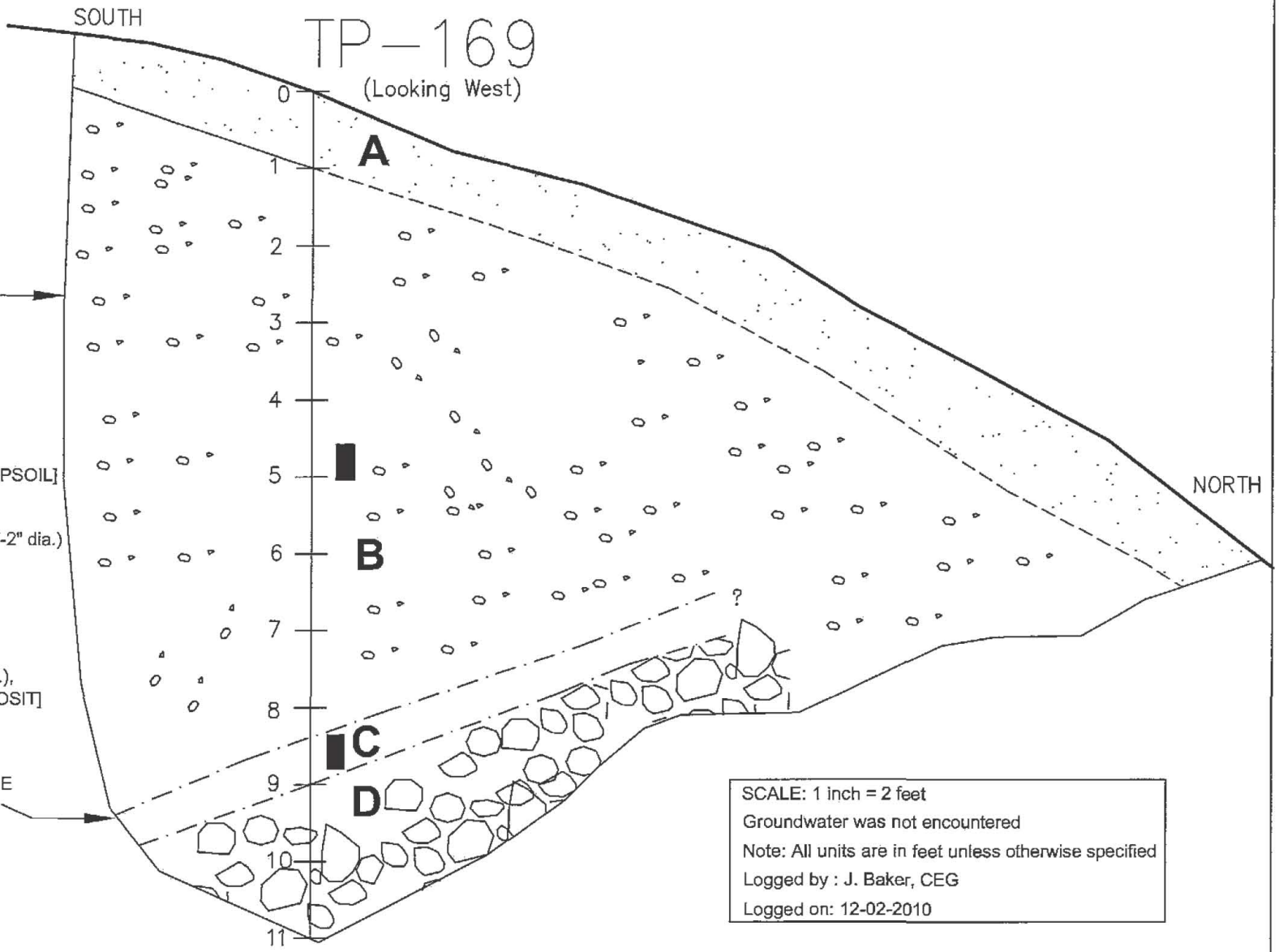
LOG OF TEST PIT TP-168

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.



Station : 350+00

Offset : 166 feet Left of "N2" Line

Elevation : 78 ft.

DESCRIPTIONS OF UNITS

A : Dark brown, sandy SILT with roots, [TOPSOIL] [TOPSOIL]

B : Yellow-orange, SAND and GRAVEL (1"-2" dia.) [LANDSLIDE DEPOSIT]

C : Gray brown, CLAY, slickensides [SLIDE PLANE]

D : Mottled dark gray and yellow-orange, sandy CLAY and GRAVEL, (1/2"-3" dia.), SANDSTONE clasts [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 12-02-2010

LOG OF TEST PIT TP-169

LEGEND

■1 Sample Location

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.

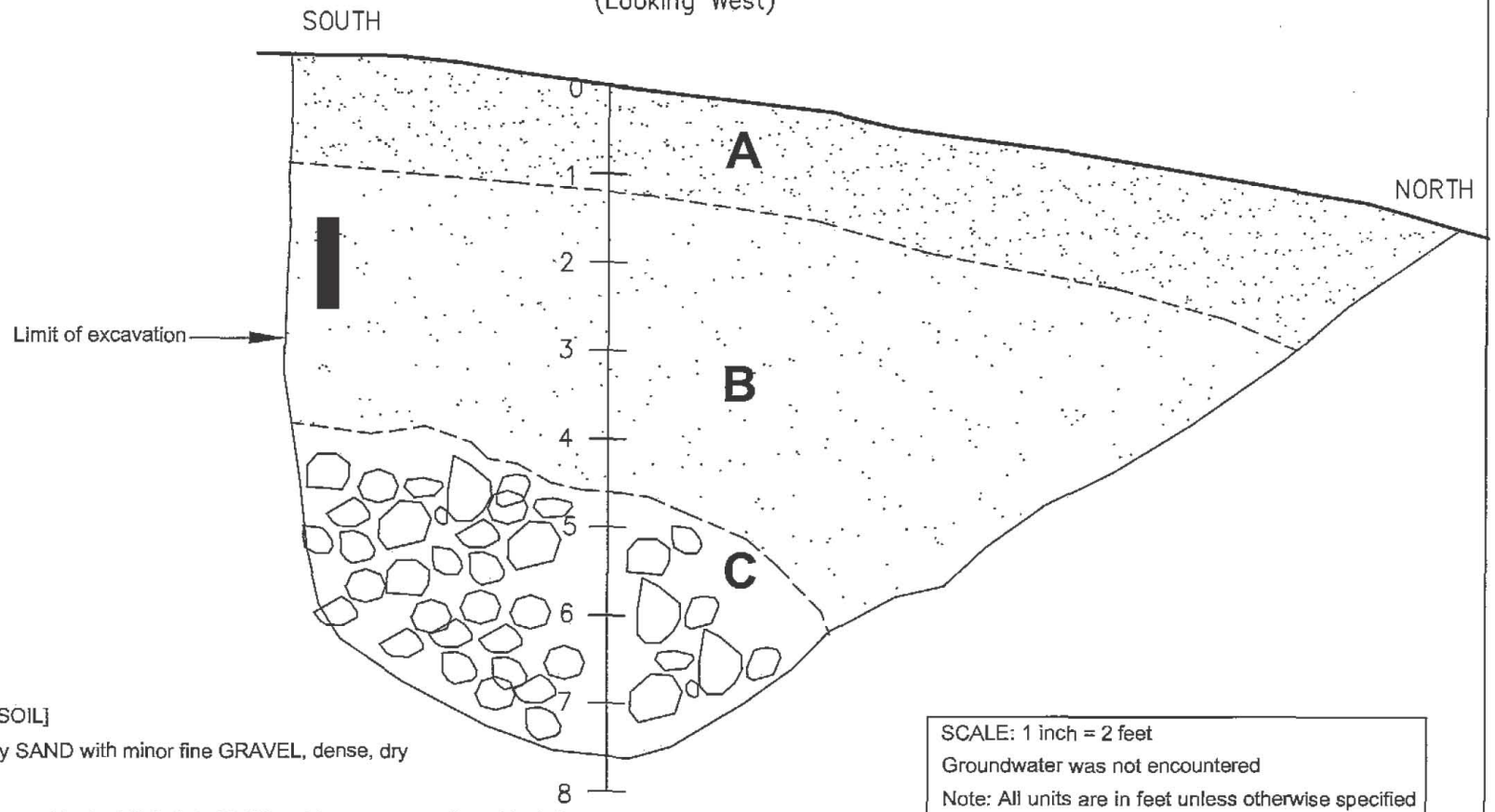
Station : 350+00

Offset : 155 feet Left of "N2" Line

Elevation : 81 ft.

TP–170

(Looking West)



DESCRIPTIONS OF UNITS

A : Dark brown, sandy SILT, [TOPSOIL]

B : Light yellow-orange, silty clayey SAND with minor fine GRAVEL, dense, dry [LANDSLIDE DEPOSIT]

C : Light yellow-orange, SANDSTONE blocks (1"-24") in CLAY matrix, very dense (hard blocks) [LANDSLIDE DEPOSIT]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 12-02-2010

LOG OF TEST PIT TP-170

LEGEND

■1 Sample Location

PARIKH CONSULTANTS, INC.

GEOTECHNICAL CONSULTANTS

MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.

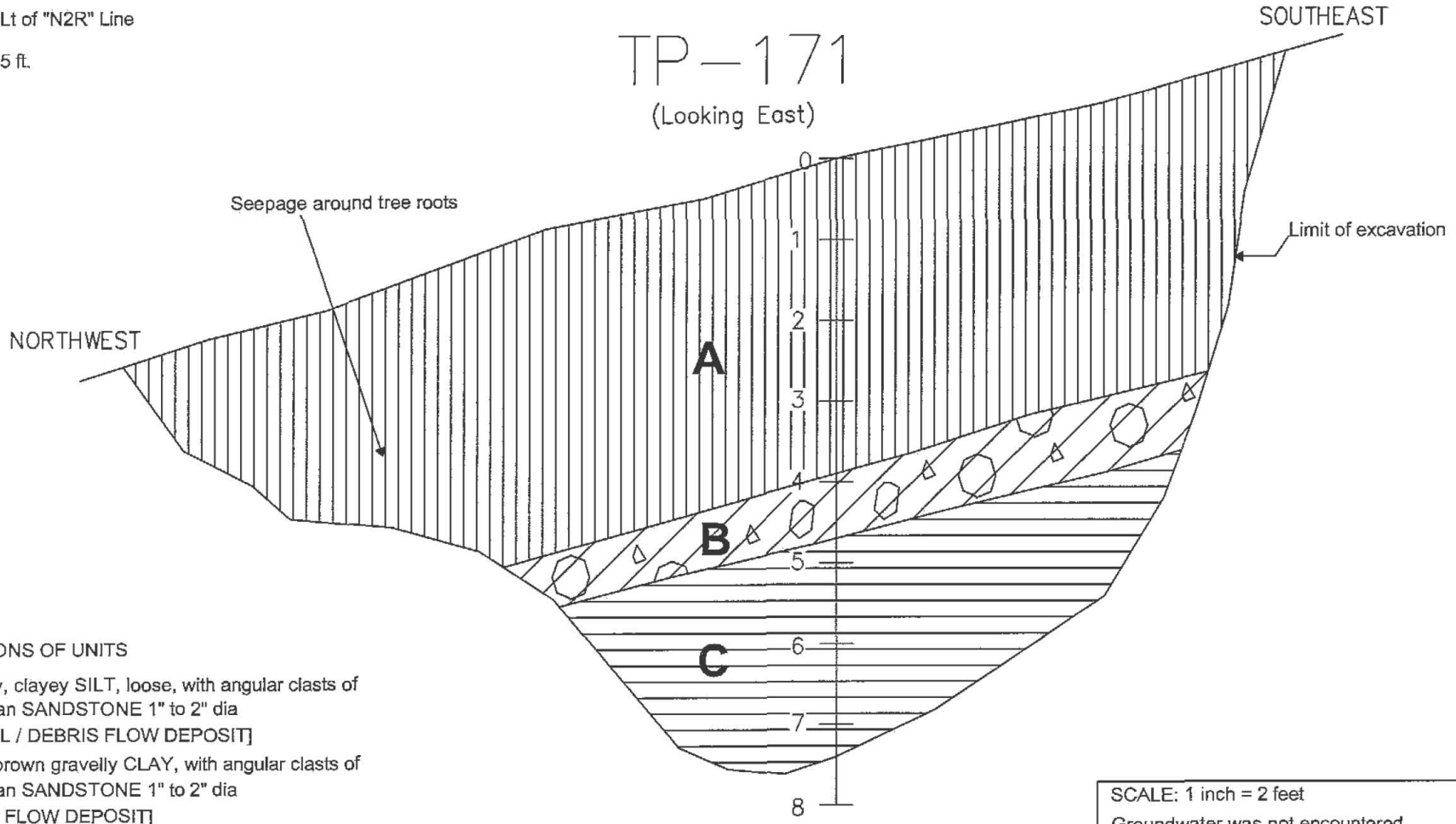
Station : 339+10

Offset : 300 Lt of "N2R" Line

Elevation : 75 ft.

TP – 171

(Looking East)



DESCRIPTIONS OF UNITS

A : Dark gray, clayey SILT, loose, with angular clasts of Fransiscan SANDSTONE 1" to 2" dia [TOPSOIL / DEBRIS FLOW DEPOSIT]

B : Yellow - brown gravelly CLAY, with angular clasts of Franciscan SANDSTONE 1" to 2" dia [DEBRIS FLOW DEPOSIT]

C : Medium brown graywacke SANDSTONE, hard, fractured (bedding planes dip=22 degrees NNE) 2" to 4" spacing

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

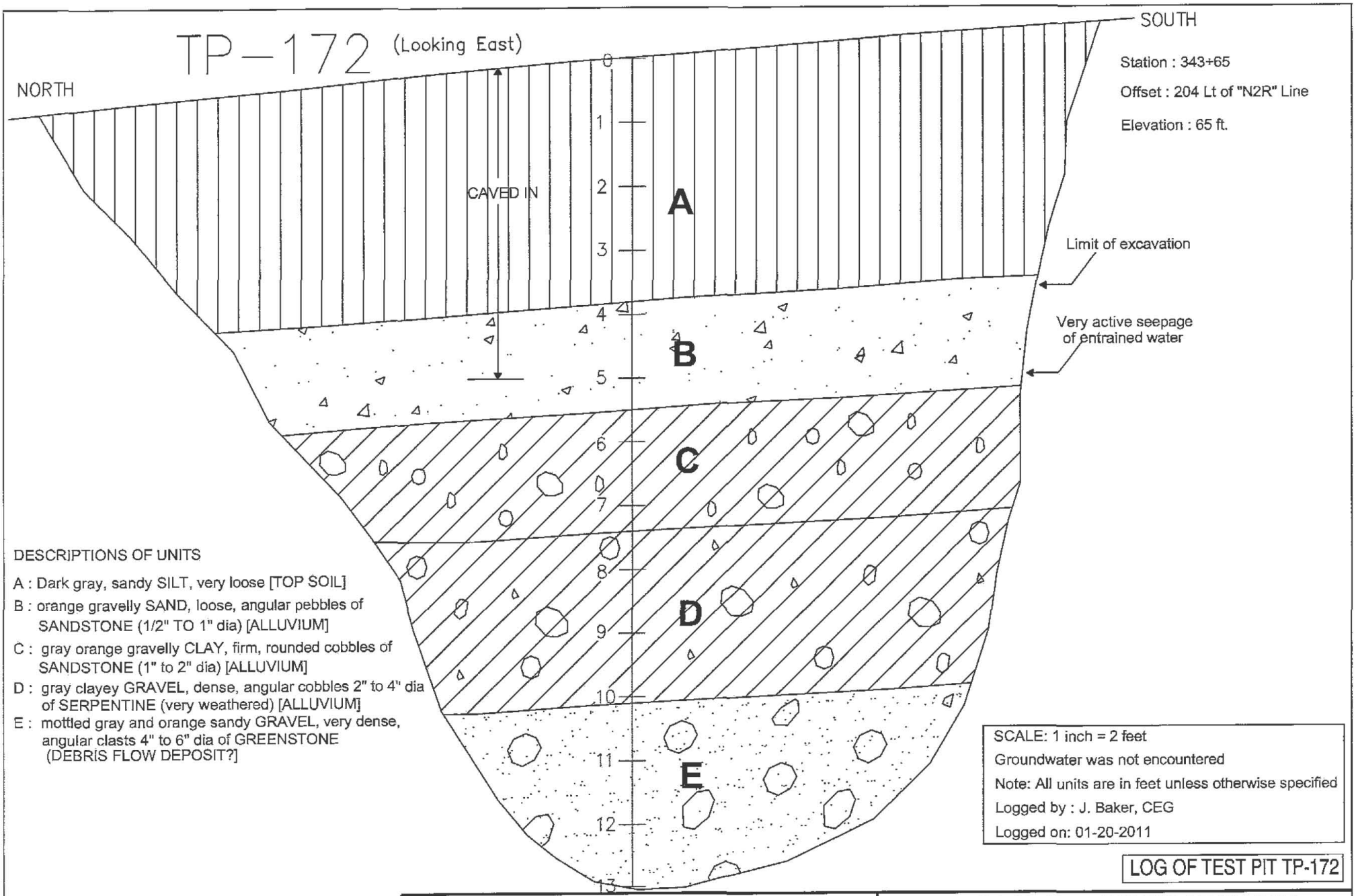
LOG OF TEST PIT TP-171

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.



DESCRIPTIONS OF UNITS

A : Dark gray, sandy SILT, very loose [TOP SOIL]

B : orange gravelly SAND, loose, angular pebbles of SANDSTONE (1/2" TO 1" dia) [ALLUVIUM]

C : gray orange gravelly CLAY, firm, rounded cobbles of SANDSTONE (1" to 2" dia) [ALLUVIUM]

D : gray clayey GRAVEL, dense, angular cobbles 2" to 4" dia of SERPENTINE (very weathered) [ALLUVIUM]

E : mottled gray and orange sandy GRAVEL, very dense, angular clasts 4" to 6" dia of GREENSTONE (DEBRIS FLOW DEPOSIT?]

SCALE: 1 inch = 2 feet

Groundwater was not encountered

Note: All units are in feet unless otherwise specified

Logged by : J. Baker, CEG

Logged on: 01-20-2011

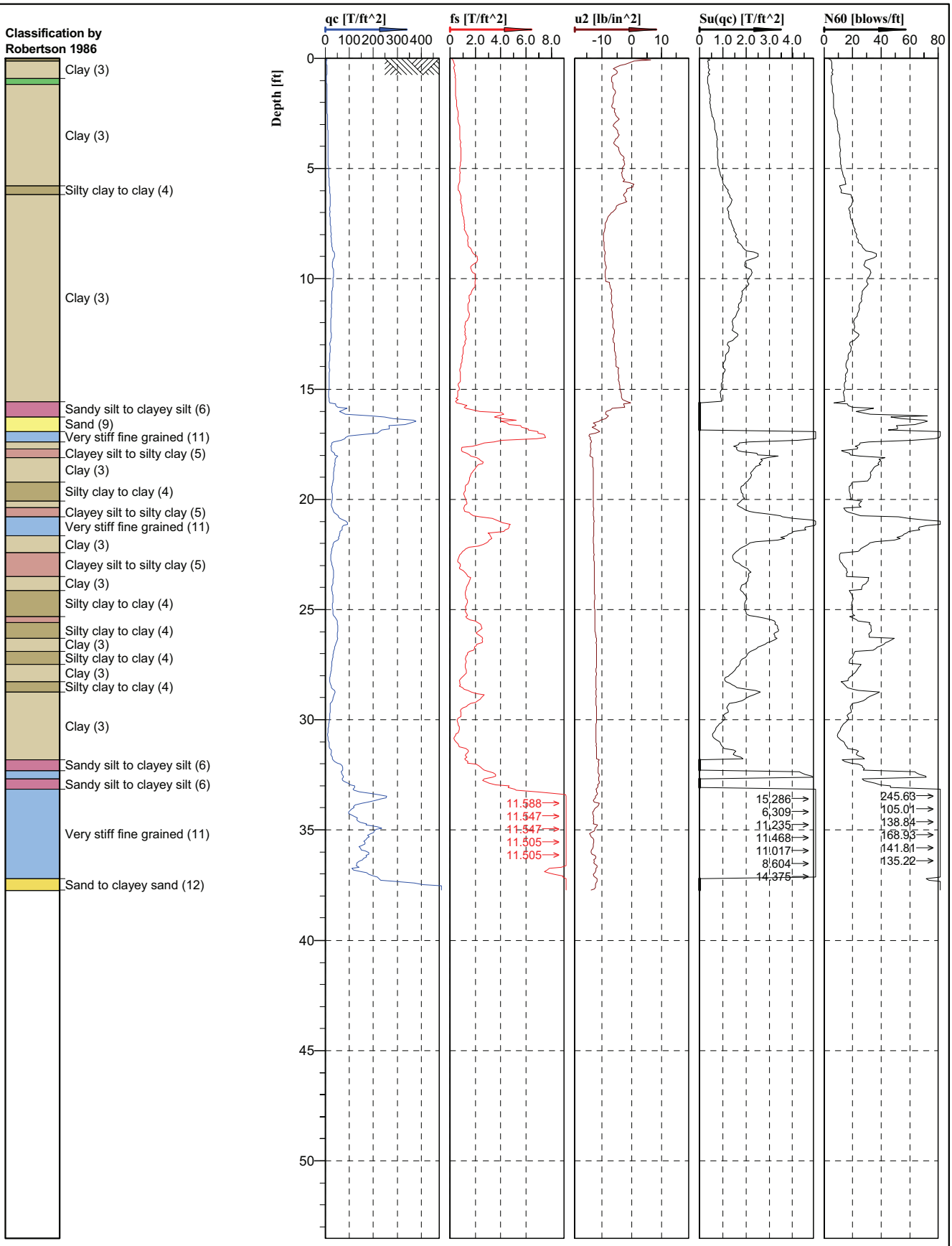
LOG OF TEST PIT TP-172

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN- SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.

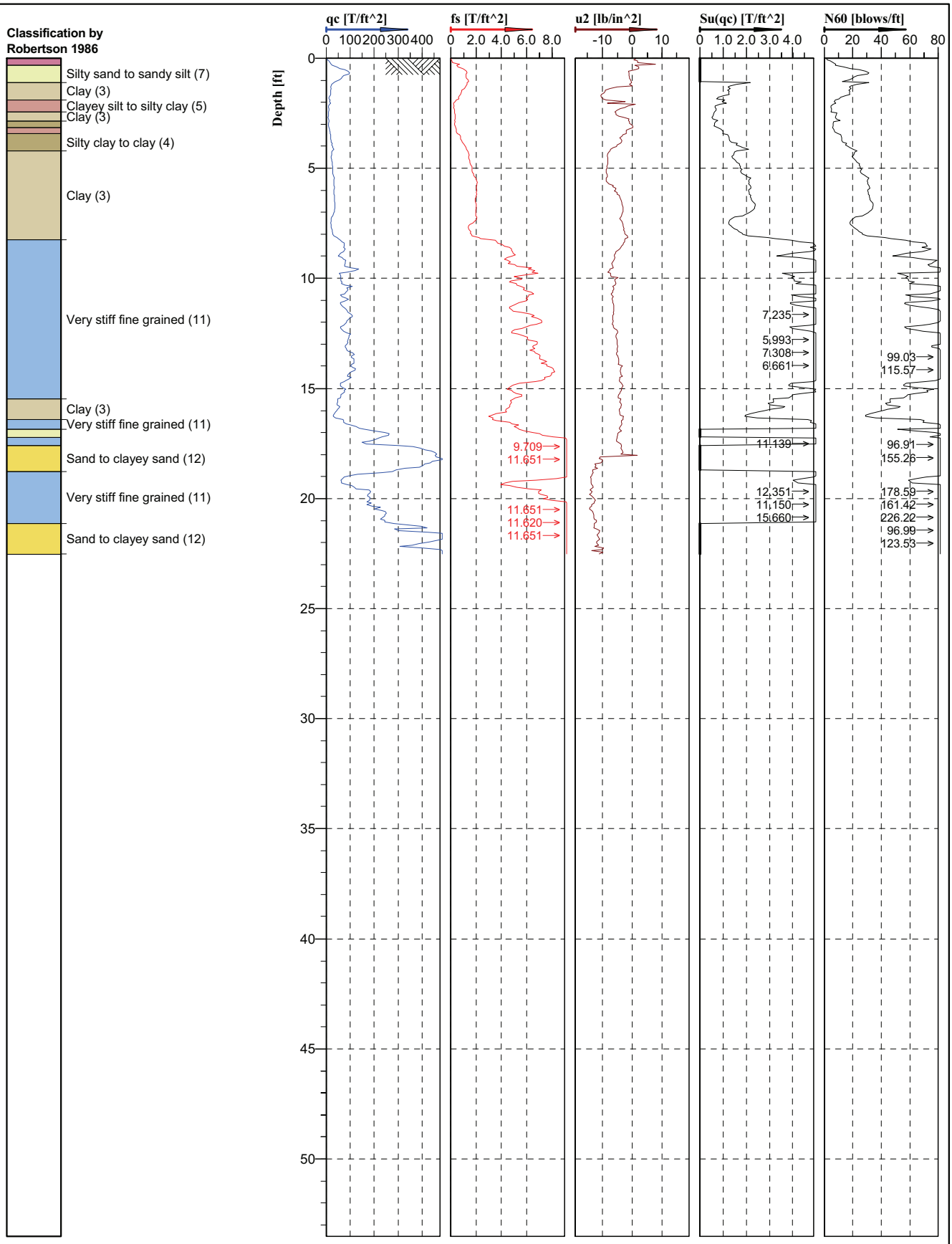


Location: Novato, California	Position:	Ground level:	Test no: S-1
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contract		Page: 1/1	Fig:
		File: S-1.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

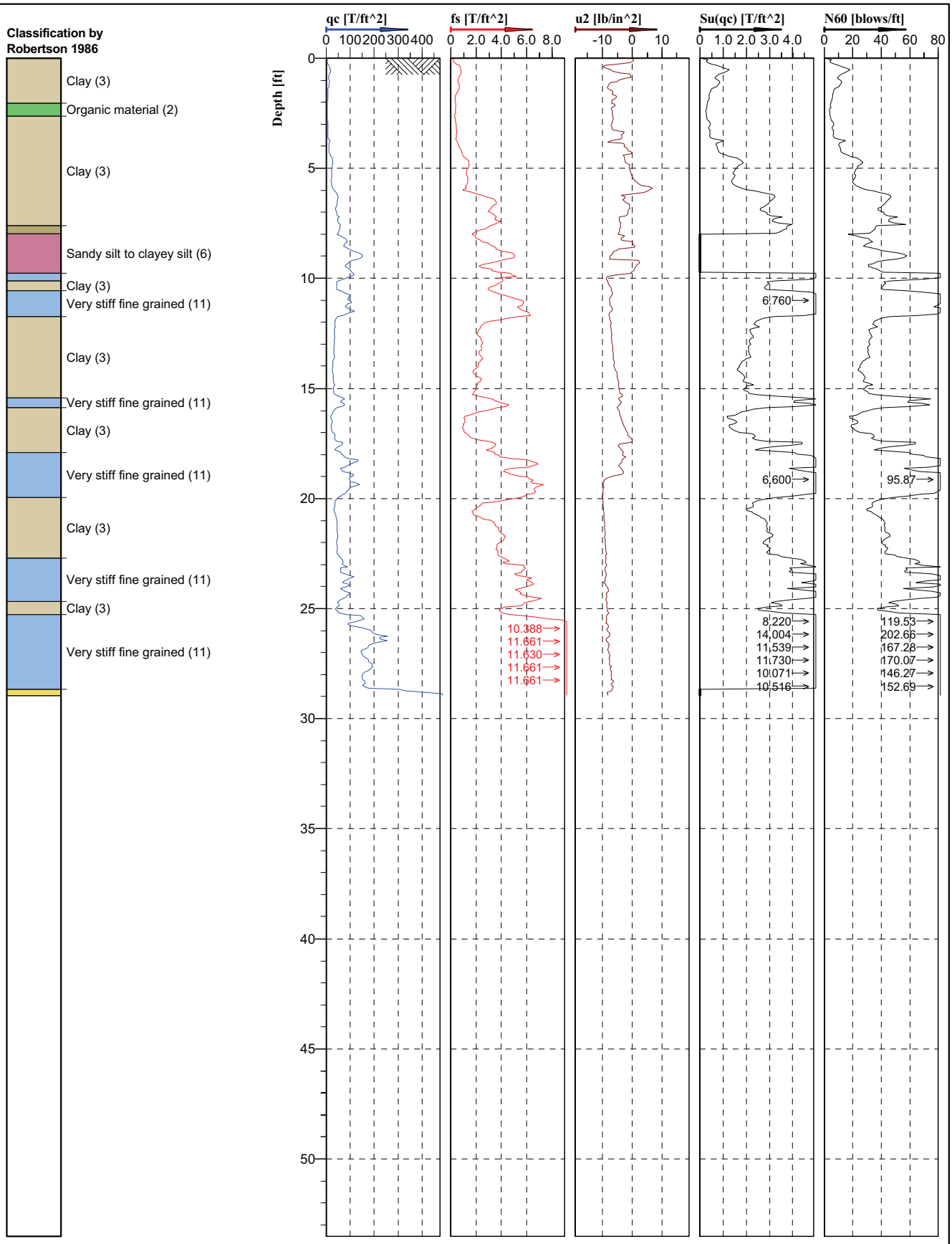


Location: Novato, California	Position:	Ground level:	Test no: S-2
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contract		Page: 1/1	Fig:
		File: S-2.cpd	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

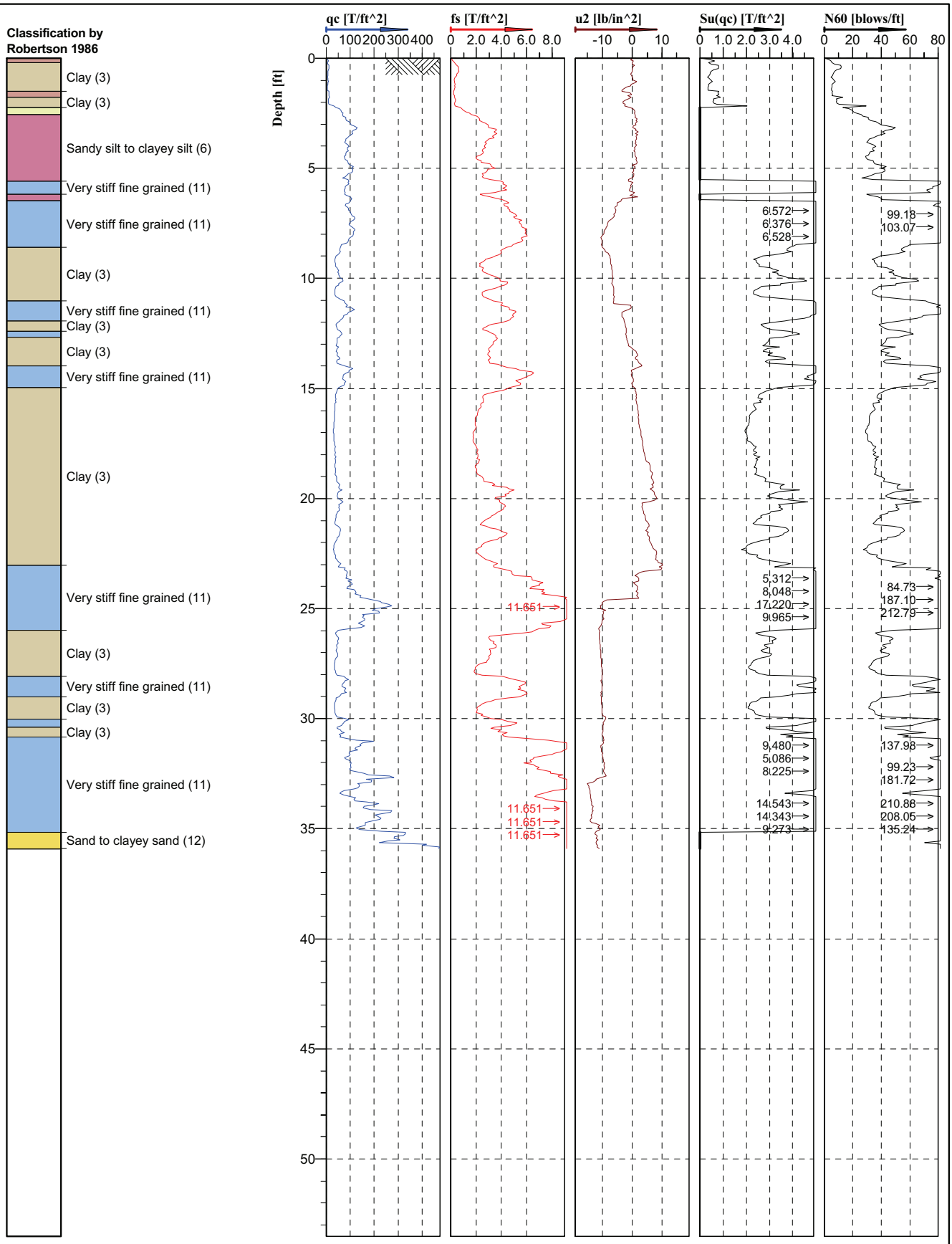


CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Novato, California	Position:	Ground level:	Test no: S-3
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contract		Page: 1/1	Fig:
		File: S-3.cpd	



CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

U2

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Novato, California	Position:	Ground level:	Test no: S-4
Project ID: 2008-140-GDR	Client: Parikh Consultants	Date: 2/23/2011	Scale: 1 : 75
Project: MSN Contracts		Page: 1/1	Fig:
		File: S-4.cpd	

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2A and Plate B-2B, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results presented on Plate B-3A thru Plate B-3F, "Grain Size Distribution Curves".

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The tests results are presented on Plate B-4A and Plate B-4K.

Unconfined Compressiou Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Test Borings" and Plate B-5A and Plate B-5F.

APPENDIX B

LABORATORY TESTS

Consolidation Tests

Consolidation tests were performed on selected samples in accordance with ASTM Test Method D 2435. The test results are presented on the Plate B-6A thru Plate B-6C.

Direct Shear Tests

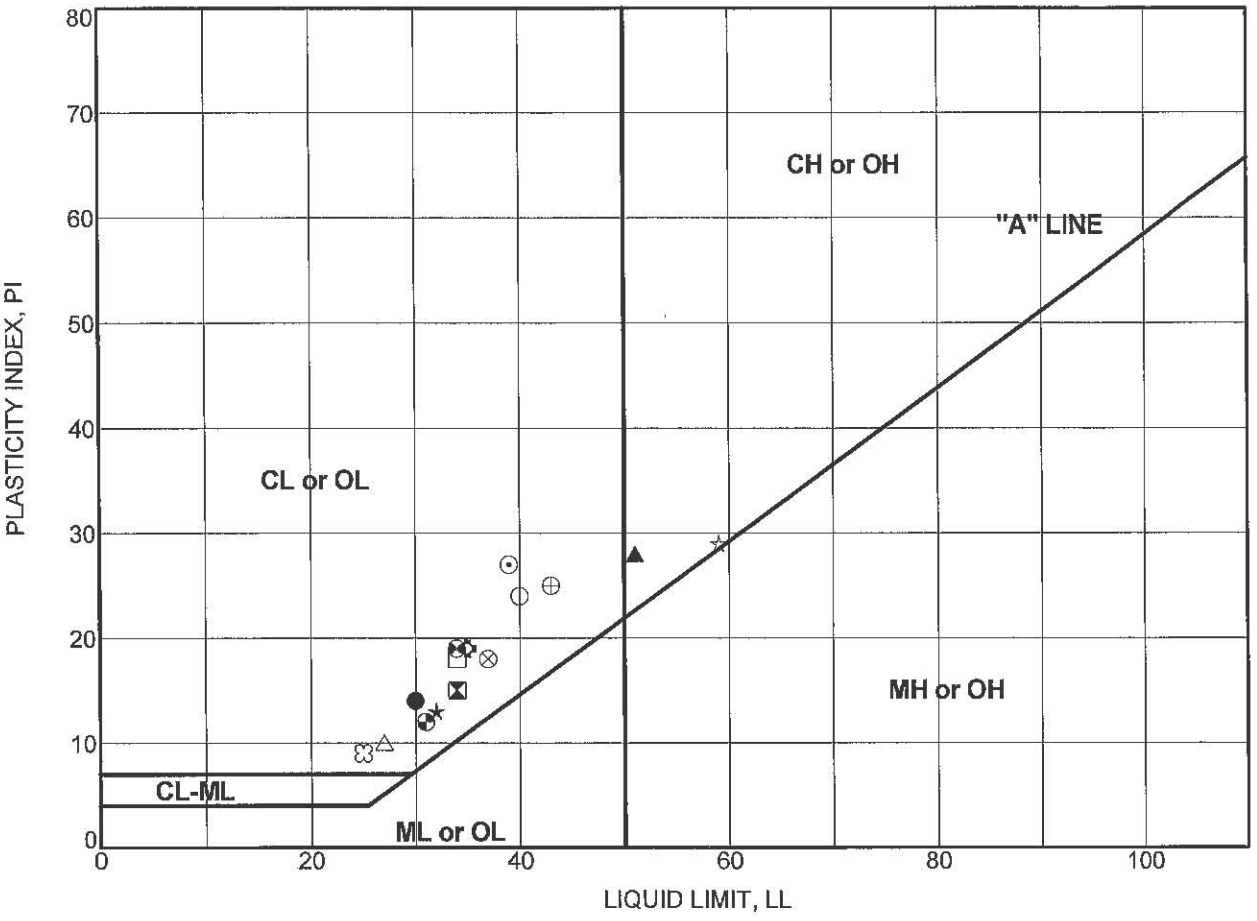
Direct Shear tests were performed on selected undisturbed samples to determine the shear strength of a soil material in direct shear. The tests were performed according to ASTM Test Method D 3080 by Cooper. The test results are presented on Plate B-7A and Plate B-7B.

Consolidated Undrained Triaxial Compression Tests

Consolidated Undrained Triaxial Compression tests were performed on selected samples in accordance with ASTM Test Method D 4767. The test results are presented on the Plate B-8A thru Plate B-8B.

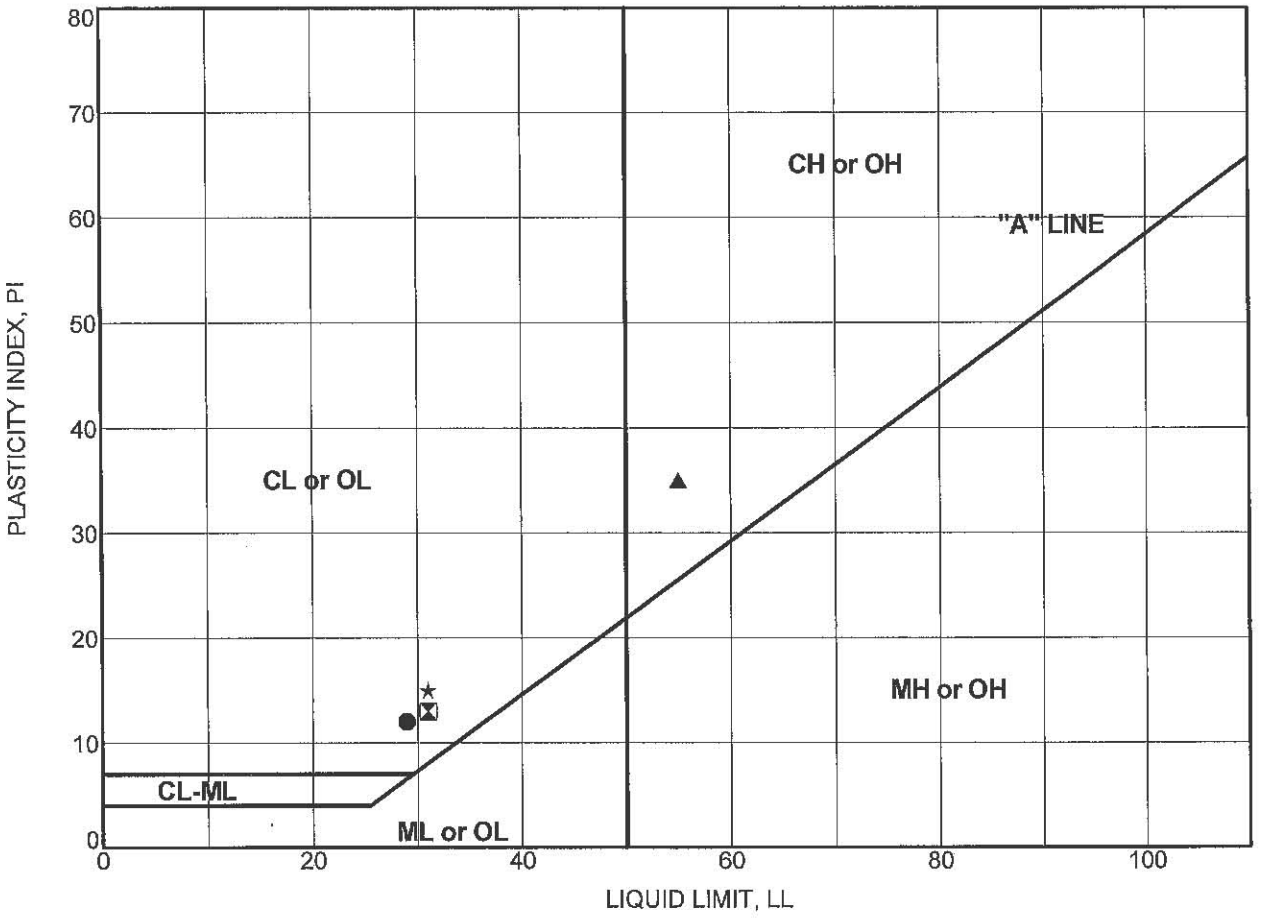
Unconsolidated Undrained Triaxial Compression Tests

Unconsolidated Undrained Triaxial Compression tests were performed on selected samples in accordance with ASTM Test Method D 4767. The test results are presented on the Plate B-9



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-104	MC-2	9.5	●	18	30	16	14	LEAN CLAY WITH SAND (CL)
A-09-117	BULK-1	5.0	⧓	15	34	19	15	LEAN CLAY (CL)
A-09-133	MC-2	9.5	▲	16	51	23	28	FAT CLAY (CH)
A-09-134	MC-1	4.5	★	16	32	19	13	SANDY LEAN CLAY (CL)
A-09-137	SPT-2	9.5	⊙	16	39	12	27	SILT (ML)
A-09-138	MC-1	4.0	✿	17	35	16	19	LEAN CLAY (CL)
A-09-139	MC-2	9.5	○	17	40	16	24	SANDY LEAN CLAY (CL)
A-09-144	MC-4	19.5	△	18	27	17	10	SANDY LEAN CLAY WITH GRAVEL (CL)
A-09-145	MC-2	9.5	⊗	19	37	19	18	LEAN CLAY (CL)
A-09-149	MC-2	9.5	⊕	20	43	18	25	LEAN CLAY WITH SAND (CL)
A-09-150	MC-2	4.5	□	20	34	16	18	LEAN CLAY (CL)
A-09-151	MC-2	4.5	⊛	18	34	15	19	LEAN CLAY (CL)
A-10-158A	MC-1	2.0	◔	24	31	19	12	Lean CLAY (CL)
A-10-162A		32.5	☆		59	30	29	FAT CLAY (CH)
A-10-163		10.5	⊠	22	25	16	9	LEAN CLAY WITH SAND (CL)



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-10-163		11.0	●	22	29	17	12	LEAN CLAY (CL)
A-10-163		16.0	⊠	25	31	18	13	LEAN CLAY (CL)
A-10-164	MC-9	13.0	▲	22	55	20	35	SILTY SAND (SM)
R-10-165	MC-2	5.5	★		31	16	15	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

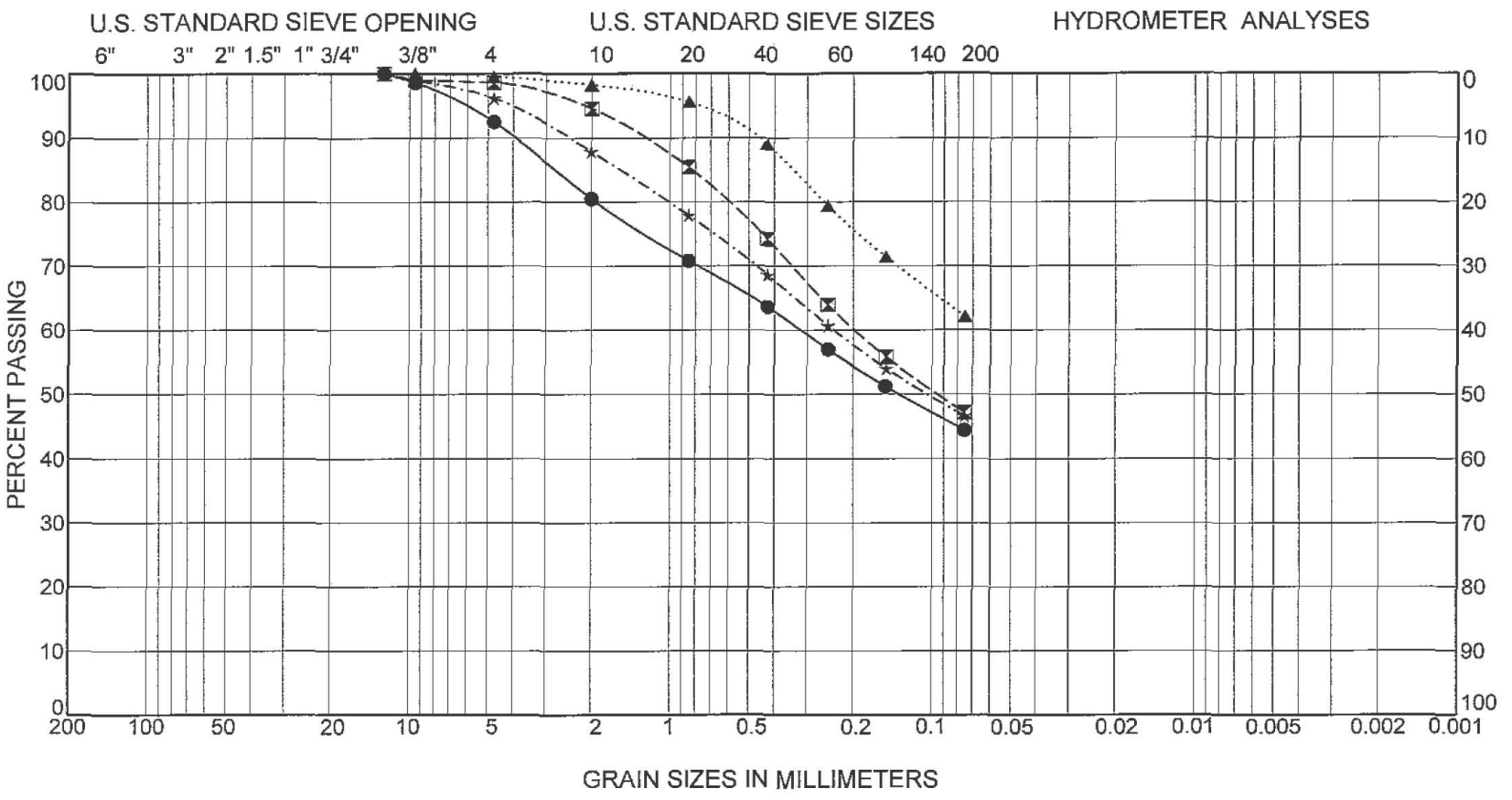
JOB NO: 208140.MWD

PLATE NO: B-2B

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-117	BULK-1	5.0	●	34	15	LEAN CLAY (CL)
A-09-120	MC-2	9.5	⊠			CLAYEY SAND (SC)
A-09-120	MC-3	12.5	▲			SANDY LEAN CLAY (CL)
A-09-129	MC-1	2.0	★			SILTY SAND WITH GRAVEL (SM)

JOB NO: 208140.MWD

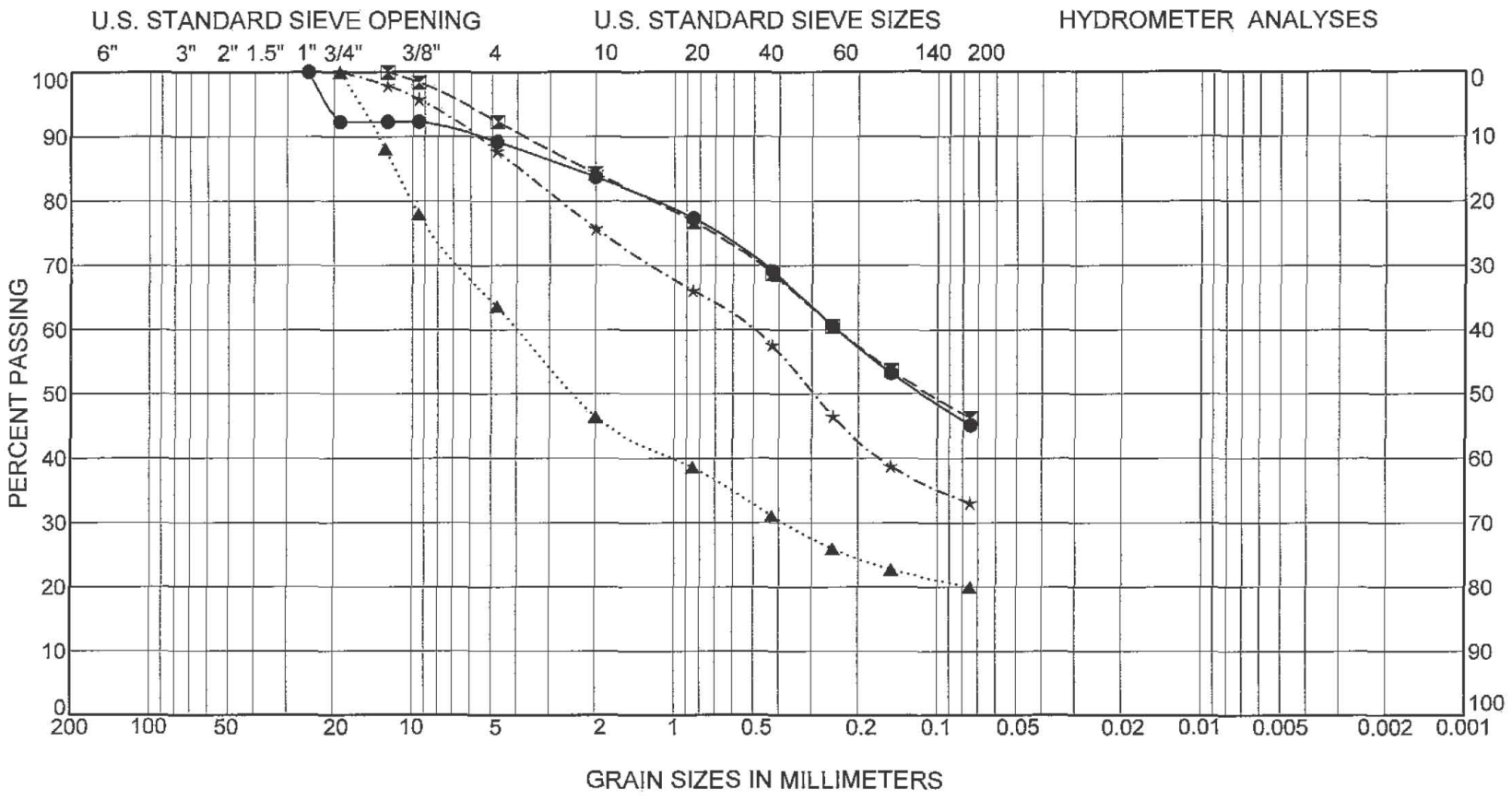
MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

PLATE NO: B-3A

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-135	MC-2	4.5	●			SILTY SAND (SM)
A-09-136	MC-1	4.5	⊠			CLAYEY SAND (SC)
A-09-143	SPT-3	14.5	▲			CLAYEY SAND WITH GRAVEL (SC)
A-09-143	SPT-5	24.5	★			CLAYEY SAND WITH GRAVEL (SC)

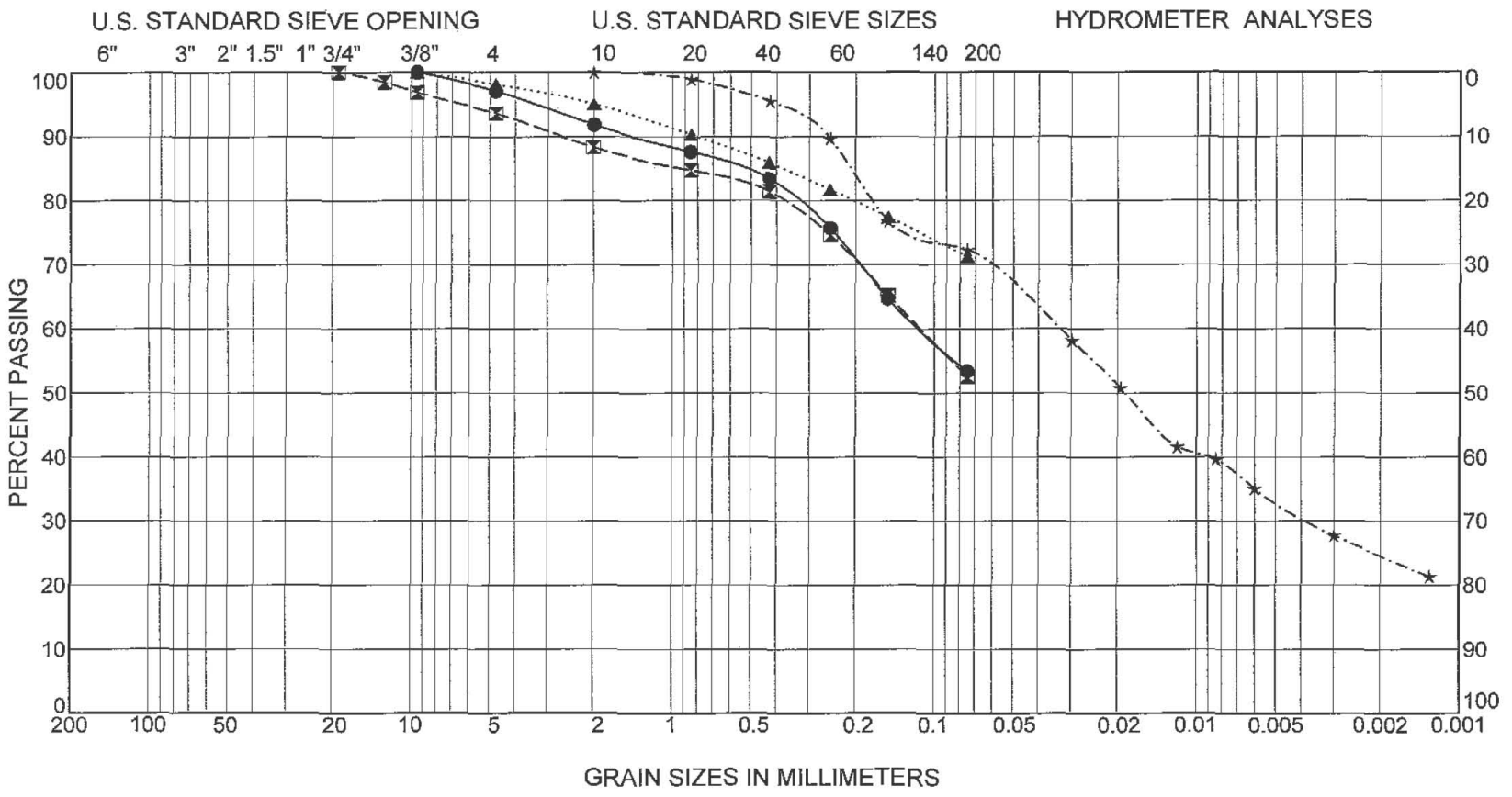
MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.MWD

PLATE NO: B-3B

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-144	MC-1	4.0	●			SANDY SILTY CLAY (CL-ML)
A-09-144	MC-5	24.5	⊠			SANDY LEAN CLAY WITH GRAVEL (CL)
A-09-146	MC-2	9.5	▲			LEAN CLAY WITH SAND (CL)
A-10-162A	MC-1	3.5	★			LEAN CLAY WITH SAND (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

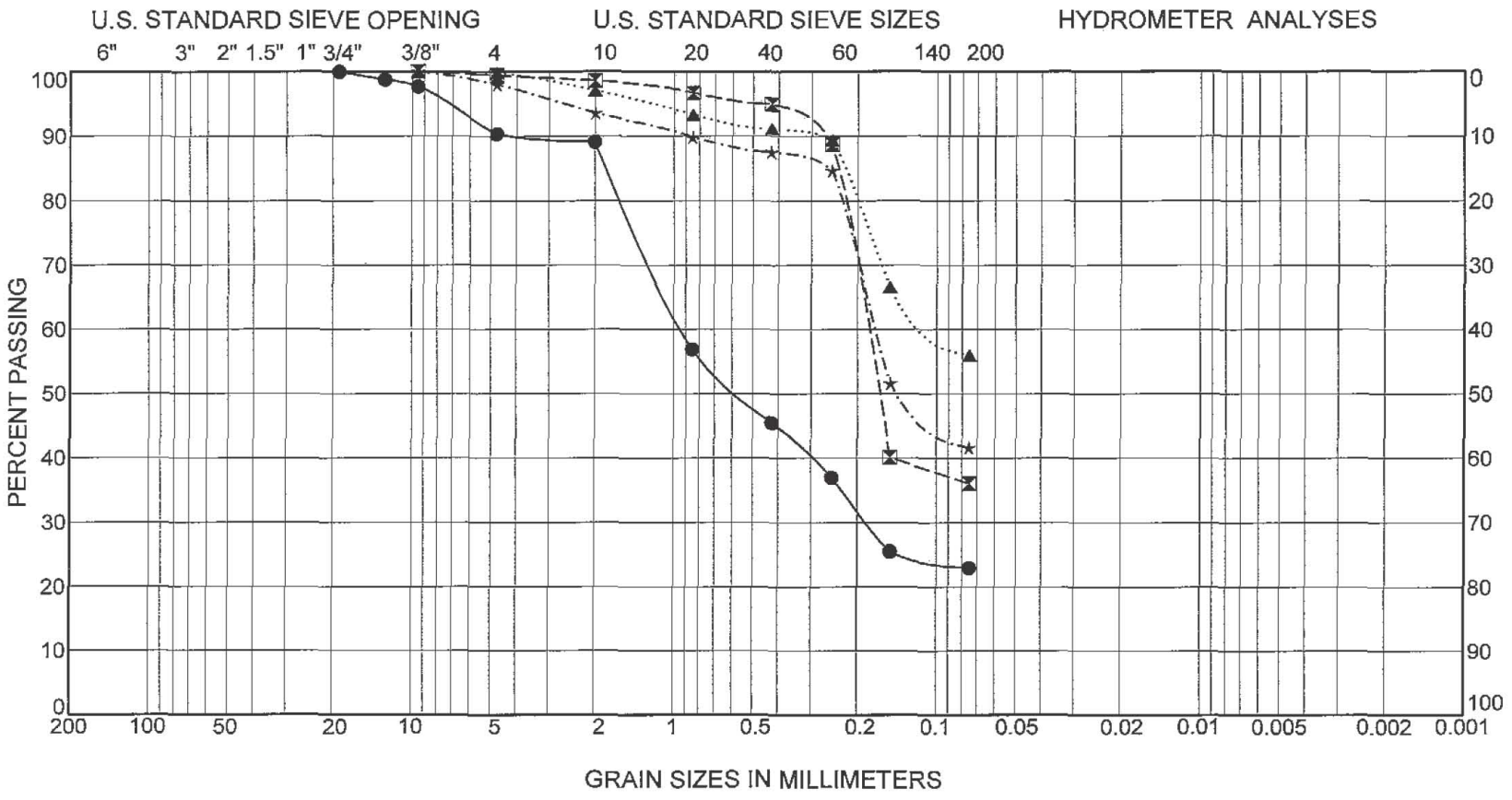
MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.MWD

PLATE NO: B-3C

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-10-162A	MC-2	5.0	●			SILTY SAND (SM)
A-10-162A	MC-3B	8.5	⊠			SILTY SAND (SM)
A-10-163		11.5	▲			SANDY LEAN CLAY (CL)
A-10-163		14.5	★			CLAYEY SAND (SC)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

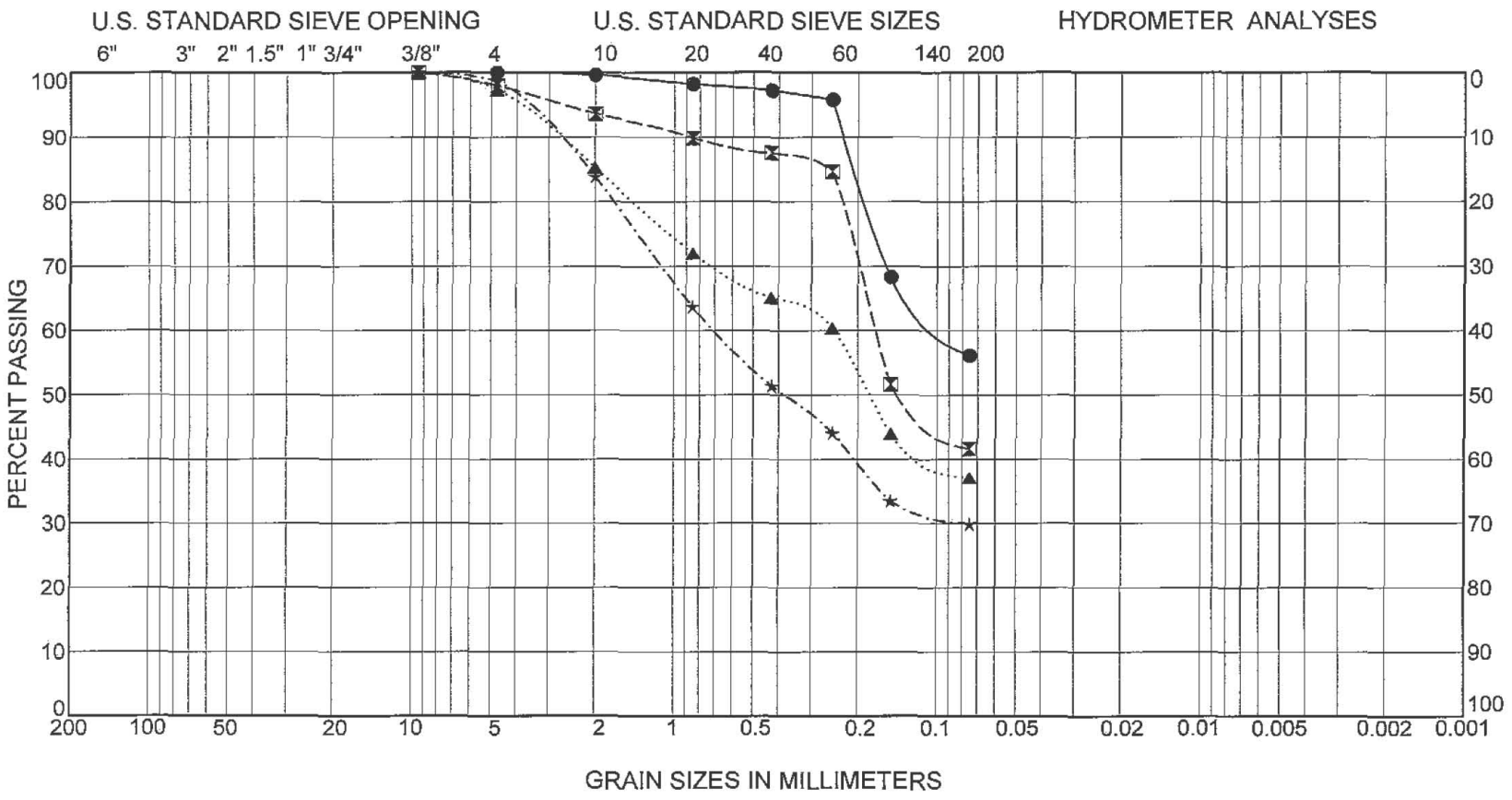
JOB NO: 208140.MWD

PLATE NO: B-3D

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

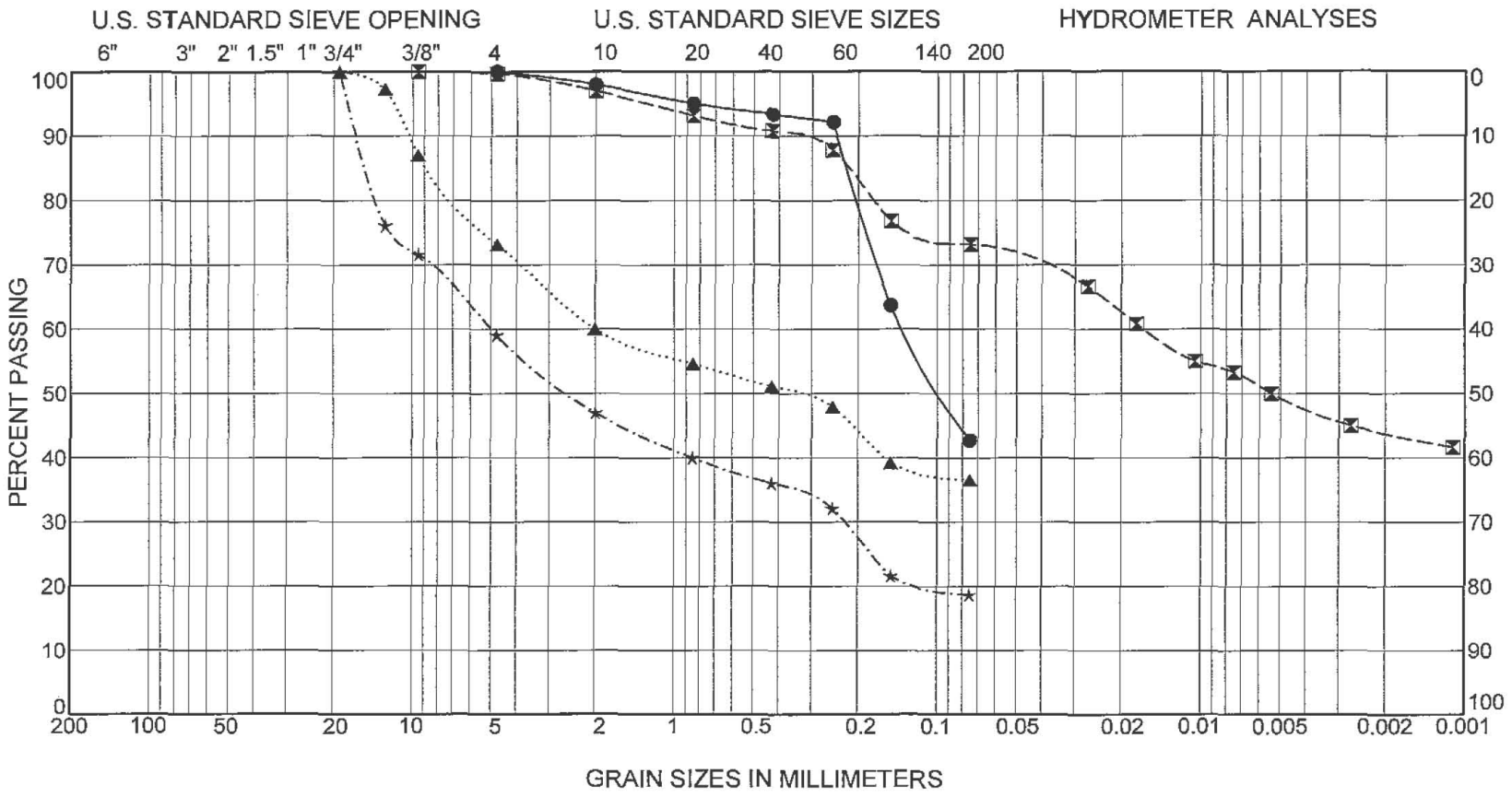


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-10-163		16.0	●	31	13	LEAN CLAY (CL)
A-10-163		16.5	⊠			SANDY LEAN CLAY (CL)
A-10-164	MC-4	5.5	▲			CLAYEY SAND (SC)
A-10-164	MC-6	8.5	★			CLAYEY SAND (SC)

MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA
JOB NO: 208140.MWD
PLATE NO: B-3E

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-10-164	MC-9	13.0	●	55	35	SILTY SAND (SM)
A-10-164		15.5	⊠			FAT CLAY (CH)
R-10-167	MC-3	10.0	▲			CLAYEY SAND WITH GRAVEL
R-10-167	MC-4	15.5	★			CLAYEY GRAVEL WITH SAND (GC)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MARIN-SONOMA NARROWS CONTRACT B-1 NWMD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO: 208140.MWD

PLATE NO: B-3F

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : B104 #1 @ 4'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112902.

EVALUATION FOR SOIL CORROSION

Soil pH	6.71	
Minimum Resistivity	1.15 ohm-cm (x1000)	
Chloride	63.2 ppm	00.00632 %
Sulfate	27.6 ppm	00.00276 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL - 4 2009
By

Plate B-4A

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B117 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113590.

EVALUATION FOR SOIL CORROSION

Soil pH	3.72		
Minimum Resistivity	2.68 ohm-cm (x1000)		
Chloride	31.8 ppm	00.00318	%
Sulfate	18.2 ppm	00.00182	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B129 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113591.

EVALUATION FOR SOIL CORROSION

Soil pH	5.18		
Minimum Resistivity	5.36 ohm-cm (x1000)		
Chloride	13.4 ppm	00.00134	%
Sulfate	1.9 ppm	00.00019	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
BY

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

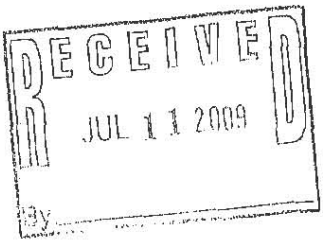
The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B134#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113085.

EVALUATION FOR SOIL CORROSION

Soil pH	5.47		
Minimum Resistivity	2.57 ohm-cm (x1000)		
Chloride	20.3 ppm	00.00203	%
Sulfate	15.9 ppm	00.00159	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B135 #3@9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113589.

EVALUATION FOR SOIL CORROSION

Soil pH	4.23	
Minimum Resistivity	2.68 ohm-cm (x1000)	
Chloride	57.1 ppm	00.00571 %
Sulfate	6.4 ppm	00.00064 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 24 2009
BY

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B137#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113084.

EVALUATION FOR SOIL CORROSION

Soil pH	6.73		
Minimum Resistivity	1.05 ohm-cm (x1000)		
Chloride	56.1 ppm	00.00561	%
Sulfate	23.2 ppm	00.00232	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009

Plate B-4F

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B143#2 @ 9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113086.

EVALUATION FOR SOIL CORROSION

Soil pH	6.15	
Minimum Resistivity	1.88 ohm-cm (x1000)	
Chloride	19.5 ppm	00.00195 %
Sulfate	4.9 ppm	00.00049 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009

Plate B-4G

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/01/2009
Date Submitted 06/24/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR REDWOOD Site ID : 145 @ 0-5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55971-112899.

EVALUATION FOR SOIL CORROSION

Soil pH	5.58	
Minimum Resistivity	4.02 ohm-cm (x1000)	
Chloride	9.7 ppm	00.00097 %
Sulfate	4.4 ppm	00.00044 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL - 4 2009
By

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/08/2009
Date Submitted 07/02/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR/REDWOOD Site ID : B146#1 @ 4'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56059-113088.

EVALUATION FOR SOIL CORROSION

Soil pH	7.80	
Minimum Resistivity	0.29 ohm-cm (x1000)	
Chloride	245.1 ppm	00.02451 %
Sulfate	813.7 ppm	00.08137 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 11 2009
By

Plate B-4I

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B149 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113592.

EVALUATION FOR SOIL CORROSION

Soil pH	6.78	
Minimum Resistivity	0.54 ohm-cm (x1000)	
Chloride	137.2 ppm	00.01372 %
Sulfate	109.7 ppm	00.01097 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/29/2009
Date Submitted 07/22/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 208140.GDR Site ID : B151#3@9.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 56277-113588.

EVALUATION FOR SOIL CORROSION

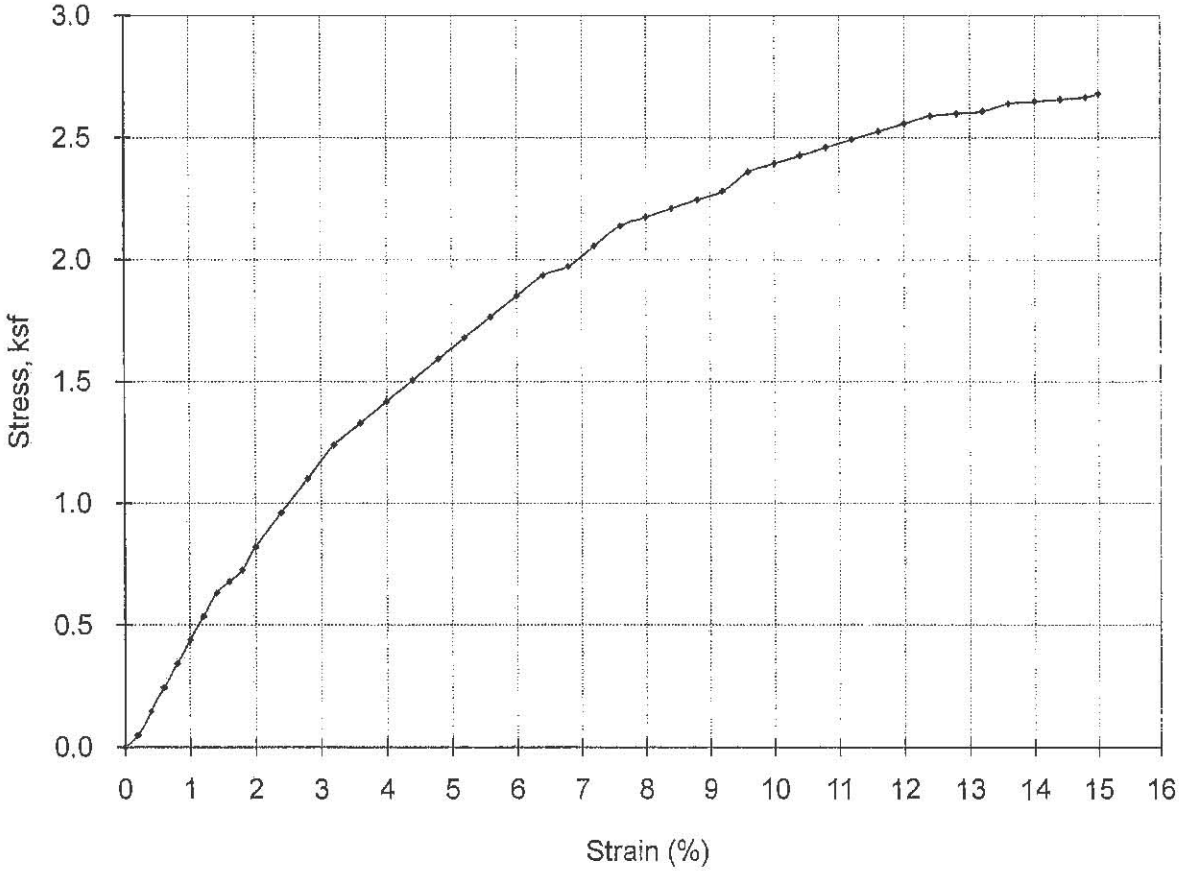
Soil pH	6.09	
Minimum Resistivity	0.94 ohm-cm (x1000)	
Chloride	42.9 ppm	00.00429 %
Sulfate	37.5 ppm	00.00375 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JUL 31 2009
By

Plate B-4K

UNCONFINED COMPRESSION TEST



Boring No.: A-10-158A

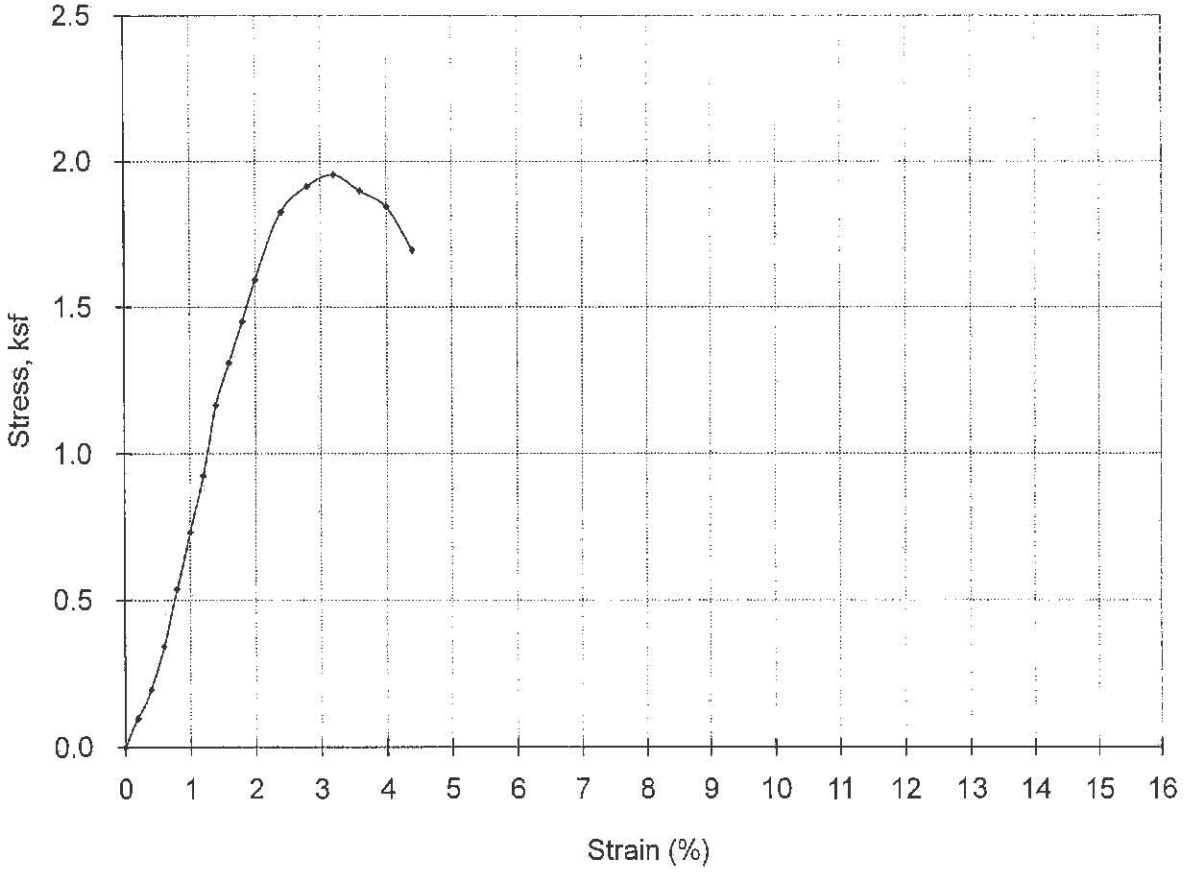
Sample No. : 1 **Strength (ksf):** 2.68

Depth (feet): 2 **Strain (%):** 15.00

Material Description:
Stiff, Lean Clay

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	REDWOOD LANDFILL INTERCHANGE PROJECT MARINE COUNTY, CALIFORNIA
	JOB NO.: 2008-140-GDR / PLATE NO.:

UNCONFINED COMPRESSION TEST



Boring No.: A-10-158A

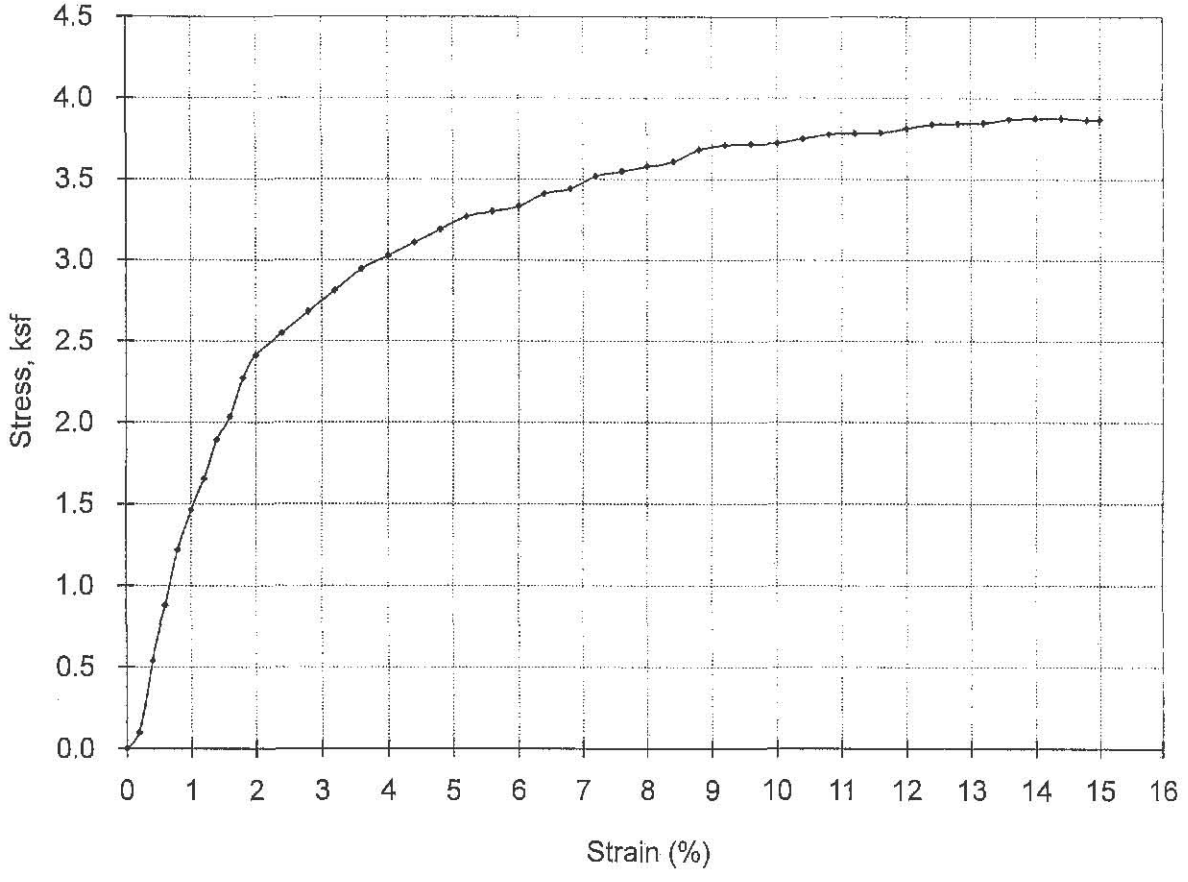
Sample No. : 2 **Maximum Strength (ksf):** 1.95

Depth (feet): 5 **Strain @ Failure (%):** 3.20

Material Description:
Firm, Sandy Lean Clay with Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	REDWOOD LANDFILL INTERCHANGE PROJECT MARINE COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-GDR	PLATE NO.:

UNCONFINED COMPRESSION TEST



Boring No.: A-10-163

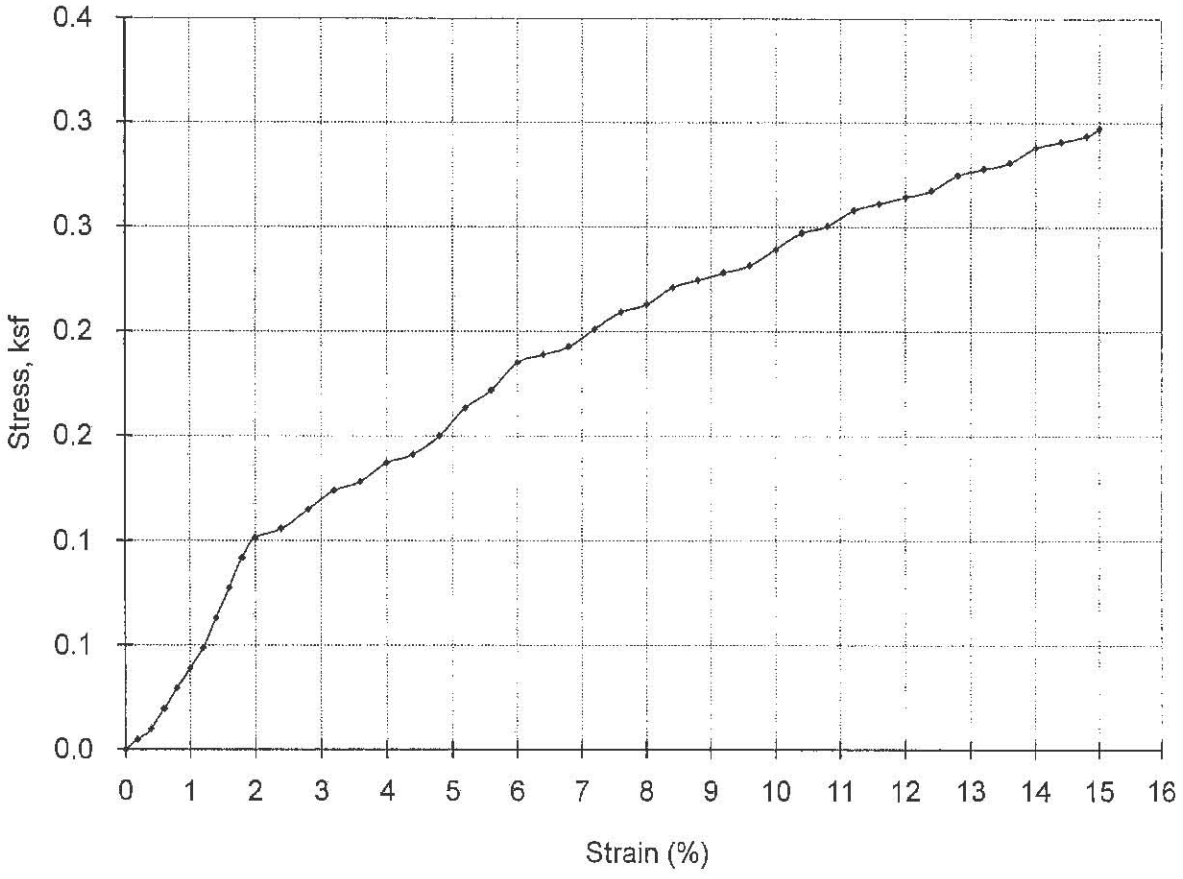
Sample No. : 3 **Strength (ksf):** 3.87

Depth (feet): 8.5 **Strain (%):** 15.00

Material Description:
Very Stiff, Lean Clay

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 2008-140-LLS	PLATE NO.:

UNCONFINED COMPRESSION TEST



Boring No.: A-10-163

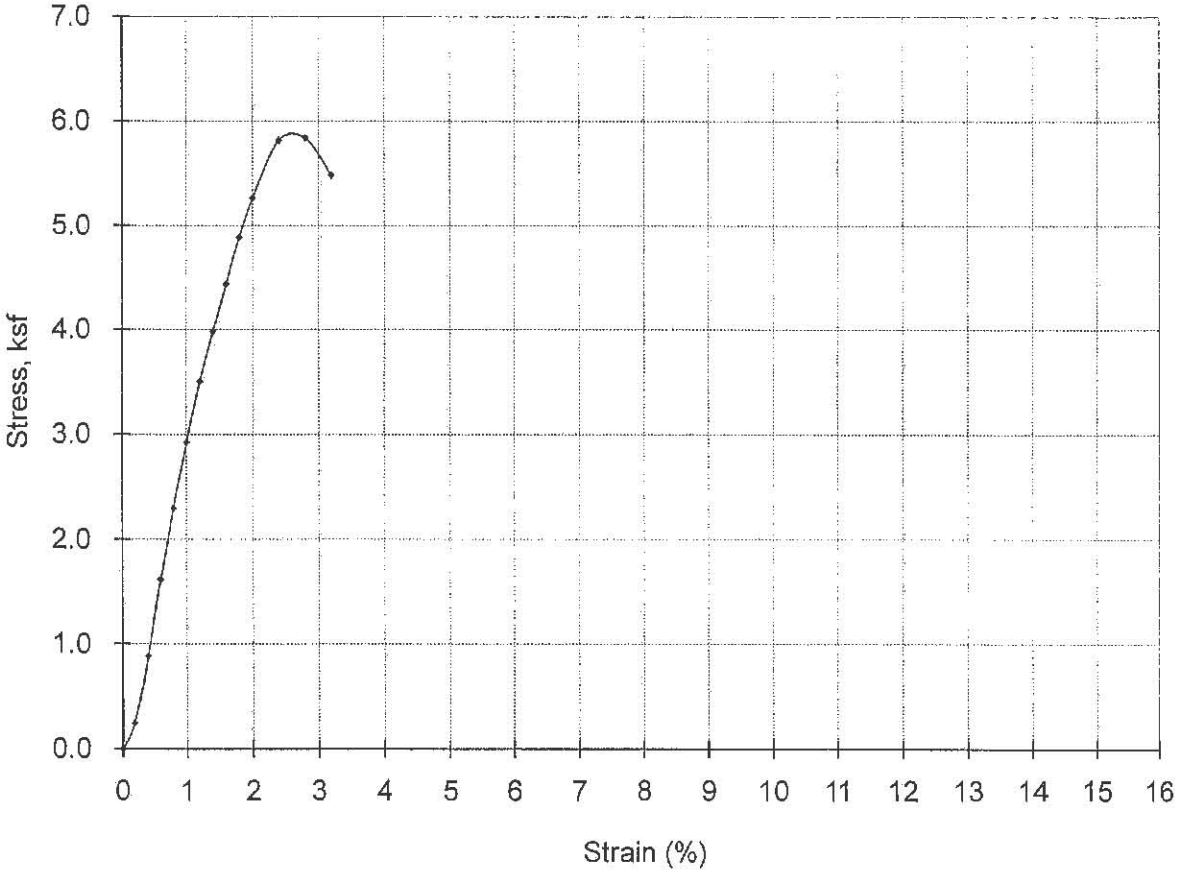
Sample No. : 5 **Strength (ksf):** 0.30

Depth (feet): 10-11.5 **Strain (%):** 15.00

Material Description:
Very Soft, Lean Clay with some Sand and Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA
	JOB NO.: 2008-140-LLS PLATE NO.:

UNCONFINED COMPRESSION TEST



Boring No.: R-10-165

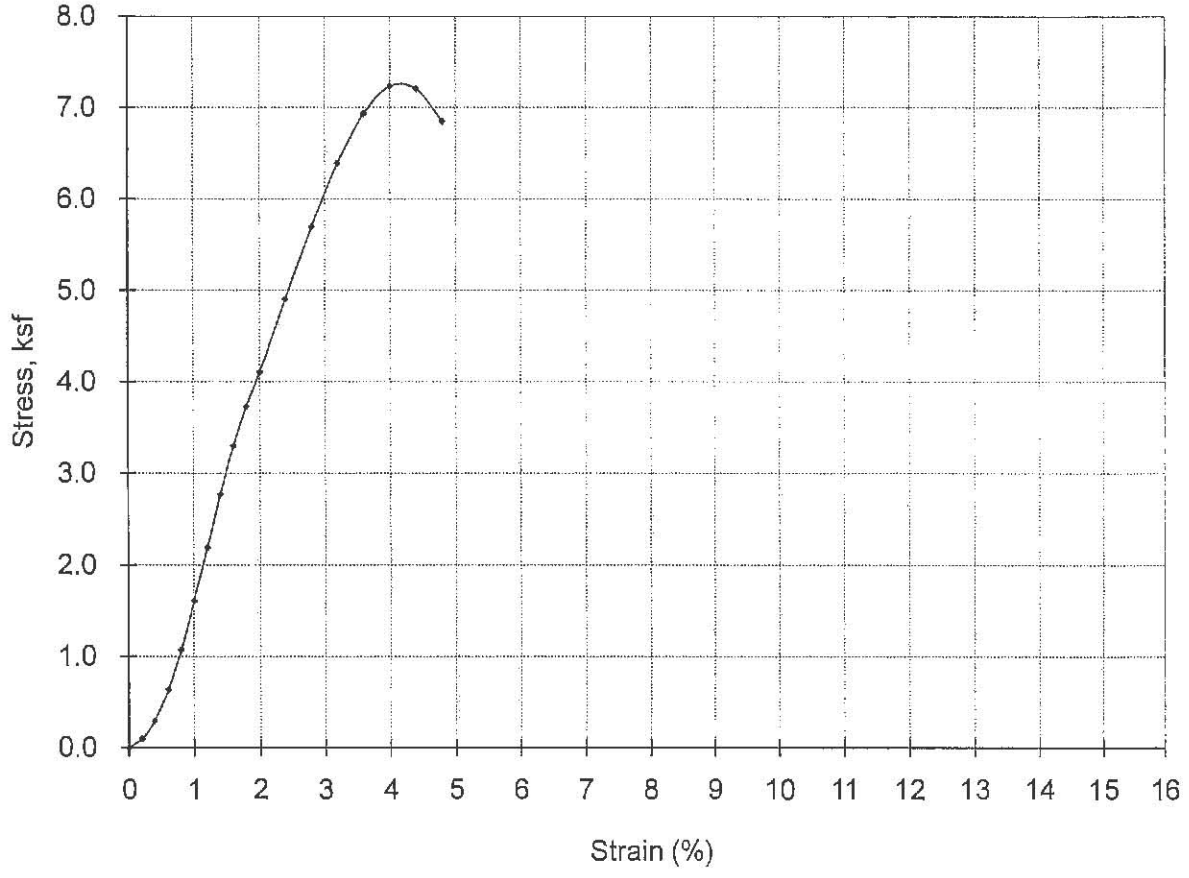
Sample No. : 1A **Maximum Strength (ksf):** 5.84

Depth (feet): 2 **Strain @ Failure (%):** 2.80

Material Description:
Hard, Lean Clay with Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.LLS	PLATE NO.:

UNCONFINED COMPRESSION TEST



Boring No.: R-10-165

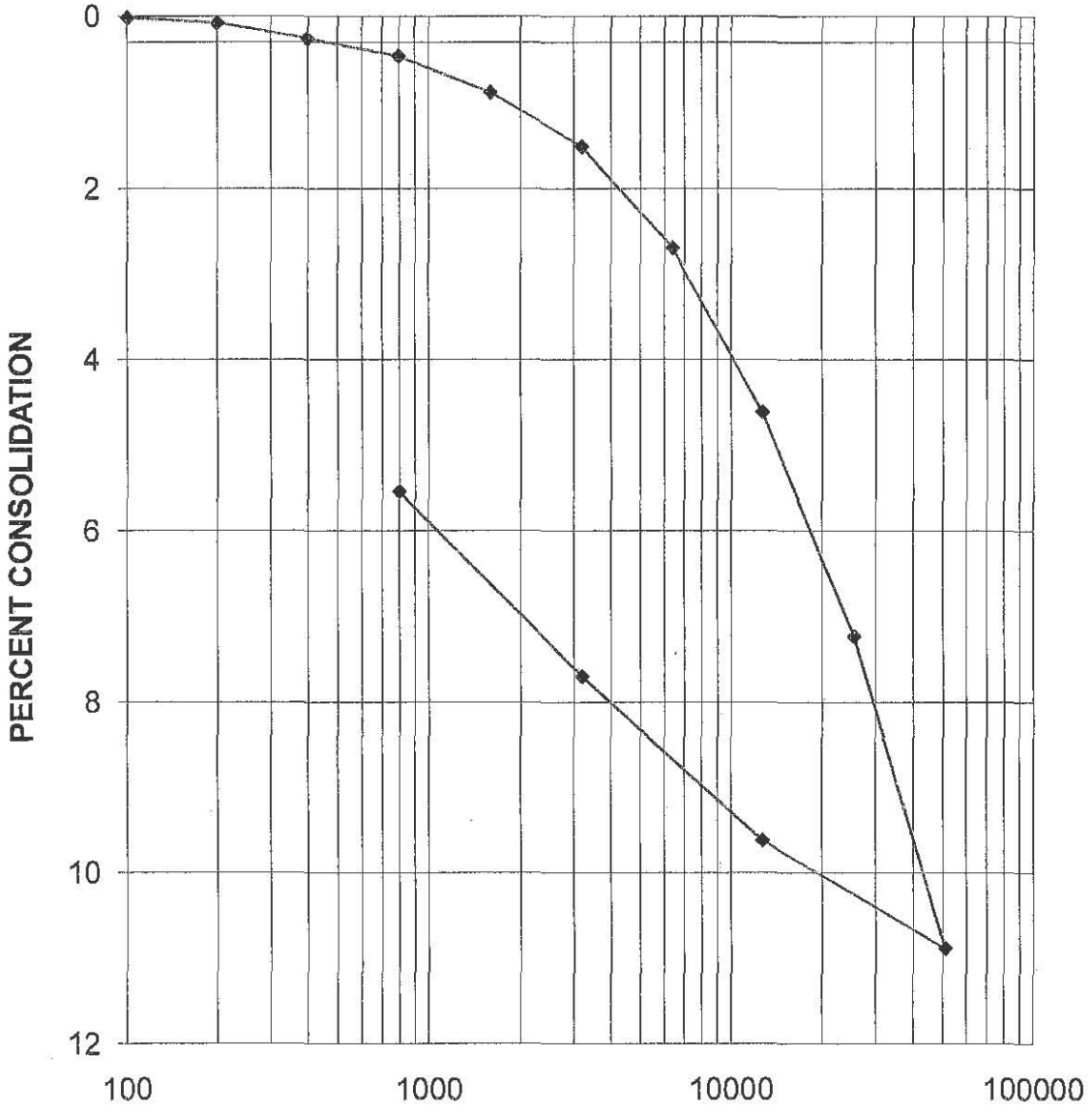
Sample No. : 2 **Maximum Strength (ksf):** 7.23

Depth (feet): 5.5 **Strain @ Failure (%):** 4.00

Material Description:
Hard, Lean Clay with Gravel

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN SONOMA NARROWS CONTRACT B1 - LANDSLIDE STUDY MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.LLS	PLATE NO.:

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	16.7	119.4	1.0000	2.416
FINAL	15.4	126.4	0.9446	2.416

BORING NO.	B110	SAMPLE NO.	3	ELEV. OR DEPTH	9.5'
DESCRIPTION	Sandy Lean Clay, brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Reedwood Landfill Interchange
MARIN COUNTY / BKF

DATE	JOB NO:
7/21/2009	208140.GDR

Reported by: Prav Dayah

PLATE NO.: B-6A

CONSOLIDATION TEST - TIME CURVE

JOB #: 208140.GDR

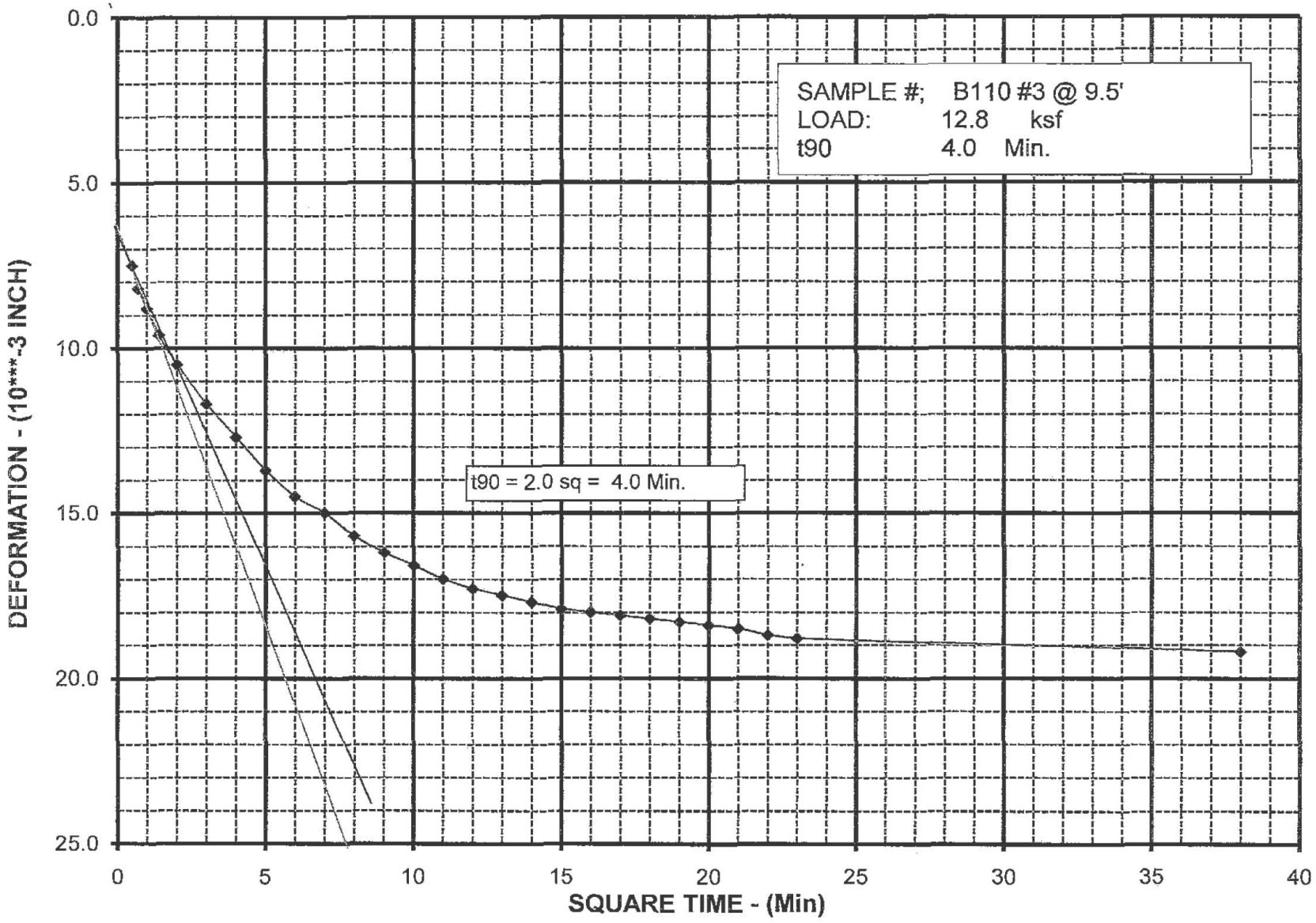


PLATE NO.: B-6B

CONSOLIDATION TEST - TIME CURVE

JOB #: 208140.GDR

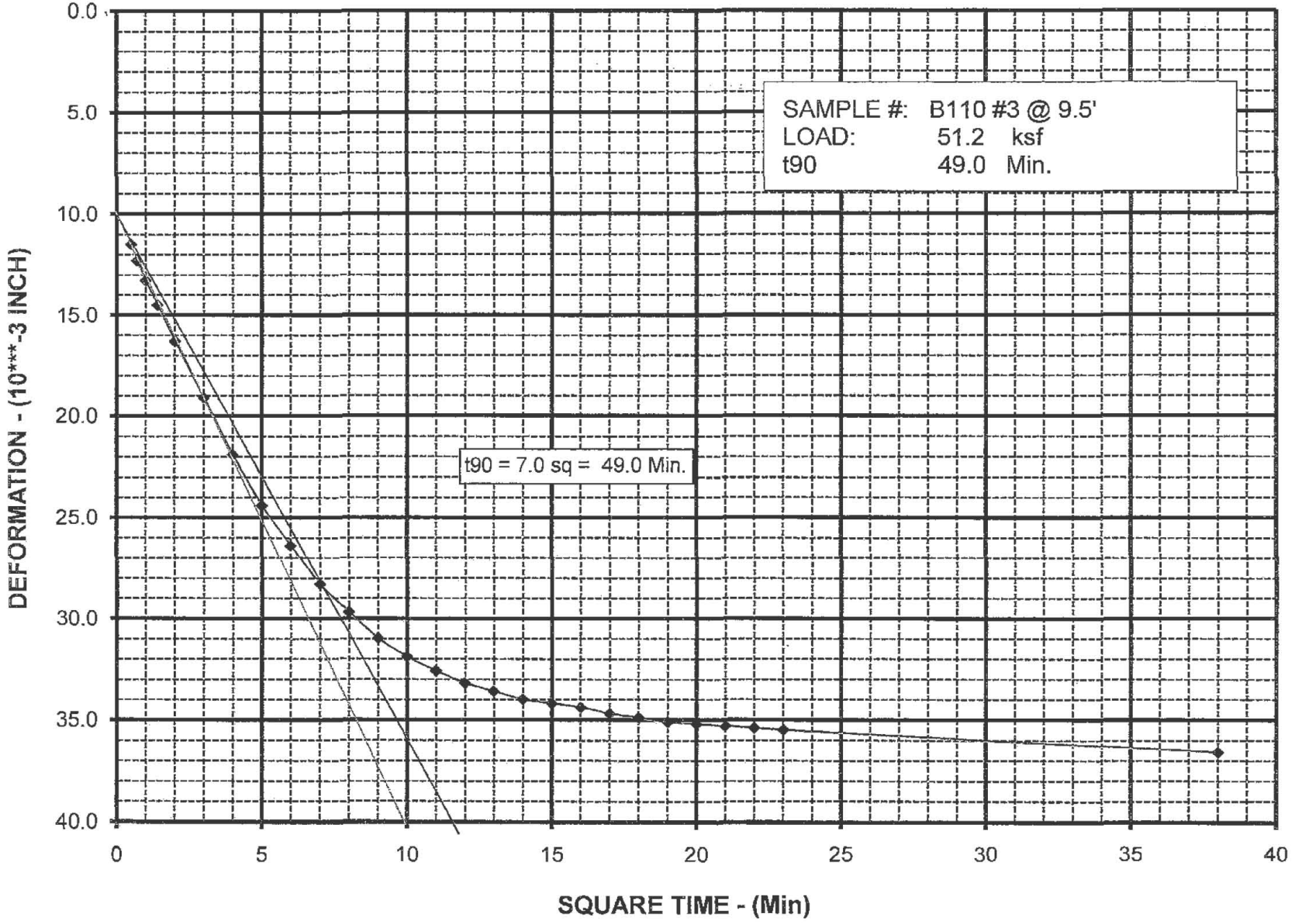
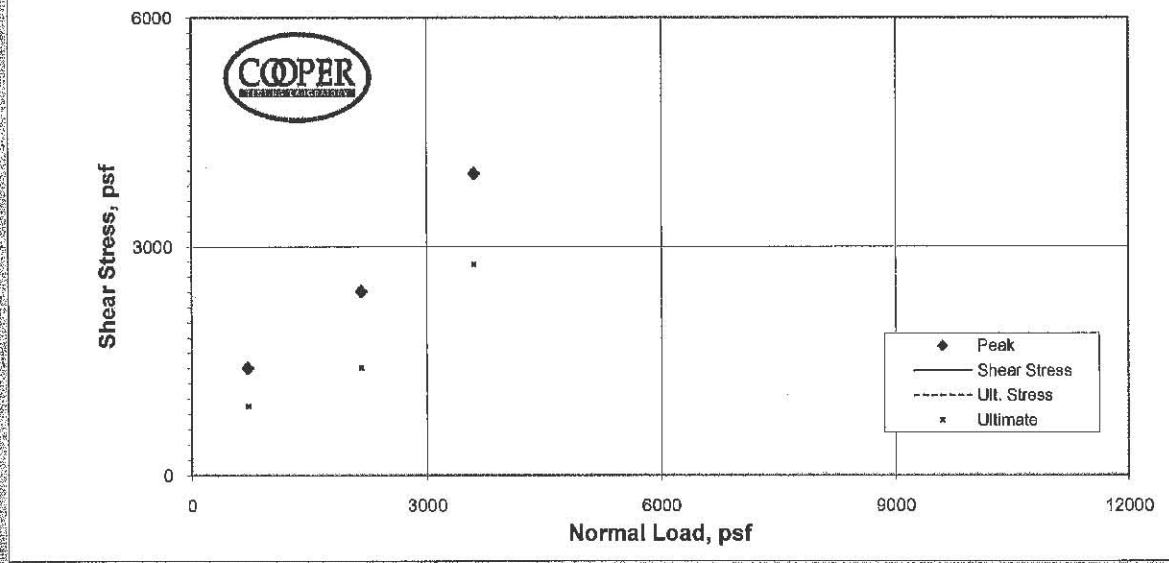


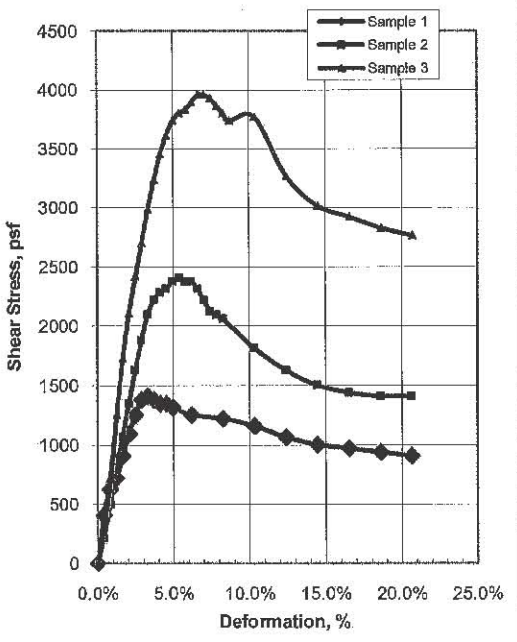
PLATE NO.: B-6C

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



Sample Data: Initial	1	2	3	4
Moisture %	16.3%	15.2%	15.2%	
Dry Dens., pcf	95.5	97.9	97.6	
Void Ratio	0.765	0.722	0.728	
Saturation %	57.5	57.0	56.3	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	22.6%	21.6%	21.6%	
Dry Dens., pcf	104.7	106.6	106.5	
Void Ratio	0.611	0.583	0.584	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.912	0.918	0.916	
Normal Stress, psf	720	2160	3600	
Shear Stress, psf	1409	2411	3961	
Strengths picked at	3.3%	5.4%	7.0%	
Ult. Stress, psf	908	1409	2766	
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	157-283
Client:	Parikh Consultants
Project	MSN Contract B1-Landslide Study - 208140.LLS
Tested By:	MD
Reduced By:	RU
Date:	12/1/2010

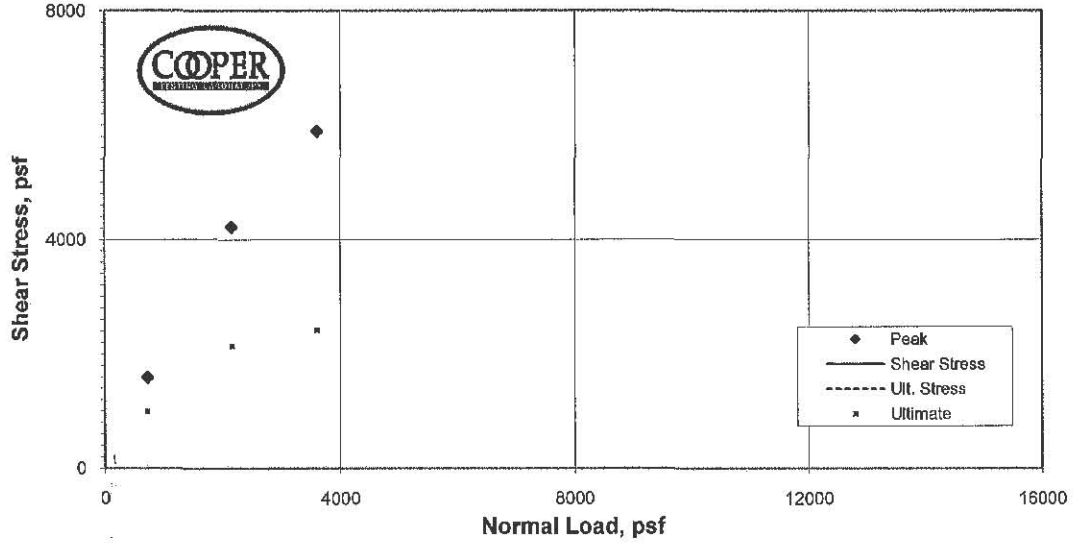
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	R-10-162A		15	Olive Silty SAND (slightly plastic)
2	R-10-162A		15	Olive Silty SAND (slightly plastic)
3	R-10-162A		15	Olive Silty SAND (slightly plastic)

Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

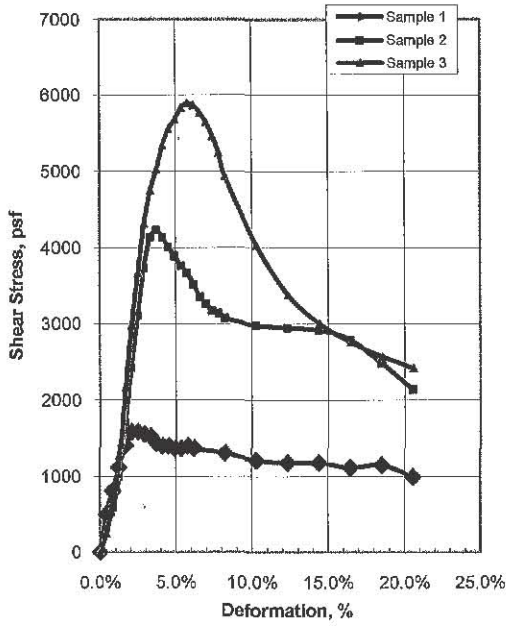
Plate No. 7A

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



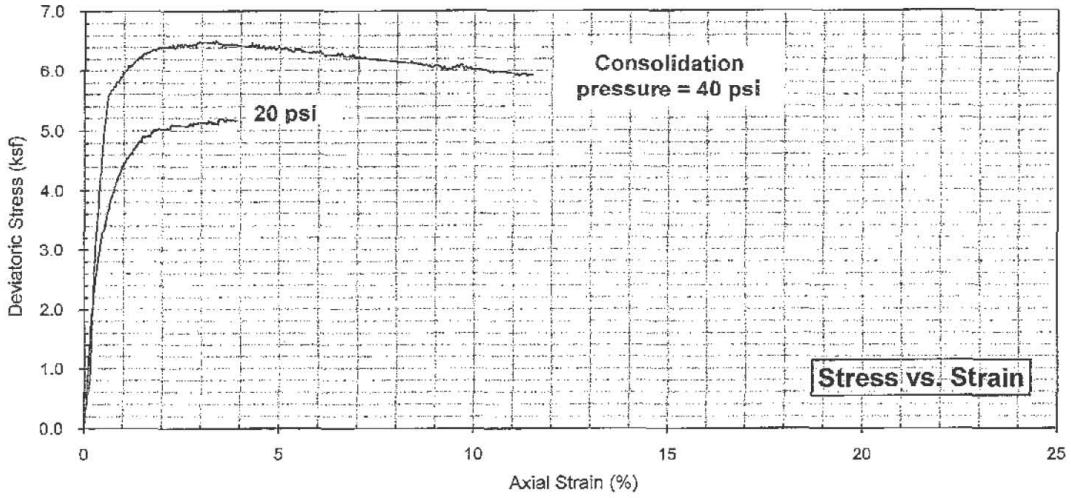
	Sample Data: Initial			
	1	2	3	4
Moisture %	22.2%	24.7%	20.8%	
Dry Dens., pcf	90.9	89.0	93.7	
Void Ratio	0.854	0.894	0.799	
Saturation %	70.2	74.7	70.3	
Diameter	2.43	2.43	2.43	
Height	1.01	1.01	1.01	
	Sample Data: At Test			
Moisture %	25.2%	26.5%	23.6%	
Dry Dens., pcf	100.3	98.4	103.0	
Void Ratio	0.682	0.715	0.638	
Saturation %	100.0	100.0	100.0	
Diameter	2.43	2.43	2.43	
Height	0.913	0.911	0.918	
Normal Stress, psf	720	2160	3600	
Shear Stress, psf	1584	4223	5899	
Strengths picked at	2.5%	3.7%	5.8%	
Ult. Stress, psf	994	2142	2422	
Strain Rate, %/min.	1.0	1.0	1.0	

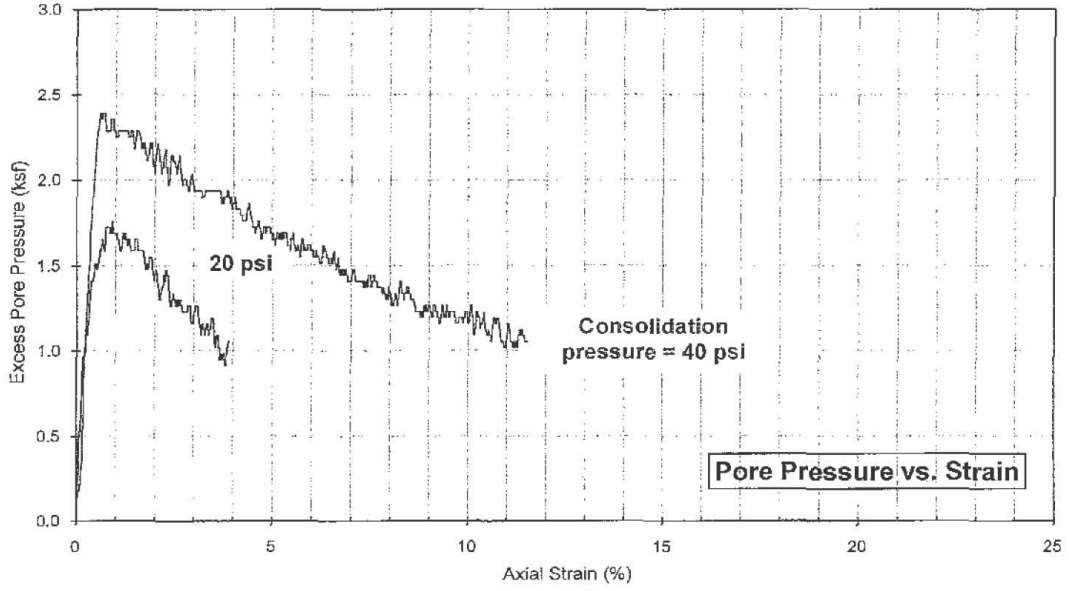
CTL #	157-283
Client:	Parikh Consultants
Project	MSN Contract B1-Landslide Study - 208140.LLS
Tested By:	MD
Reduced By:	RU
Date:	12/1/2010

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	RW-10-162		24-25	Olive Silty SAND
2	RW-10-162		24-25	Olive Silty SAND
3	RW-10-162		24-25	Olive Silty SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

Plate No. 7B

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST





Boring No.	R-10-162
Sample No.	
Elev. or Depth (ft)	32.5'- 33.5'
Soil Description	Fat Clay, yellowish brown

	Stage	1	2
INITIAL	Moisture (%)	31.8	--
	Dry density (pcf)	88.7	--
	Diameter (inch)	2.416	2.446
	Height (inch)	5.0	4.8
AT TEST	Moisture (%)	--	31.9
	Area (sq. inch)	4.52	4.67
	Height (inch)	4.98	4.81
	B-value	1	1
	Total Cell Pressure (ksf)	6.91	9.79
	Back Pressure (ksf)	4.03	4.03
	Effective Cell Pressure (ksf)	2.9	5.8
	Strain Rate (%/min)	0.18	0.18
	Max. Deviator Stress (ksf)	5.12	6.54
	Strain @ Failure (%)	3.1	3.28
	Excess Pore Pressure @ Failure (ksf)	1.23	1.93
	σ_1' @ failure	6.77	10.37
	σ_3' @ failure	1.65	3.83

Remark:

Date: 12/2/2010
File Name: CU-R-10-162

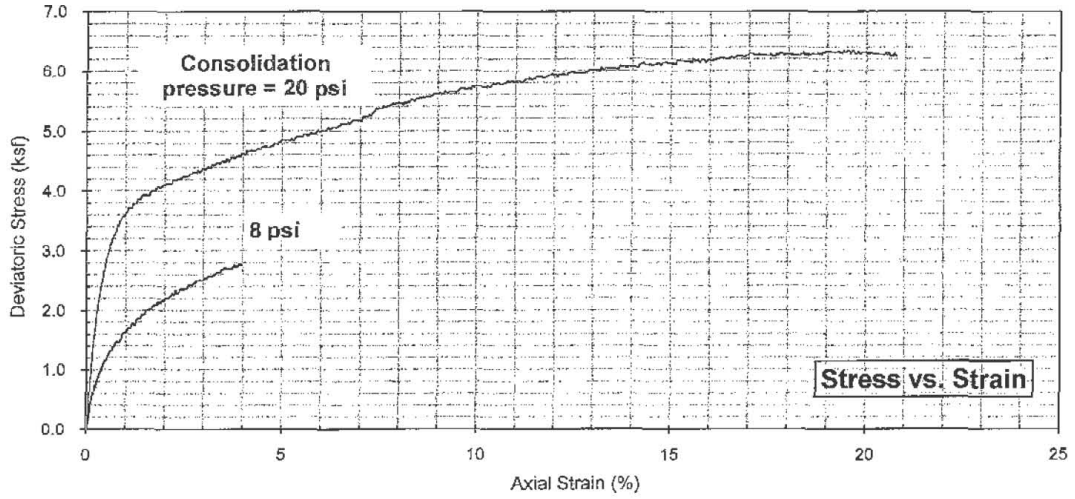
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

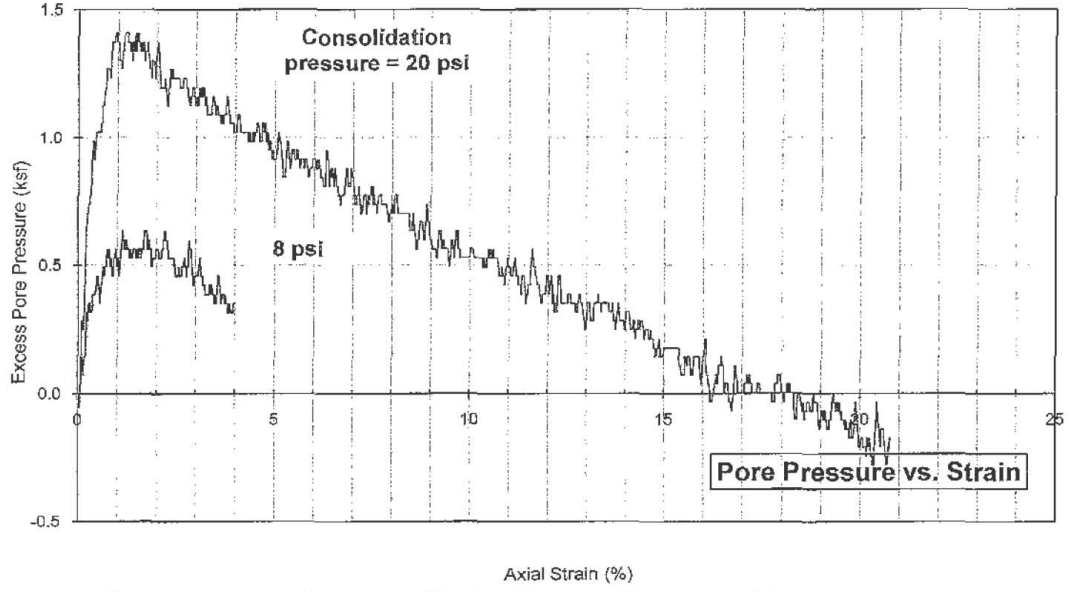
MARIN SONOMA NARROWS CONTRACT B1 - MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.LLS

Plate B-8A

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST





Boring No.	A-10-164
Sample No.	
Elev. or Depth (ft)	15.5 - 16
Soil Description	Fat Clay with Sand, dark brown

	Stage	1	2
INITIAL	Moisture (%)	24.6	–
	Dry density (pcf)	97.9	–
	Diameter (inch)	2.416	2.447
	Height (inch)	5.0	4.8
AT TEST	Moisture (%)	–	28.6
	Area (sq. inch)	4.51	4.68
	Height (inch)	5.03	4.84
	B-value	1	1
	Total Cell Pressure (ksf)	5.18	6.91
	Back Pressure (ksf)	4.03	4.03
	Effective Cell Pressure (ksf)	1.2	2.9
	Strain Rate (%/min)	0.18	0.18
	Max. Deviator Stress (ksf)	2.77	6.38
	Strain @ Failure (%)	4.0	20.57
	Excess Pore Pressure @ Failure (ksf)	0.35	0.00
	σ_1' @ failure	3.57	9.26
	σ_3' @ failure	0.80	2.88

Remark:

Date: 12/20/2010
File Name: A-10-164

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

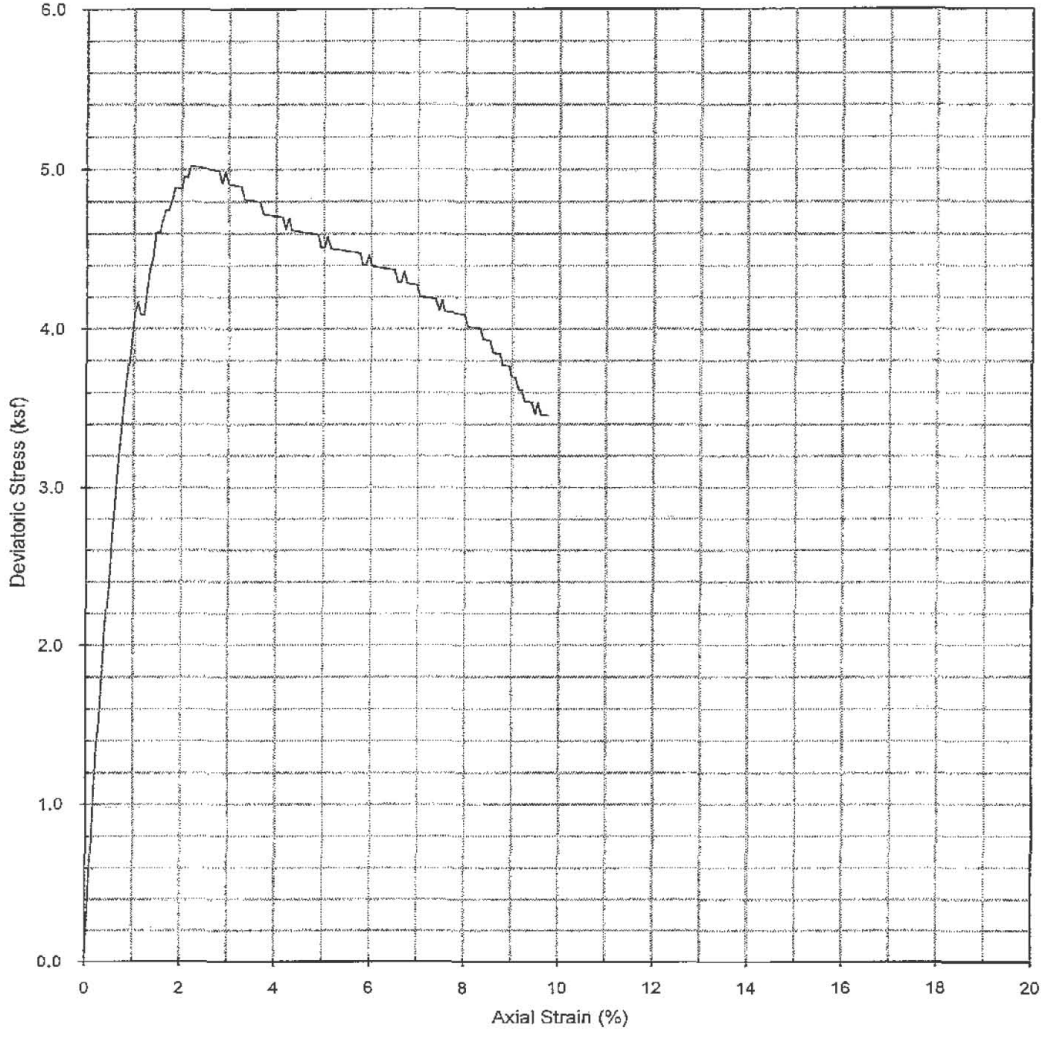
REDWOOD LANDFILL INTERCHANGE - LANDSLIDE STUDY

JOB NO.: 2008-140-LLS

Plate B-8B

UNCONSOLIDATED UNDRAINED COMPRESSION TEST

Stress vs. Strain



Boring No.	R-10-161
Sample No.	
Elev. or Depth (ft)	11.5'-13'
Soil Description	Sandy Lean Clay, light brown

Height of Sample (inch)	5
Initial Diameter (inch)	2.416
% Moisture	26.1
Dry Density (pcf)	96.3
Cell Pressure (ksf)	0.72
Maximum Strength (ksf)	5.02
Strain @ Failure (%)	2.1

Date: 11/24/2010

File Name: UUR101161

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MSN CONTRACT B1 - LANDSLIDE STUDY

JOB NO.: 208140.LLS

APPENDIX C

NORTH MARIN WATER DISTRICT

STANDARD SPECIFICATIONS

SECTION 02223 TRENCHING, EXCAVATION, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing and installation for trench excavation, backfill, and compaction of piping, conduit, manholes and vaults.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM C 131 -	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 150 -	Portland Cement
ASTM D 75 -	Practice for Sampling Aggregates
ASTM D 1556 -	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557 -	Test Method for Moisture-Density Relations of Soils Using a Modified Effort
ASTM D 2419 -	Test Method for Sand Equivalent Values of Soil and Fine Aggregate
ASTM D 2922 -	Test Method for Density of Soil in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017 -	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods
ASTM D 3776 -	Test Method for Mass Per Unit Area (Weight) of Woven Fabric
ASTM D 4253 -	Test Methods for Maximum Index Density and unit weight of Soils Using a Vibratory Plate
ASTM D 4254 -	Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4632 -	Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751 -	Test Method for Determining the Apparent Opening Size of a Geotextile
CAL-OSHA -	Title 8 General Industry Safety Orders
STANDARD SPECIFICATIONS -	State of California Department of Transportation

1.03 RELATED WORK SPECIFIED ELSEWHERE

NMWD Standard Drawings
NMWD Standard Specifications 01000, 02200, 02202, 02700, 03461, 03462, 15000, 15044, 15056, 15061, 15064, and 15065

1.04 GEOTECHNICAL TESTING

The Developer or Contractor shall engage the services of a geotechnical engineering firm or individual licensed in the State of California to monitor soil conditions during earthwork, trenching, bedding, backfill and compaction operations. Sampling and testing procedures shall be performed in accordance with the Reference Standards and as follows:

A. The soils technician shall be present at the site during all backfill and compaction operations. Failure to have the soils technician present will subject such operations to rejection.

B. Density and optimum moisture content of soil shall be determined by the use of the sand cone method, ASTM D 1556, or nuclear density gauge method, ASTM D 2922 & D 3017. Since the composition of the pipe and the walls of the trench can have an effect on the nuclear density gauge output, any tests performed at depths greater than 1 foot below the ground surface shall be performed with a gauge calibrated within the trench at the test depth.

C. Determine laboratory moisture-density relations of existing soil by ASTM D 1557.

D. Determine the relative density of cohesionless soils by ASTM D 4253, ASTM D 4254 AND D4564.

E. Sample backfill material by ASTM D 75.

F. Express "relative compaction" as a percentage of the ratio of the in-place dry density to the laboratory maximum dry density.

A report of all soils tests performed shall be stamped and signed by the soils firm or individual and shall be submitted by the Developer or Contractor prior to the filing of the Notice of Completion by the District. The report shall document the sampling and testing of materials, the location and results of all tests performed, and shall certify that materials and work are in compliance with this specification.

1.05 PIPE ZONE

The pipe zone includes the full width of the trench from four (4) inches below the bottom of the pipe to twelve (12) inches above the top of the pipe and extends into manhole or vault excavations to the point of connection to or penetration of such structure.

1.06 TRENCH ZONE

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the pavement zone in paved areas, or to the existing surface in unpaved areas, and extends into manhole or vault excavations above the pipe zone.

1.07 PAVEMENT ZONE

The pavement zone includes the concrete or asphalt concrete pavement and aggregate base section placed over the trench zone and extends into manhole or vault excavations above the trench zone.

1.08 PROTECTION OF EXISTING UTILITIES AND FACILITIES

The Contractor shall be responsible for the care and protection of all existing utilities, facilities and structures that may be encountered in or near the area of the work in accordance with Section 01000.

1.09 PROTECTION OF EXISTING LANDSCAPING

The Contractor shall be responsible for the protection of all the trees, shrubs, fences, and other landscape items adjacent to or within the work area in accordance with Section 01000.

1.10 ACCESS

The Contractor shall provide continuous, unobstructed access to all driveways, water valves, hydrants, or other property or facilities within or adjacent to the work areas.

1.11 SAFETY

A. Protection of workers within trenches shall be as required by the California Labor Code and in accordance with Section 01000.

B. All excavations shall be performed in a safe manner and shall be protected and supported in accordance with CAL-OSHA regulations.

C. Barriers and traffic delineators shall be placed in accordance with the requirements of the agency having jurisdiction.

1.12 BLASTING

Blasting for excavation shall not be performed without the written permission of the District. Submit verification that procedures and methods of blasting shall conform to all Federal, State and local laws and ordinances to District for approval prior to issuance of written permission.

1.13 PIPE JACKING

Pipe jacking may be permitted in accordance with Section 15125. District approval is required in advance of such operations.

1.14 EXCESS EXCAVATED MATERIAL

A. The Contractor shall remove and legally dispose of all excess excavated material and demolition debris.

B. It is the intent of these specifications that all surplus material shall be legally disposed of by the Contractor. Before acceptance of the work by District, the Contractor shall provide the District with written releases signed by all property owners with whom the Contractor has entered into agreements for disposing of excess excavated material, absolving the District from any liability connected therewith.

1.15 CHANGES IN LINE AND GRADE

In the event obstructions not shown on the plans are encountered during the progress of the work, and which will require alterations to the plans, the Engineer shall have the authority to change the plans and order the necessary deviation from the line and grade, in accordance with Section 01000. The Contractor shall not deviate from the specified line and grade without prior written approval by the District.

1.16 HYDROSTATIC TESTING

Pre-testing of the piping system may be performed for the Contractor's convenience at any time. However, the final hydrostatic pressure test shall be as described in Section 15044.

PART 2 MATERIALS

2.01 GENERAL

The Contractor shall furnish backfill material as specified below. All materials used in and above the pipe zone shall be capable of attaining the required relative density.

2.02 PIPE ZONE GRANULAR MATERIAL

Granular Material shall be used within the Pipe Zone. Suitable material for pipe zone granular material shall have an ASTM 2487 soil classification of SW, SM, GW, or GM.

Material shall have a sand equivalent value of not less than 30 per ASTM D 2419, a coefficient of uniformity of 3 or greater.

Pipe zone granular material shall be certified to contain less than 1% asbestos by weight or volume and shall conform to the following gradation and requirements:

U. S. Standard Sieve Size	Percent Passing By Weight
¾ inch	100
½ inch	90-100
3/8 inch	80-100
No. 4	50-80
No. 30	10-35
No 200	0-5

Test	Test Method	Requirement
Percentage Wear	ASTM C 131	----
100 Revolutions	----	15 Maximum
500 Revolutions	----	52 Maximum

Test	Test Method	Requirement
Plasticity Index	ASTM D4318	NP-10
Liquid Limit	ASTM D4318	Less than 20
Min. pH	EPA 9040	Greater than 6
Sat. Soil Resistivity	SM 2510	Greater than 3,000(Ohm-cm)
Chloride Concentration	EPA 300	Less than 200 mg/kg

2.04 TRENCH ZONE MATERIAL

Suitable material for trench zone (above the bedding material and below any pavement section) shall have an ASTM 2487 soil classification of SW, SM, SC, GW, GM, or GC and shall be free of organic matter and conform to the following gradation and requirements.

U. S. Standard Sieve Size	Percent Passing By Weight
3 inch	100
1 inch	70-100
3/8 inch	40-100
No. 4	20-90
No. 30	5-50
No. 200	0-40

Test	Test Method	Requirement
Plasticity Index	ASTM D4318	Less than 20
Liquid Limit	ASTM D4318	Less than 40
R-value	Caltrans 301	30 minimum

Imported trench zone material shall be Caltrans Class 1, 2 or 3 Aggregate Subbase or Class 2 Aggregate Base per Sections 25 and 26 of the latest version of Caltran's Standard Specifications.

Excavated spoil from the trenches may be suitable for the trench zone (above the bedding material and below any pavement section) provided it meets the above criteria and approved by the District Engineer.

2.05 SAND-CEMENT SLURRY (CONTROLLED DENSITY, CDF)

Sand-cement slurry shall be Shamrock Mix No. 1503 consisting of two sacks, 188 pounds of Portland cement per cubic yard of sand and sufficient moisture for workability. District approval is required for use of sand-cement slurry as a backfill material.

2.06 TRENCH PLUGS

Trench plugs consisting of compacted impermeable material approved by District Engineer or sand-cement slurry shall be installed on piping systems that are backfilled with crushed rock or placed on slopes steeper than 4:1 (horizontal:vertical).

2.07 ENGINEERING FABRICS

All engineering fabrics used for trench backfill operations shall be in accordance with Section 88 of Caltran's Standard Specifications.

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. Areas where work is to be performed shall be cleared of all trees, shrubs, rubbish, and other objectionable material of any kind, which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or would form obstructions therein.

B. Organic material from clearing and grubbing operations will not be incorporated in the trench backfill and shall be removed from the project site or retained and incorporated into the topsoil.

3.02 PAVEMENT, CURB, AND SIDEWALK REMOVAL

Bituminous or concrete pavements, curbs, and sidewalks shall be removed and replaced in accordance with the requirements of the agency having jurisdiction.

3.03 DEWATERING

A. The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering excavations or other parts of the work. Dewatering shall be performed by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Dewatering methods may include well points, sump points, suitable rock or gravel placed as pipe bedding for drainage and pumping, temporary pipelines, or other means, all subject to the approval of the District. The cost of all dewatering activities shall be borne by the Contractor.

B. Sewer systems shall not be used as drains for dewatering trenches or excavations, nor for disposal of collected or accumulated groundwater, without the approval of the agency of jurisdiction.

C. Concrete shall not be poured in water, nor shall water be allowed to rise around concrete or mortar until it has set at least four hours.

D. The Contractor is responsible for meeting all Federal, State, and local laws, rules and regulations regarding the treatment and disposal of water from dewatering operations at the construction site.

3.04 SHORING AND SHIELDING

A. The Contractor's design and installation of shoring shall be consistent with the rules, orders, and regulations of CAL-OSHA. Unless otherwise specified, Type "C" soils should be assumed for shoring design.

B. Excavations shall be shored, sheeted, and supported such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.

C. The sheeting and shoring shall be arranged so as not to place any stress on portions of the completed work until the general construction has proceeded far enough to provide ample strength.

D. Care shall be exercised in the moving or removal of trench shields, sheeting, and shoring to prevent the caving or collapse of the excavation faces being supported.

3.05 CORRECTION OF OVEREXCAVATION

Overexcavations shall be corrected by backfilling with approved pipe zone or trench zone material, compacted to 90% relative compaction, as directed by the District.

3.06 FOUNDATION STABILIZATION

A. When unsuitable soil materials are encountered, the unsuitable material shall be removed to the depth determined necessary in the field by the Soils Engineer, and as acceptable to the District. The sub-grade shall be restored with compacted pipe zone, trench zone material or crushed rock as recommended by the Soils Engineer. Place the appropriate bedding or base material on this restored foundation.

B. When rock encroachment is encountered, the rock shall be removed to a point below the intended trench or excavation sub-grade as determined necessary in the field by the Soils Engineer, and as acceptable to the District. The sub-grade shall be restored with compacted pipe zone or trench zone material as recommended by the Soils Engineer. Place the appropriate bedding or base material on this restored foundation.

C. When excessively wet, soft, spongy, or similarly unstable material is encountered at the surface upon which the bedding or base material is to be placed, the unsuitable material shall be removed to the depth determined necessary in the field by the Soils Engineer, and as acceptable to the District. Restore the trench with crushed rock enclosed in filter fabric or rock slope protection fabric as directed by the Engineer. Larger size rocks, up to six (6) inches with appropriate gradation, shall be used if recommended by the Soils Engineer. Place the appropriate bedding or base material on this restored foundation.

3.07 TRENCH EXCAVATION AND PLACEMENT OF BEDDING

A. Excavate the trench to the lines and grades shown on the drawings with allowance for four (4) inches of pipe bedding material. The trench section shall be as shown on the Standard Drawings.

B. The maximum length of open trench shall be five hundred (500) feet except by permission of the District. The distance is the collective length at any location, including open excavation and pipe laying, which has not been backfilled to the elevation of the surrounding grade.

C. Trench walls shall be sloped or shored per the requirements of CAL-OSHA.

D. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions.

E. Place the specified thickness of bedding material over the full width of the trench. Grade the top of the pipe base ahead of the pipe laying to provide a firm, uniform support along the full length of pipe.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

G. Trenches for main pipelines and all appurtenances shall be backfilled with the materials and methods as specified for the Pipe Zone, Trench Zone and Pavement Zone.

H. Trench widths shall be in accordance with the Standard Drawings.

I. Trench depth shall be as required to install pipelines in accordance with the Approved Plans and these Standard Specifications. Unless shown otherwise in the Approved Plans, the minimum cover for pipelines shall be as follows:

Pipeline Application	Minimum Cover Required
Potable Water	36 inches
Recycled Water	48 inches
Sewer	60 inches

J. Excavation and backfill of conduit for telemetring cables shall meet the requirements of this specification.

K. Final street sub-grade shall be established prior to the excavation of pipeline trenches. Minimum cover above pipe shall be 24 inches for hydrotesting.

3.08 MANHOLE AND VAULTS

A. The Contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations. The walls of the excavation shall be sloped or shored per the requirements of CAL-OSHA. Assume Type "C" soils unless otherwise specified.

B. Manholes and vaults shall be placed at the location and elevation shown on the plans, on undisturbed soils and six (6) inches of compacted crushed rock base.

C. Manhole and vault excavations shall be backfilled with the materials and methods as specified for the Pipe Zone, Trench Zone and Pavement Zone.

3.09 COMPACTION REQUIREMENTS

A. Compaction shall be accomplished by mechanical means. Consolidation by water settling methods such as jetting or flooding is prohibited.

B. If the backfill fails to meet the specified relative compaction requirements; the backfill shall be reworked until the requirements are met. All necessary excavations for density tests shall be made as directed by the Soils Engineer, and as acceptable to the Engineer. The requirements of the City or County having jurisdiction shall prevail on all public roads.

C. Compaction tests shall be performed at random depths, and at random intervals not to exceed one hundred fifty (150) feet, as directed by the Soils Engineer or District.

D. Relative compaction shall be determined by the impact or field compaction test made in accordance with ASTM D 1557, D2922 and D3017.

E. Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

1. Pipe zone - 90% relative compaction.

2. Trench zone - 90% relative compaction. In paved areas, upper twelve (12) inches 95% relative compaction.

3. Structural section in paved areas - per City or County requirements, 95% minimum.

4. Imported Granular Material for over excavation or foundation stabilization - 90% relative density.

F. All excavations are subject to compaction tests.

3.10 TRENCH PLUGS

Trench plugs shall be installed at two hundred (200) feet intervals along the entire length of piping systems as specified in Section 2.06 or as shown on the plans. For trench plugs required on sloping terrain, trench plugs shall be placed at every twenty-five (25) feet in vertical elevation. Trench plugs shall be ten (10) feet in length and shall encompass the entire pipe zone. Additional trench plugs may be required as directed by the Engineer.

3.11 PIPE ZONE BACKFILL

A. Care shall be taken in placing the pipe zone material simultaneously around the main pipeline and appurtenance pipes so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe or on the sides of the pipe. Care shall be taken to place material simultaneously on both sides of the pipe to prevent lateral movement. This area shall be mechanically compacted to attain 90% relative density. Care shall be taken when compacting appurtenance laterals two (2) inches and smaller to prevent the crushing or denting of the copper lateral. Additional lifts of twelve (12) inches or less thickness may be required on sixteen (16) inches or larger diameter pipe to attain complete support of the haunch area. Soils tests may be taken on this layer of backfill.

B. After the spring line backfill has been approved by the Soils Engineer, backfill of the remainder of the Pipe Zone may proceed. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.

C. Place and compact the pipe zone material at a maximum of eight (8) inch lifts. Compact all material placed in the Pipe Zone by mechanical methods. Field density tests shall be taken on this layer of backfill.

D. The use of a backhoe-mounted compaction wheel is prohibited within the pipe zone to twelve (12) inches above the top of the pipe.

E. Under no circumstances shall consolidation by water settling or water-setting methods (i.e. jetting, diking, etc.) be permitted.

3.12 TRENCH ZONE BACKFILL

A. After the Pipe Zone material has been placed, compacted, approved by the Soil Engineer and accepted by the District, backfill in the Trench Zone may proceed.

B. Compaction using vibratory equipment, tamping rollers, pneumatic tire rollers, or other mechanical tampers shall be performed with the type and size of equipment necessary to accomplish the work. The backfill shall be placed in horizontal layers of such depths (not to exceed eighteen (18) inches) as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened, and compacted to the specified relative density. The Contractor shall repair or replace any pipe, fitting, manhole, or structure damaged by the installation operations as directed by the District.

3.13 PAVEMENT ZONE BACKFILL AND RESTORATION

A. After the Trench Zone material has been placed, compacted, approved by the Soil Engineer, and accepted by the District; backfill in the Pavement Zone may proceed as necessary in accordance with the requirements of the agency having jurisdiction.

B. Replace bituminous and concrete pavement, curbs, and sidewalks removed or damaged during construction in accordance with the requirements of the agency having jurisdiction.

C. Unpaved areas disturbed in any way by trenching and backfilling operations shall be restored to their original condition by the Contractor.

END OF SECTION

APPENDIX D

APPENDIX D

SITE GEOLOGY – INTERPRATIONS AND MAPPING

D.1 PREVIOUS GEOLOGIC MAPPING

Dickerson (1922) originally mapped the Petaluma, Santa Rosa, and Point Reyes 15' quadrangles, focusing exclusively on Tertiary and Quaternary rocks. Aside from the volcanic rocks of Burdell Mountain, most Tertiary rocks were not distinguished as separate units in Dickerson's (1922) study. The Novato Conglomerate (now known to be Cretaceous) was mapped as a member of the "Pliocene" Sonoma Volcanics. (In 1922, the beginning of the Pliocene was considered to be ~10 million years before present.)

Weaver's (1949) map of the Petaluma Quadrangle is one of nine 15-minute geologic quadrangle maps in his report of the geology north of San Francisco Bay. Weaver informally named the Novato Conglomerate and tentatively assigned it a Cretaceous(?) age. Weaver assigned all Mesozoic rocks, excluding the Novato Conglomerate, to the "Franciscan group", then considered to be entirely of Late Jurrassic age. Weaver identified volcanic rocks in the vicinity of Burdell Mountain as "Pliocene" Sonoma volcanics.

Weaver's (1934) reconnaissance-level studies in the vicinity of Burdell Mountain led to the first generalized map of the area. He was the first to identify the Burdell Mountain fault trace, which he mapped for a distance of about 20 km, from San Francisco Bay northwestward to the northeastern flank of Burdell Mountain, similar to how the fault is depicted on recently published maps.

Rose (1955; 1958) described the petrology of the volcanics of Burdell Mountain area (designated Sonoma Volcanics) and the stratigraphy of the Franciscan (Complex), and Great Valley (Group) (e.g., Knoxville Formation and Novato Conglomerate). Rose (1955) was also the first to describe the Tertiary strata that underlie the volcanic rocks at Burdell Mountain, which he correlated to the Merced Formation.

Rice (1973 and 1975) produced the most complete and detailed maps of the Burdell Mountain and Novato area. Although Rice's (1973) report primarily focused on landslide features and related hazards, he also included detailed studies of the rock units and geologic structure of the

area. Rice mapped large areas on all sides of Burdell Mountain as "Quaternary landslides". Small areas of intact bedrock exposed in the landslide scarps and drainages were not mapped by Rice. Many of these exposures are critical for understanding the stratigraphic relations and geologic structure at Burdell Mountain.

Blake's *et al* (2000) map that encompasses the Burdell Mountain area is the USGS 1:125,000-scale Geologic map of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California. The map and database are largely compilations that, for the Burdell Mountain and Novato area, include or are based on the previous mapping described above.

Wagner's (2002) map shows landslides scarps located approximately 470 feet north of the locations on Rice's 1975 map and the toes of the landslides "trimmed" southward. We brought this apparent error to the attention of the California Geological Survey; they informed us that they intended to correct the error when they published the regional map of the Napa 30 x 60 degree map in 2010.

Ford's (2007) map shows two traces of the Burdell Mountain fault slightly differently than did previous geologic maps. Landslide scarps mapped northeast of the fault are located 470 feet north of the locations shown on Rice's 1975 map (just like Wagner's 2002 map, which Ford worked on).

The most recently published geologic map of the area was compiled by Wagner and Gutierrez (2010). The map is presented as Plate 3A in the main body of the report. They shifted the landslides southward so that their headscarps returned to the locations originally mapped by Rice (1975); however, they did not restore the northward extent of the toes of those slides as Rice had mapped them. The two traces of the Burdell Mountain fault are shown at the same locations mapped by Ford (2007).

All of the available geologic maps are more or less in agreement that bedrock northeast of the Burdell Mountain fault is Franciscan Complex and mélange, while bedrock southwest of the fault is Burdell Mountain Volcanics (andesite) on top of Tertiary Sandstone and Franciscan Complex which have been involved in large-scale landsliding to various degrees.

Our interpretation of the site geology, based on the latest published bap and our engineering geologist's examination of air photos and detailed topographic contours, is presented in Plates D-1 through D-7. Detailed discussions of the pertinent rock units for the project site as indicated in

the plates are presented in Section D.2 under appropriate era. An explanation of the map symbols is presented on Plate D.

D.2 STRATIGRAPHY

Bedrock units of project area consist of the Jurassic and Cretaceous Franciscan Complex and melange, Tertiary sedimentary rocks, and Miocene volcanic rocks of the Burdell Mountain volcanic field which unconformably overlie the other units. The boundaries of underlying bedrock units are difficult to define precisely due to poor exposures and some similar lithologies. Surficial deposits in the Burdell Mountain area are dominated by Quaternary landslide deposits that blanket both the east and west flanks of Burdell Mountain. Landslide deposits, along with colluvium, alluvium, and vegetation commonly obscure underlying stratigraphic relationships. On Burdell Mountain itself, exposures of intact andesite flows are almost entirely restricted to the mountain top, within steep, narrow drainages, or in exposures along landslide scarps.

D.2.1 Jurassic and Cretaceous Units

The Franciscan Complex in the northern Coast Ranges has been divided into the northwest-trending Coastal, Central, and Eastern tectonic belts. (Irwin, 1960) In Marin County, the Franciscan is mostly composed of relatively coherent gently northeast-dipping thrust sheets of the Eastern Metamorphic and Central Mélange belts that range in age from Early Jurrassic to Late Cretaceous. (Blake *et al.*, 1984)

The Eastern Metamorphic belt generally consists of schistose or phyllitic metagraywacke, metachert, and metabasalt. These rocks commonly contain abundant blueschist-facies minerals such as lawsonite, jadeite, pyroxene, and metamorphic aragonite. (Blake *et al.*, 1984) The Central Mélange belt is lithologically heterogenous and consists of a complex structural assemblage of graywacke, metagraywacke, radiolarian chert, metachert, gabbro, serpentinite, and medium to high-grade blueschist, eclogite and amphibolite in a highly-sheared shaley matrix. In the vicinity of Burdell Mountain, the Franciscan Complex includes rocks assigned to both the Eastern Metamorphic belts and Central Melange.

In the San Francisco Bay Area, serpentinite occurs within the Franciscan Complex and the Great Valley Group as accreted, exotic fragments of oceanic crust (ophiolite) and often marks the base of thrust zones or tectonic boundaries. (Warhaftig, 1989) Serpentinite generally forms tabular and elongate bodies along shear zones in the Burdell Mountain area.

The Great Valley Group consists of a thick accumulation of latest Jurassic to early Paleocene marine clastic sedimentary rocks that were deposited in an extensive, elongate, north-trending forearc basin, originally located between the Sierran magmatic arc and the Franciscan subduction complex. The Great Valley Group was deposited within a complex depositional system ranging from fluvial-deltaic in the east to deep-sea fan and basin plain in the west. (Bailey *et al.*, 1964) In contrast to the Eastern Metamorphic and Central Mélange belts of the Franciscan Complex, the Great Valley Group strata are unmetamorphosed and relatively unaffected by deformation associated with subduction and accretion.

Franciscan Complex schist, phyllite, and semischist (KJfsch)

Schistose rocks of the Franciscan Complex in the Burdell Mountain area have been assigned to the Eastern Metamorphic belt (i.e., the Yolla Bolly terrane of Bailey *et al.* [1964]). These rocks form two subparallel, northwest-trending belts located northeast and southwest of Burdell Mountain. All rocks of this unit have blueschist facies, high-pressure low-temperature alteration. (Wakabayashi, 1992) Rocks include meta-sandstone ranging from very low grade and weakly foliated to moderate low-and moderate-grade phyllite and schist, shale, chert, basalt, minor greenstone, and rare blocks of amphibolite and blueschist, which are found as isolated bodies found within or near serpentinite.

Near Burdell Mountain, the Franciscan Complex schist is generally a slope former. The predominate geomorphic feature of this unit is a northwest-striking ridge which is bounded to the southwest by the Burdell Mountain fault west of Highway 101. The unit is generally exposed on steep slopes and ridges and is responsible for the most extensive landslides, which range from hummocky surficial deposits to mega-scale rotational slump blocks.

Franciscan Complex mélange (KJfm)

Franciscan Complex rocks of the Central Melange belt are found in the Burdell Mountain area in thin, elongate, fault-bounded blocks along the Burdell Mountain fault zone. The unit is bounded between two sub-parallel strands of the Burdell Mountain fault zone and is juxtaposed against Franciscan Complex schist (KJfsch) to the northeast and Burdell Mountain volcanic rocks (Tbv) to the southwest.

At Burdell Mountain, the Franciscan Complex mélange (KJfm) consists almost entirely of sandstone with only minor outcrops of chert and greenstone. The sandstone is primarily light-brown to greenish-gray lithic wacke (informally known as greywacke) that is fine to coarse

grained, moderately indurated, and it is thickly bedded to massive. The sandstone is exposed mostly in areas of low relief and in drainages, but in some areas it forms steep slopes where it has been protected upslope by more resistant rocks or it has been uplifted or folded near fault contacts. Remnants of Burdell Mountain volcanics along this ridge suggest that these more resistant rocks have preserved the morphology of the ridge. However, the proximity of two sub-parallel shear zones, and near vertical fractures with similar orientations to the shear zones within the sandstone, suggest that the relief may be fault related.

Landsliding is far less widespread within the Franciscan mélange (KJfm) than within the Franciscan schist (KJfsch) in the map area. This is interpreted to be due to the higher concentration of relatively resistant and massive sandstone rather than sheared rock that comprises the mélange in other areas in the region.

Serpentinized Ultramafic Rocks (sp)

Serpentinite associated with the Franciscan Complex and possibly with the Coast Range ophiolite (Warhaftig, 1989) forms elongate bodies along the northeast, southwest and south flanks of Burdell Mountain. It is commonly associated with fault contacts between rocks of differing lithologies and metamorphic facies. Most conspicuously, serpentinite can be traced continuously along the Burdell Mountain fault zone for several kilometers. Rocks mapped as serpentinite consist of partially to entirely serpentinized peridotite, with minor vestiges of gabbro and pyroxenite occuring locally. Silica-carbonate, a hydrothermal alteration product of serpentinite, is also found locally along fault zones, and it occurs in bold, jagged, variegated exposures with distinct green, yellow, and white colors. The rocks stand out conspicuously as linear resisistant outcrops along the easternmost trace of the Burdell Mountain fault zone south of San Antonio Road and extensively along the top of the narrow ridge that is parallel to the Burdell Mountain ridge. In the map area, the silica carbonate is largely composed of quartz or opal and calcium carbonate (and perhaps other carbonate minerals) and is a very hard, fine-grained, black, green, and white silicified rock containing intersecting veinlets of carbonate which are sometimes stained with limonite. It commonly has fault-parallel shear fabric, slickensides, and gentle to open folds that are approximately 1-10 cm in amplitude with fault-parallel hingelines.

D.2.2 Tertiary Units

Tertiary rocks at Burdell Mountain consist of sedimentary rocks of probable early to middle Miocene age and middle Miocene Burdell Mountain volcanic rocks that both lie unconformably

over rocks of the Franciscan Complex.

Rocks of the Burdell Mountain volcanic field are found only west of the Burdell Mountain fault zone and are primarily andesite (Tbv).

Tertiary Sandstone (Ts)

A relatively thin sequence of Tertiary sedimentary rocks lie stratigraphically between underlying rocks of the Franciscan Complex and overlying Burdell Mountain volcanics. The unit reaches a maximum thickness of approximately 40 m along the west flank of Burdell Mountain, but appears to pinch out stratigraphically between over and underlying units. Strata within this unit consist primarily of buff weathered sandstone with minor siltstone, pebble conglomerate, and coquina.

The composition of the sandstone is subarkose. It is light gray and tan to nearly white, with localized yellow and brown oxidation and pale green weathering. The sandstone is generally fine grained, with well-sorted, sub-angular to rounded grains, thick bedded to massive and locally planar, and is moderately fractured, friable to moderately hard, locally fossiliferous and diatomaceous, and tuffaceous along the upper part of the unit. The siltstone has similar color and weathering properties as the sandstone, although the siltstone is more thinly bedded and friable. Channelized and matrix-supported pebble conglomerate makes up a very minor part of the map unit. The clasts consist of sub-angular to well-rounded black shale, red and black chert, and quartzite, all less than 10 mm in diameter.

Burdell Mountain Andesite (Tbv)

Andesitic rocks (Tbv) make up the vast majority of the Burdell Mountain volcanics. They consist primarily of lava flows that cover an area of about 12 km^2 and are approximately 200 m thick. Along with the underlying Miocene sandstone, these volcanic flows form a gently northeast-dipping homocline that caps the northwest-trending summit ridge of Burdell Mountain and is truncated by the Burdell Mountain fault zone to the east. Smaller areas of andesitic volcanics are also found as a ridge capping unit ~2 km southeast of the southern part of Burdell Mountain and as a relatively down-dropped, fault-bounded block between two strands of the Burdell Mountain fault zone in the southeast part of the map area. The unit consists of a series of gently east-dipping lava flows that primarily rest on the Tertiary sandstone, but locally overlie faulted and folded Franciscan Complex rocks.

Twelve separate lava flows have been recognized in the southern part of the mountain: ten pyroxene andesite flows, one basalt and one biotite dacite flow locally overlying a basal tuff (this study). The andesites are porphyritic with small (1-3 mm) subhedral to euhedral phenocrysts of hypersthene, augite, and zoned plagioclase embedded in a hemi-crystalline groundmass consisting mainly of plagioclase and glass. Individual flows are 6 to 25-m-thick and consist of a massive zone underlain and overlain by non-vesicular and poorly-jointed flow breccia. The rock is moderately to deeply weathered and commonly stained red by hematite. Montronite and opal are common coatings and partial fillings of vesicles.

The age of the andesite is constrained by $^{40}Ar/^{39}Ar$ analyses of plagioclasts that yielded cooling/crystallization ages of approximately 11 million years.

D.2.3 Quaternary Units

In the project area, Quaternary deposits consist primarily of landslide deposits along the flanks of Burdell Mountain, alluvium found primarily in the lowlands overlying rocks of the Francisican Complex, and muddy sediments along the margin of San Pablo Bay. Surficial deposits are divided into units based on the type of deposit and (in the case of landslide deposits) the relative age of the deposits. The units are: mega-landslide deposit (Qlsv), landslide deposit (Qls), colluviums (Qc) including debris flow deposits (Qdf), alluvium (Qa), and bay mud (Qhbm). The surficial units were primarily mapped on aerial photographs.

Mega-landslide deposits (Qlsv)

Large-scale landslides (i.e., mega-landslides) at Burdell Mountain have drawn the interest of previous workers. In particular, Rice (1975) provided descriptions of the landslides and some of the Quaternary deposits on and near Burdell Mountain in his hazards report for Marin County and the Novato area. Ages of the older mega-landslides are unknown.

Both the northeast and southwest slopes of Burdell Mountain ridge consist of large, arcuate landslide scarps of up to 1 km across rooted near contact with the volcanic rocks and the underlying Tertiary strata and Franciscan Complex. These apparently ancient blocks of more resistant volcanic rock of up to 1 km^2 form several knobs and other areas of high relief around the base of Burdell Mountain and several large (0.5 km^2) terraces particularly high on the southwest flank of the mountain.

On the southwest slope, the large landslides are generally rotational slump-block type that have

arcuate head scarps and appear to be more deeply rooted, suggesting that slide planes cut across foliation and bedding of the Burdell Mountain volcanics and the Tertiary Sandstone strata respectively. The ages of the mega-landslides are unknown but they appear to be related to the uplift and faulting of the mountain itself, which dates back to the initiation of the East Bay fault system in the middle Miocene, although it is possibly that the preserved landslide features are Quaternary in age.

Landslide deposits (Qls)

Landslides denoted Qls include debris flow, mudflow, and block slump landslides mostly within Franciscan Complex. These are distinguished from older and larger mega-landslides by their relatively young (Holocene?) appearance, their size and slide plane depth. In general, these deposits are less than 300 feet across and/or have slide planes shallower than 30 feet. Landslide boundaries are based on surficial mapping techniques and are approximate.

Alluvium (Qa)

Due to relatively high relief and rugged terrain in the Burdell Mountain area, Quaternary alluvium is generally restricted to the large drainages, lowlands, and valleys. Quaternary alluvium is mapped primarily in the very western portion of the map area in the headwaters of San Antonio Creek and Bowman Canyon and along Highway 101 in lowlands along the eastern transition of the Burdell Mountain and the San Pablo Bay.

The alluvium consists of Pleistocene to Holocene gently sloping to horizontal, fan, terrace, and basin deposits. Generally, the alluvium is composed of sandy-clayey gravel with sub-angular to well-rounded pebbles and cobbles with a few boulders of Burdell Mountain volcanic and Franciscan Complex rocks.

Bay Mud (Qhbm)

The eastern portion of the map area is dominated by bay mud consisting of Quaternary silt, clay, peat, and fine sand deposited at or near sea level in San Pablo Bay. The flat plains of the eastern part of the Petaluma River and Novato Quadrangles east of Burdell Mountain are former marine marshlands (Rice, 1975). Bay Mud deposits are mostly several feet below mean sea level, and were regularly inundated by high tides. Tidewater from San Pablo Bay was excluded from the marshlands by a system of dikes constructed in the early 1900's (Rice, 1975). Soft Bay Mud rests on unconsolidated but compacted older stream channel and colluvial deposits.

D.3 REFERENCES

Atwater, T., 1970, Implications of plate tectonics for the Cenozoic tectonic evolution of western North America: Geological Society of America Bulletin, v. 81, p. 2513-3536.

Atwater, T., 1989, Plate tectonic history of the northeast Pacific and western North America: The Geology of North America, Vol. IV, Geological Society of America, Boulder, CO. p. 21-72.

Bailey, E.H., Irwin, W. P., Jones, D. L., 1964, Franciscan and related rocks and their significance in the geology of western California: California Division of Mines and Geology Bulletin 183, p.177.

Blake, M.C. Jr.; Bartow, J.A.; Frizzell, V.A. Jr.; Schlocker, J.; Sorg, D.; Wentworth, C.M.; and Wright, R.H.; 1974; Preliminary Geologic Map of Marin and San Francisco Counties and Parts of Alameda, Contra Costa and Sonoma Counties, California; U.S.Geological Survey, Miscellaneous Field Studies Map MF 574.

Blake, M.C., Jr., Howell, D.G., and Jayko, A.S.; 1984; Tectonostratigraphic terranes of the San Francisco Bay Region, in Blake, M.C., Jr., eds., Franciscan geology of northern California: Pacific Section of Economic Paleontologists and Mineralogists, v. 43, p. 5-22.

Blake, M.C. Jr., Graymer, R. W., and Jones, D. L.; 2000; Geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California, 1:125,000. U.S. Geological Survey, MF-2337.

Dickerson, R.E.; 1922; Tertiary and Quaternary history of the Petaluma, Point Reyes, and Santa Rosa quadrangles: California Academy of Science Proceedings, series 4, v. 11, n. 19, p. 527-601.

Dickinson, W.R., and Snyder, W.S.; 1979a; Geometry of subducted slabs related to the San Andreas transform: Journal of Geology, v.87, p. 609-627.

Dickinson, W.R., and Snyder, W. S.; 1979b; Geometry of triple junctions related to the San Andreas transform: Journal of Geophysics. Res., 84(B2), p. 561-572.

Ford, E.W.; 2003; Mesozoic and Tertiary Stratigraphy of the Burdell Mountain Area and Implicaitons for Slip along the East Bay fault System, Marin County California; Field Trip Guidebook; Northern California Geological Society

Ford, E.W.; 2007; Burdell Mountain Stratigraphy and Implications for Long-term Slip along the East Bay Fault System, California; M.S. Thesis at San Francisco State University.

Fox, K.F.; 1983; Tectonic setting of late Miocene, Pliocene, and Pleistocene rocks in part of the Coast Ranges north of San Francisco, California: U.S. Geological Survey, Professional Paper 1239, p. 33.

Fox, K.F. Jr., Fleck, R. J., Curtis, G. H., and Meyer, C. E.; 1985; Implications of the

northwestwardly younger age of the volcanic rocks of west central California: Geological Society of America Bulletin, v. 96, p. 647-654.

Grahman, S.A., Stanley, R.G., Bent, J.V., and Carter, J.B.; 1989; Oligocene and Miocene paleogeography of central California and displacement along the San Andreas fault system, Geological Society of America Bulletin, v. 101, p. 711-730.

Huffman, O.F.; 1972; Lateral displacement of upper Miocene rocks and the Neogene history of offset along the San Andreas fault in central California: Geological Society of America Bulletin, v. 83: p. 2913-2946.

Irwin, W.P.; 1960; Geologic reconnaissance of the northern Coast Ranges and Klamath Mountains, California: California Division of Mines and Geology Bulletin 179, p. 79.

Jones, D.L.; 1994; Neogene transpressive evolution of the California Coast Ranges: Tectonics, v. 13, n. 2, p. 561-574.

Mankinen, E.A.; 1972; Paleomagnetism and potassium-argon ages of the Sonoma volcanics, California: Geological Society of America Bulletin. v. 83, p. 2063-2072.

McLaughlin, R.J., Sliter, W. V., Sorg, D. H., Russell, P. C., Sarna-Wojcicki, A. M.; 1996; Large-scale right–slip displacement on the East San Francisco Bay region fault system, California: Implications for location of late Miocene to Pliocene Pacific plate boundary. Tectonics, v. 15, 18 p.

Medly, E.W.; 2008; Engineering the Geological Chaos of Franciscan and other BIMrocks; American Rock Mechanics Association, 08-316

Page, B.M., Thompson, G.A., and Coleman, R.G.; 1998; Late Cenozoic tectonics of the central and southern Coast Ranges of California Geological Society of America Bulletin. v. 110, p. 846-876.

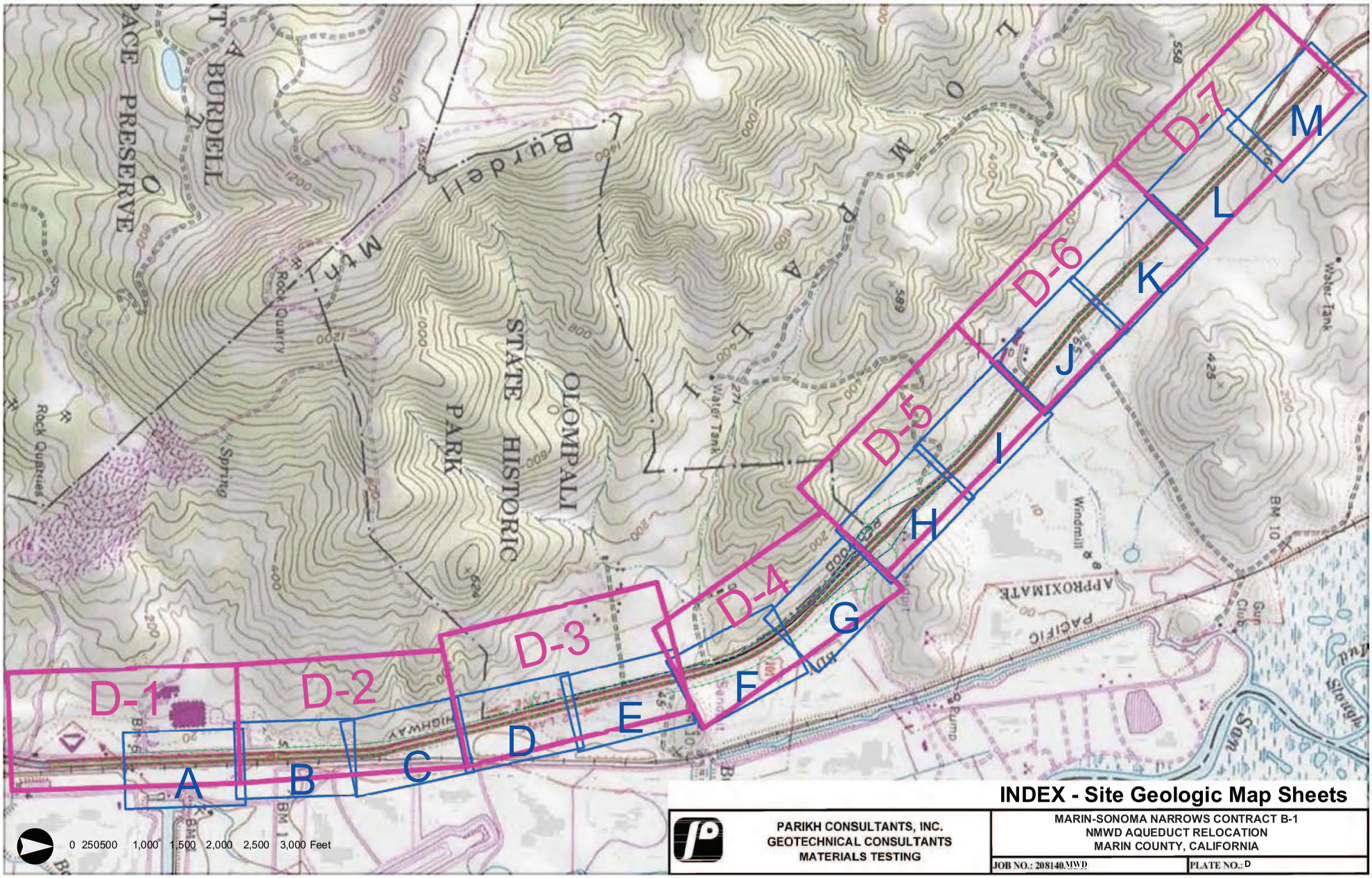
Rice, S.J.; 1973; Geology and Geologic Hazards of the Novato Area, Marin County, California. Scale 1:12,000. California division of Mines and Geology, Preliminary Report 21, 47 p.

Rice, S.J.; 1975; Geology for Planning Novato Area, Marin County, California: California Division of Mines and Geology Open-File Report 76-1, Plate 1 East - Geology, Eastern Part of the Novato Area, scale 1:12,000.

Rose, R.L.; 1958; Pre-Tertiary stratigraphy near Petaluma, California: Geological Society of America Bulletin. v. 69, p. 2.

Wagner, D.L., Rice, S.J., Bezore, S.P., Randolph-Loar, C.E., Allen, J.E. and Witter, R.C.; 2002; Geologic map of the Petaluma River 7.5' Quadrangle, Marin and Sonoma counties, California: A digital database: California Geological Survey website, http://www.conservation.ca.gov/-cgs/rghm/rgm/preliminary_geologic_maps.htm

Wakabayashi, J.; 1992; Nappes, tectonics of oblique plate convergence and metamorphic evolution related to 140 million years of continuous subduction, Franciscan Complex,

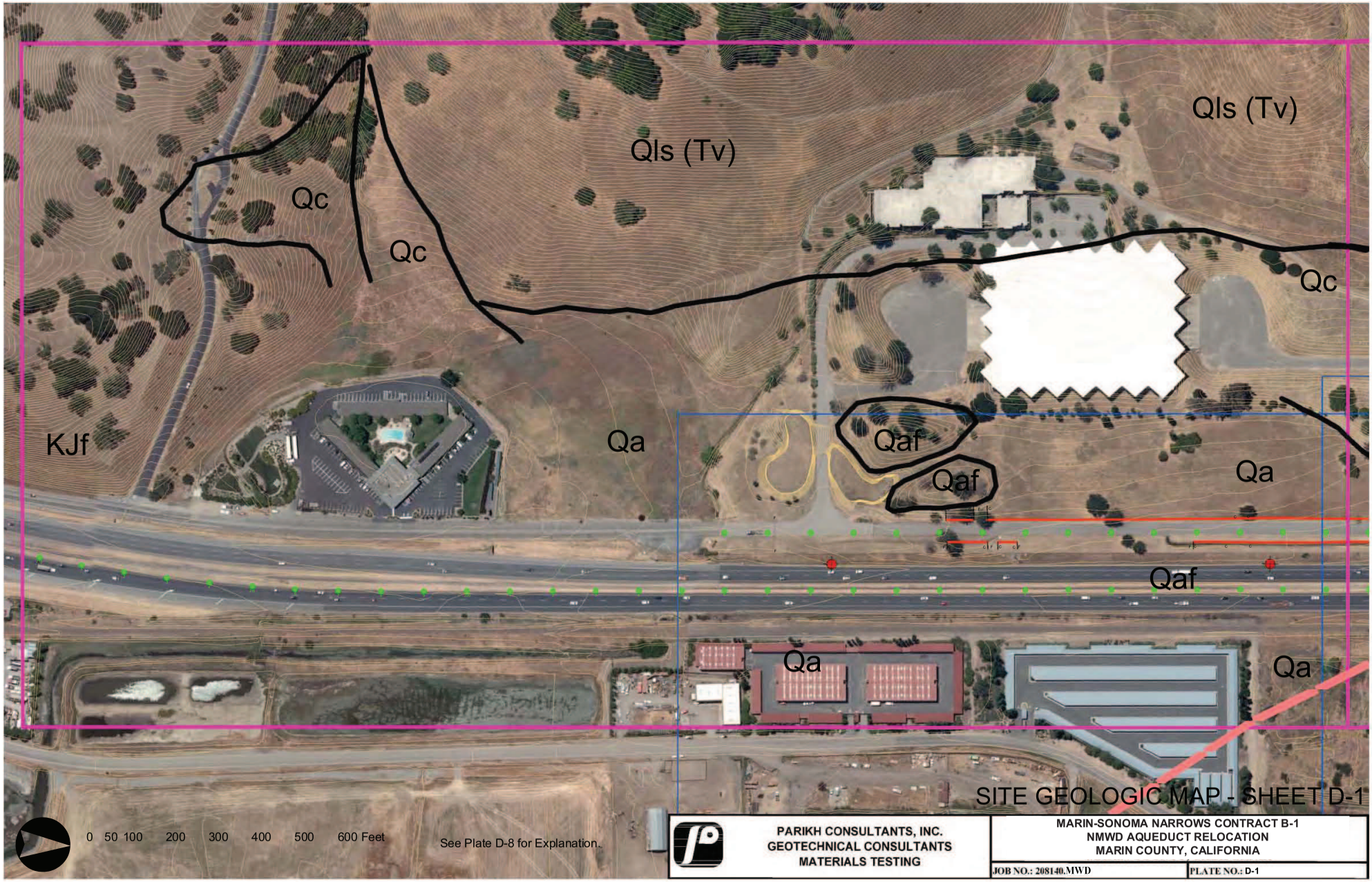


INDEX - Site Geologic Map Sheets

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D

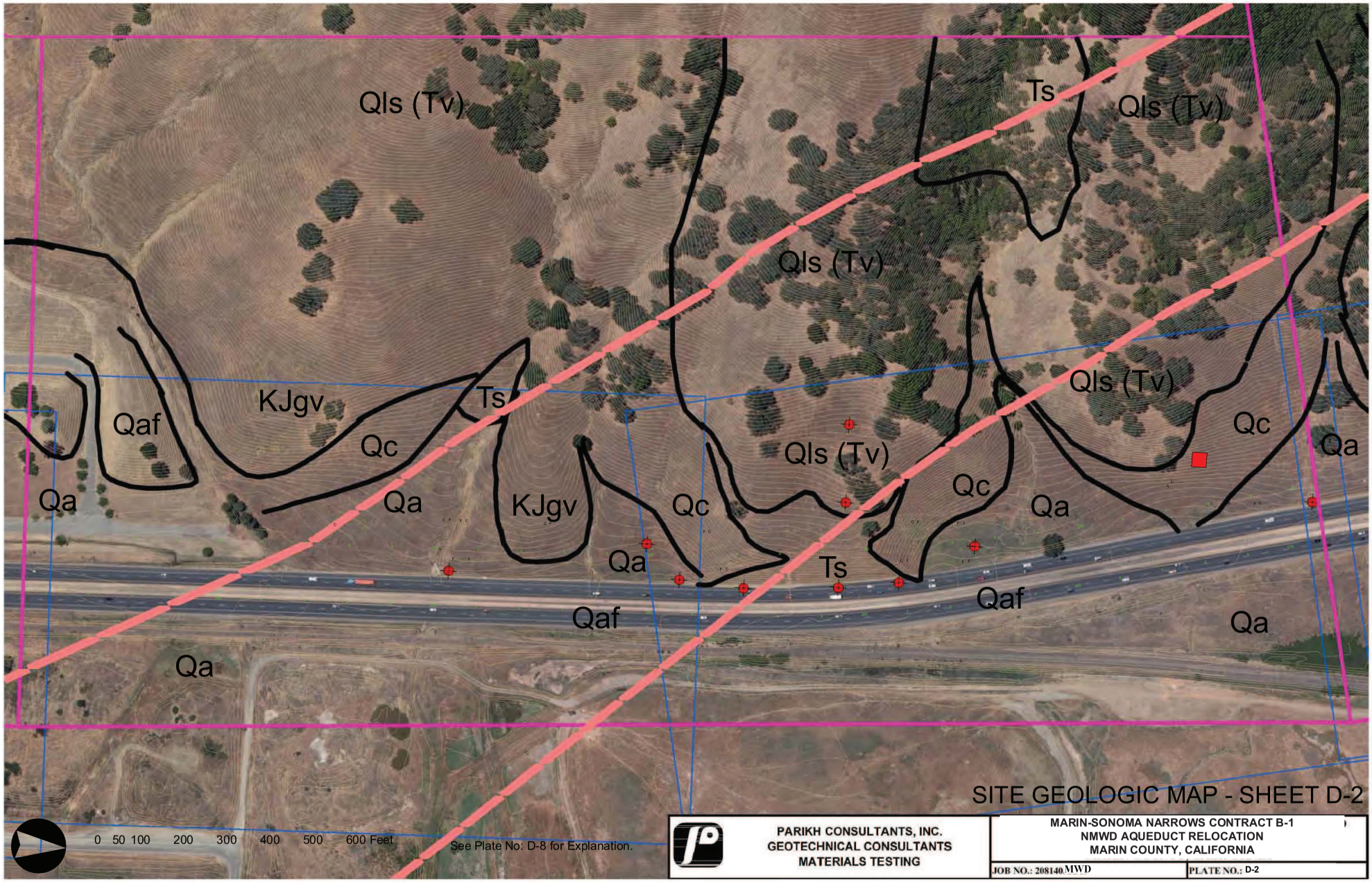


SITE GEOLOGIC MAP - SHEET D-1

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-1

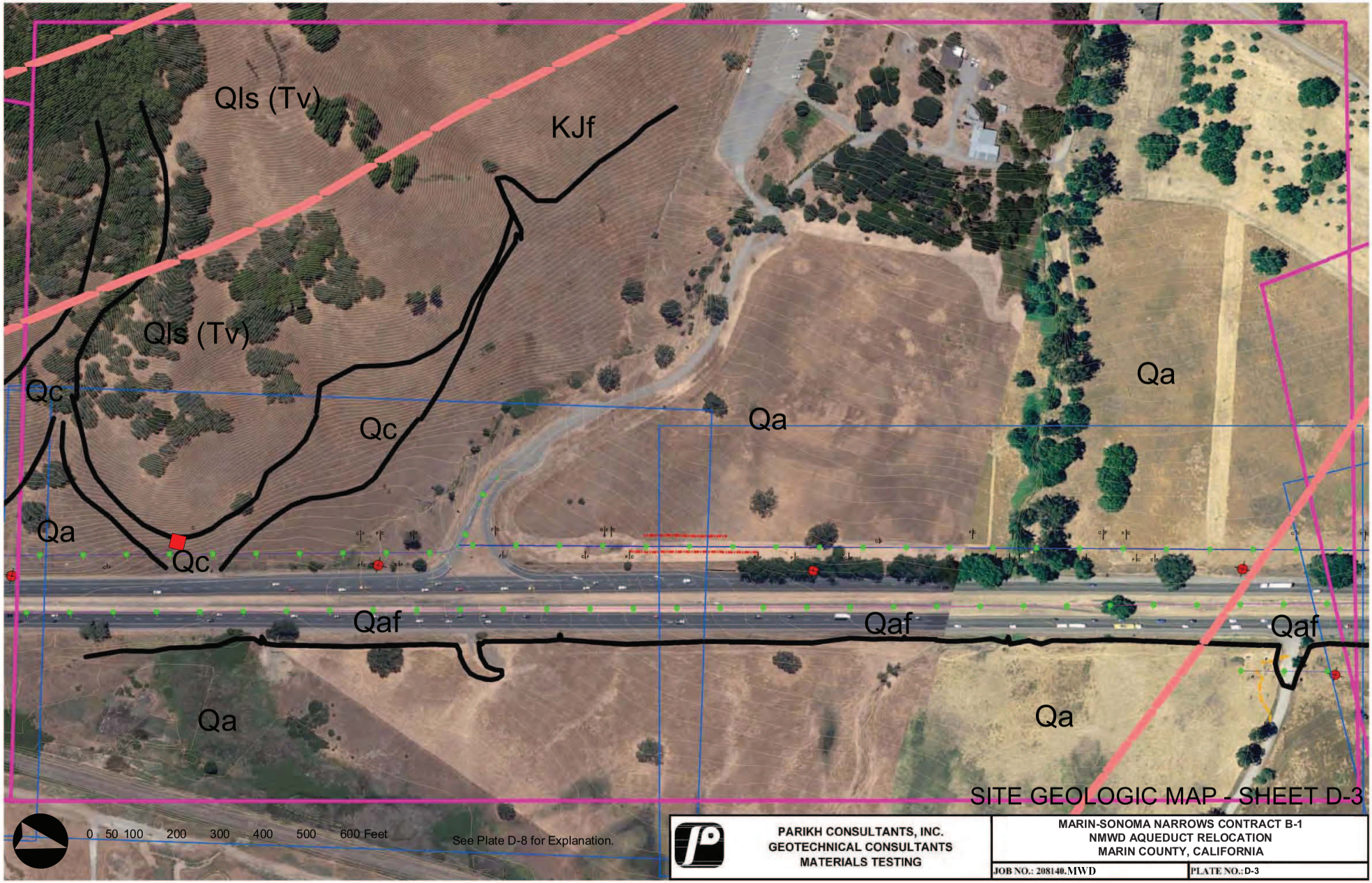


SITE GEOLOGIC MAP - SHEET D-2

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-2

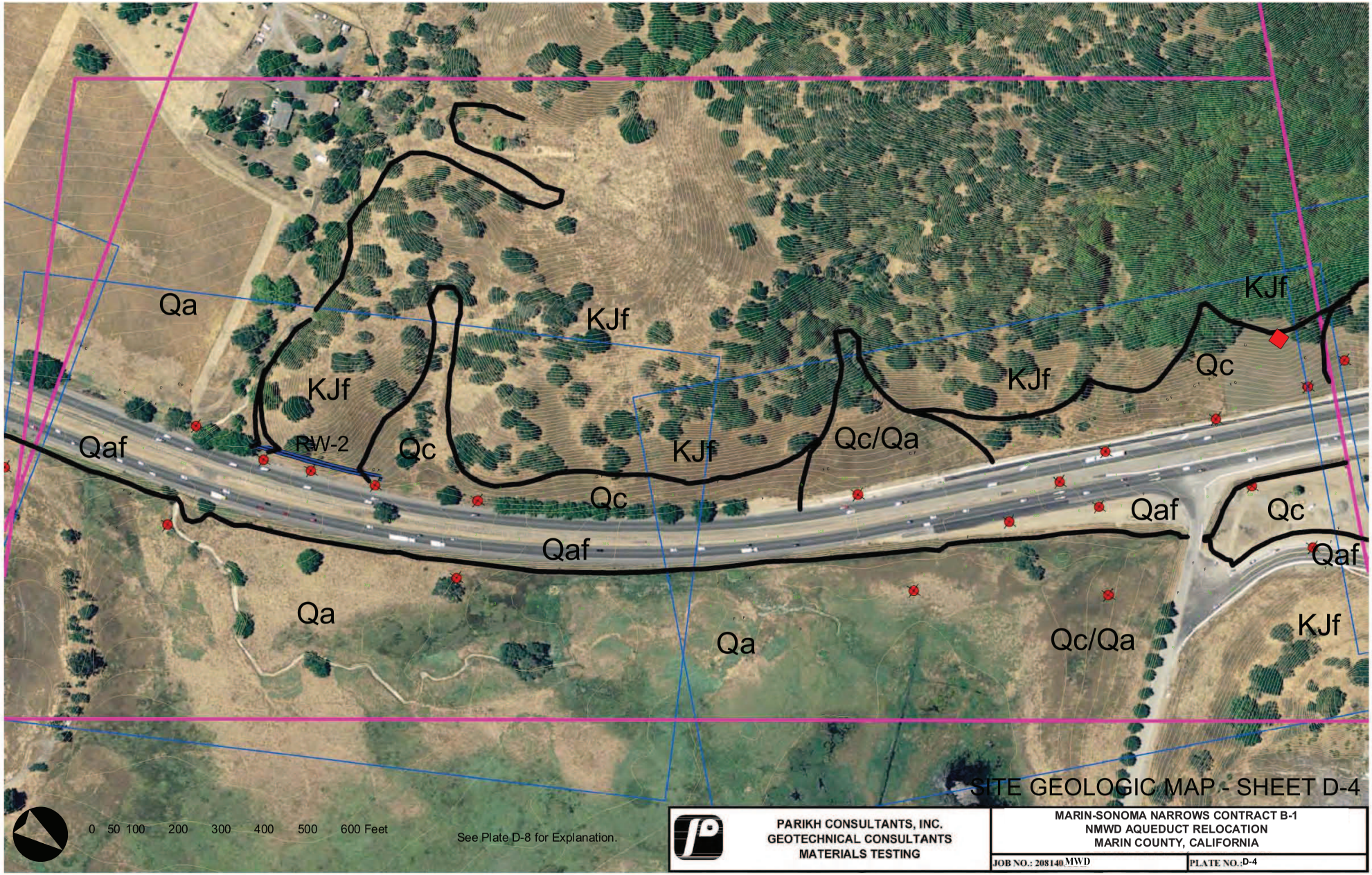


SITE GEOLOGIC MAP - SHEET D-3

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-3

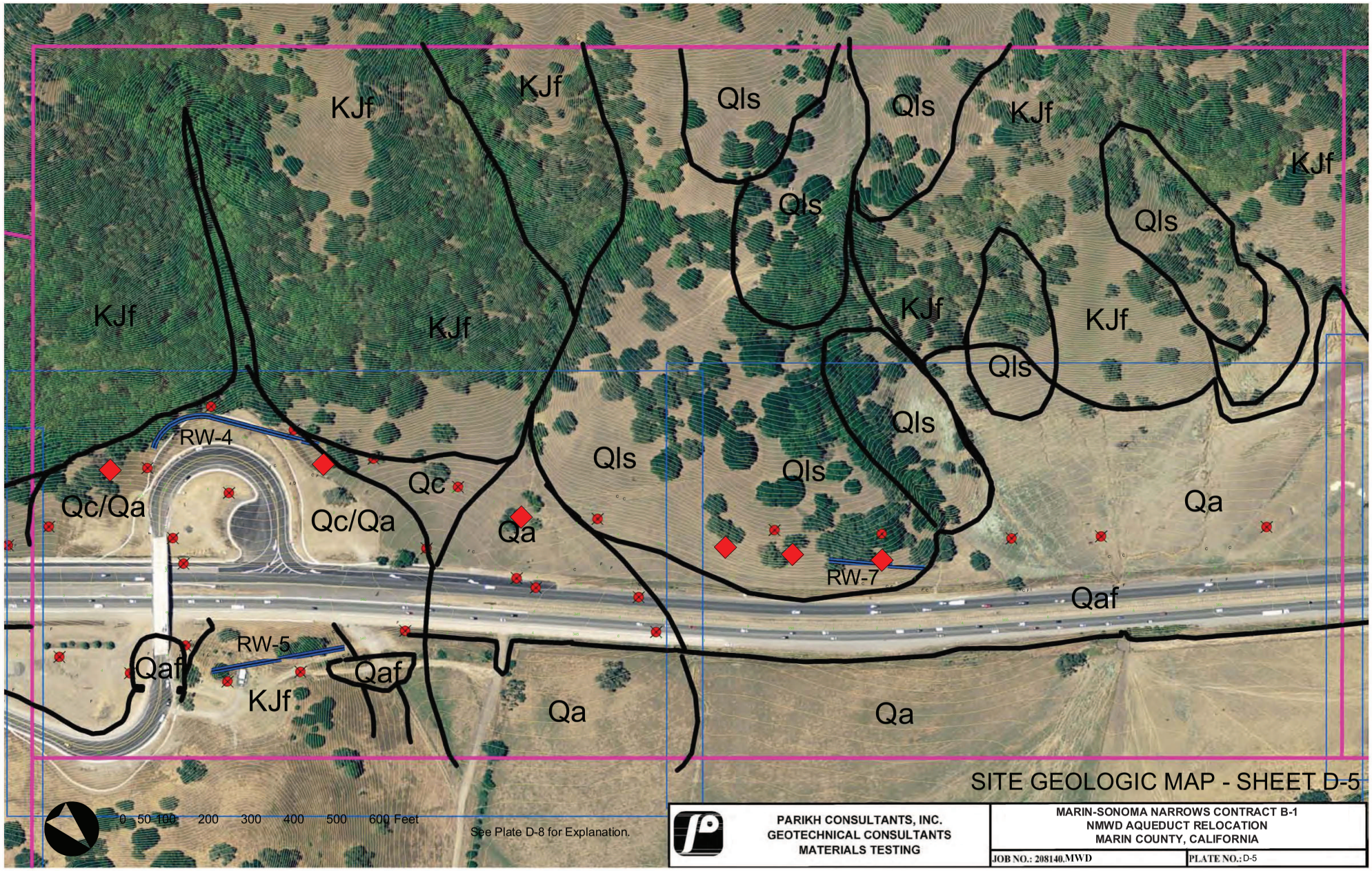


SITE GEOLOGIC MAP - SHEET D-4

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-4

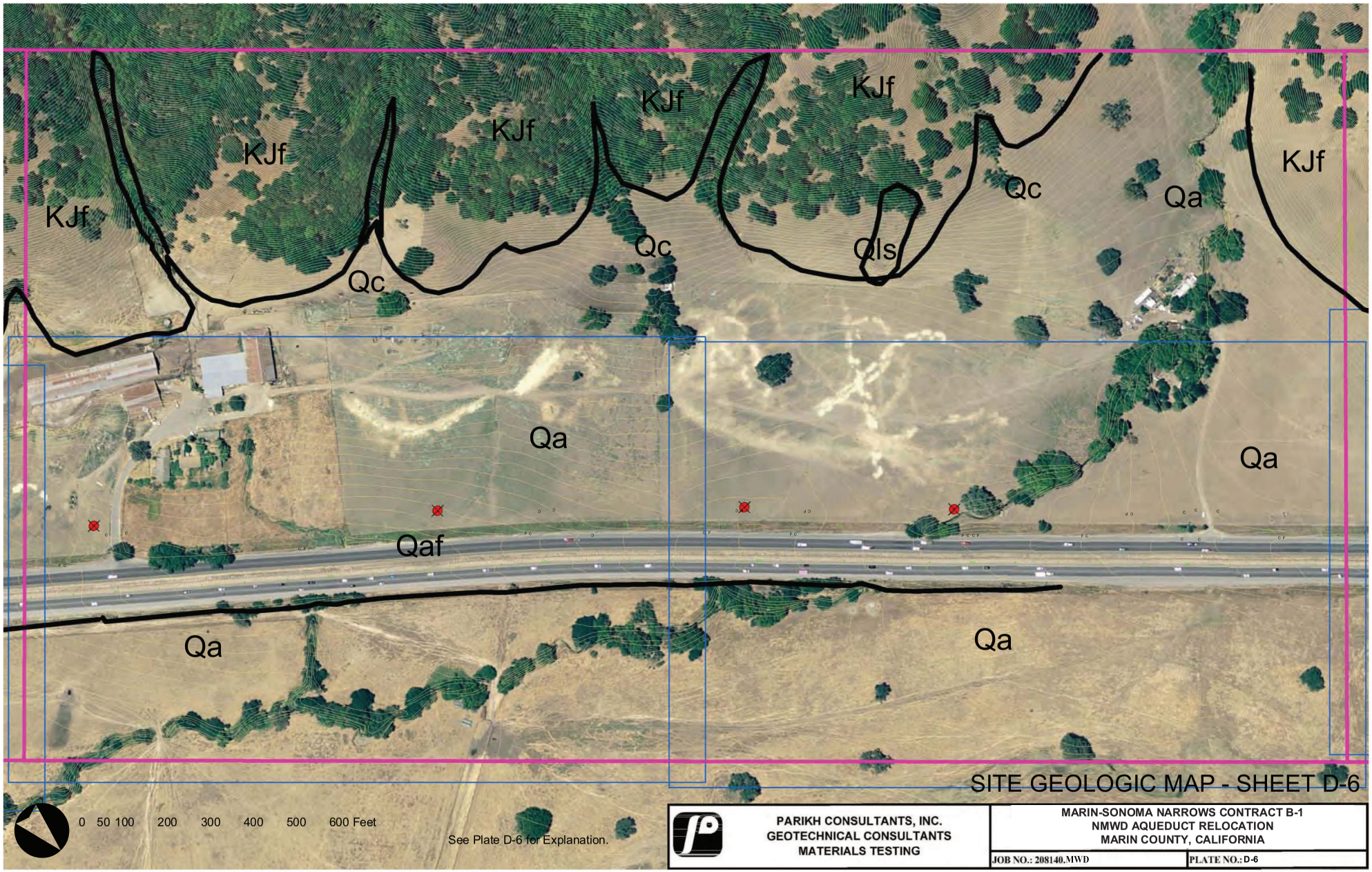


SITE GEOLOGIC MAP - SHEET D-5

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-5

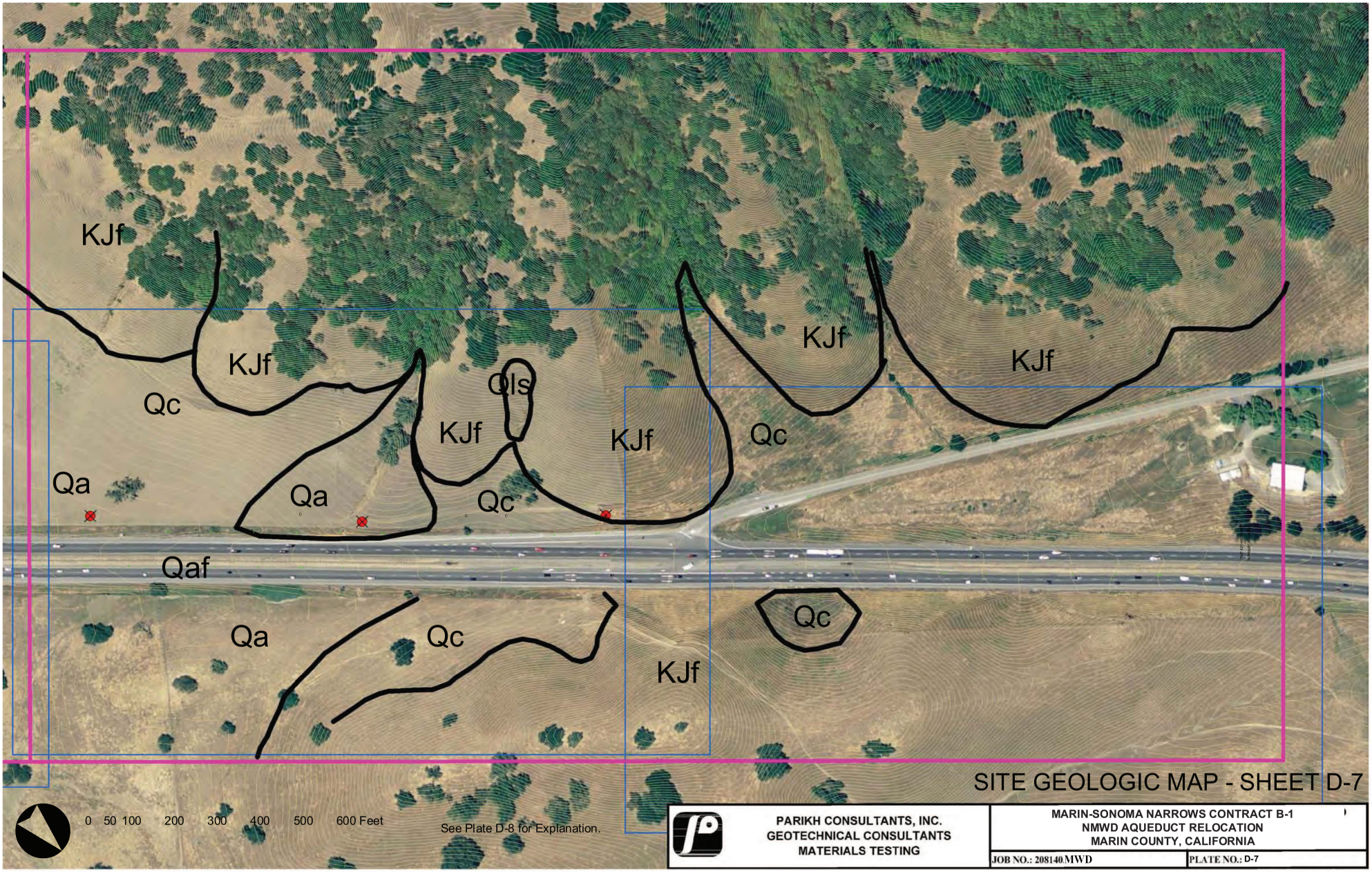


SITE GEOLOGIC MAP - SHEET D-6

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-6



SITE GEOLOGIC MAP - SHEET D-7

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: D-7

EXPLANATION FOR SITE GEOLOGIC MAPS

- Burdell Mt. Fault (Ford; 2007)

- contact (inferred)

Qaf - artificial fill

Qc - colluvium
(including debris flow deposits)

Qa - alluvium

Qls - landslides

Qls (Tv) - large landslides composed of
Burdell Mountain Volcanics

Tv - Burdell Mountain Volcanics (andesite)

Ts - Tertiary Sandstone

KJgv - Great Valley Sequence

KJf - Franciscan Complex melange
(including graywacke sandstone,
shale, chert, and serpentinite)

- Top of Proposed Cut Slope

- Toe of Proposed Fill Slope

- Proposed Retaining Wall

- Project Alignment

- Boring location

- Test Pit location

- shear zone

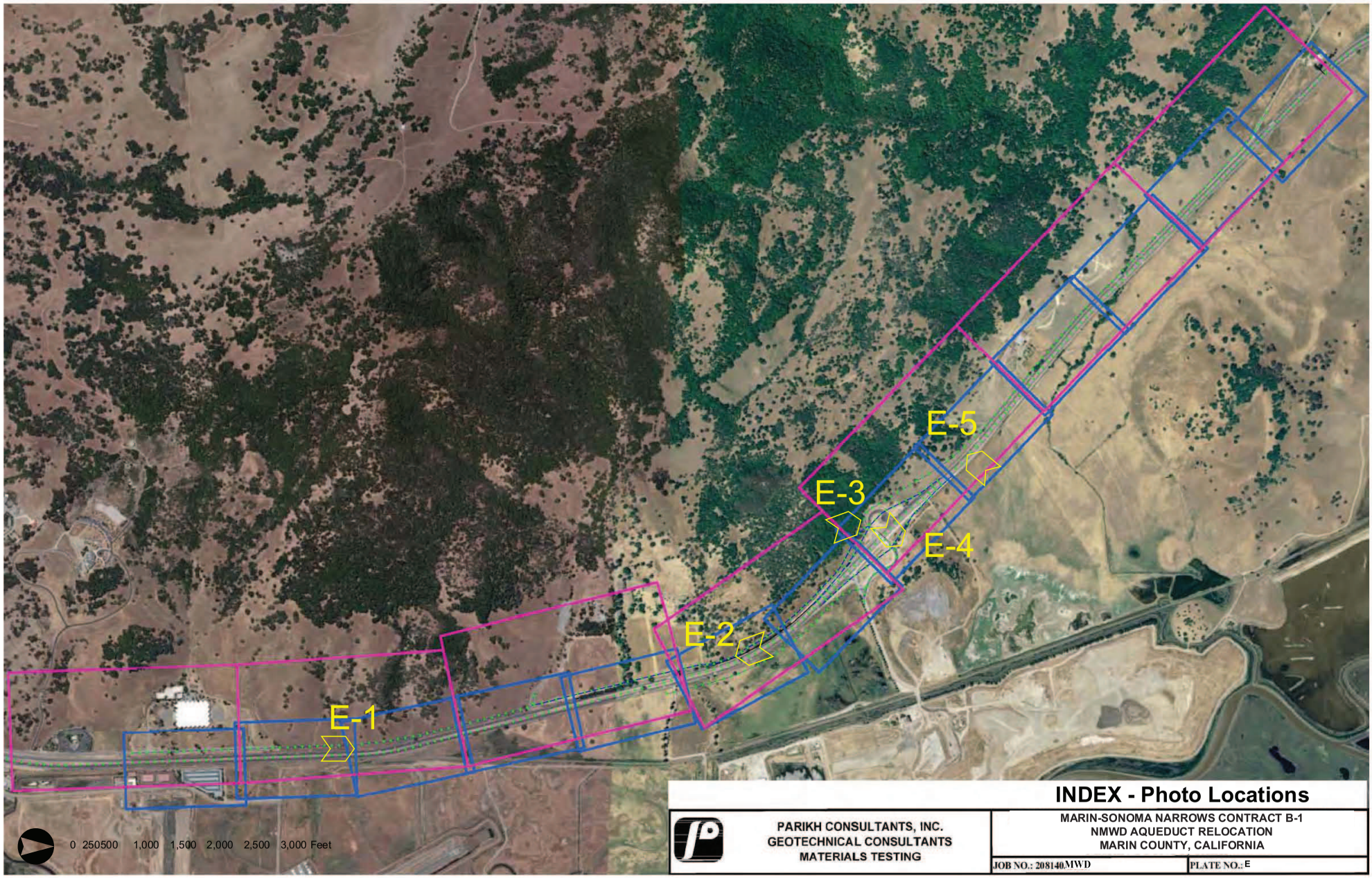
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.: D-8

APPENDIX E



INDEX - Photo Locations

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: E

PHOTO #1

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD

PLATE NO.: E-1

PHOTO #2

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: E-2

Proposed
Retaining Wall #4

PHOTO #3

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: E-3

Chert exposed in
Existing Cut Slope
@ Station 338+00

PHOTO #4

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MARIN-SONOMA NARROWS CONTRACT B-1
NMWD AQUEDUCT RELOCATION
MARIN COUNTY, CALIFORNIA

JOB NO.: 208140.MWD | PLATE NO.: E-4

Erosion and slumping of
Existing Cut Slope
@ Station 360+00

PHOTO #5

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	MARIN-SONOMA NARROWS CONTRACT B-1 NMWD AQUEDUCT RELOCATION MARIN COUNTY, CALIFORNIA	
	JOB NO.: 208140.MWD	PLATE NO.: E-5

APPENDIX F

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

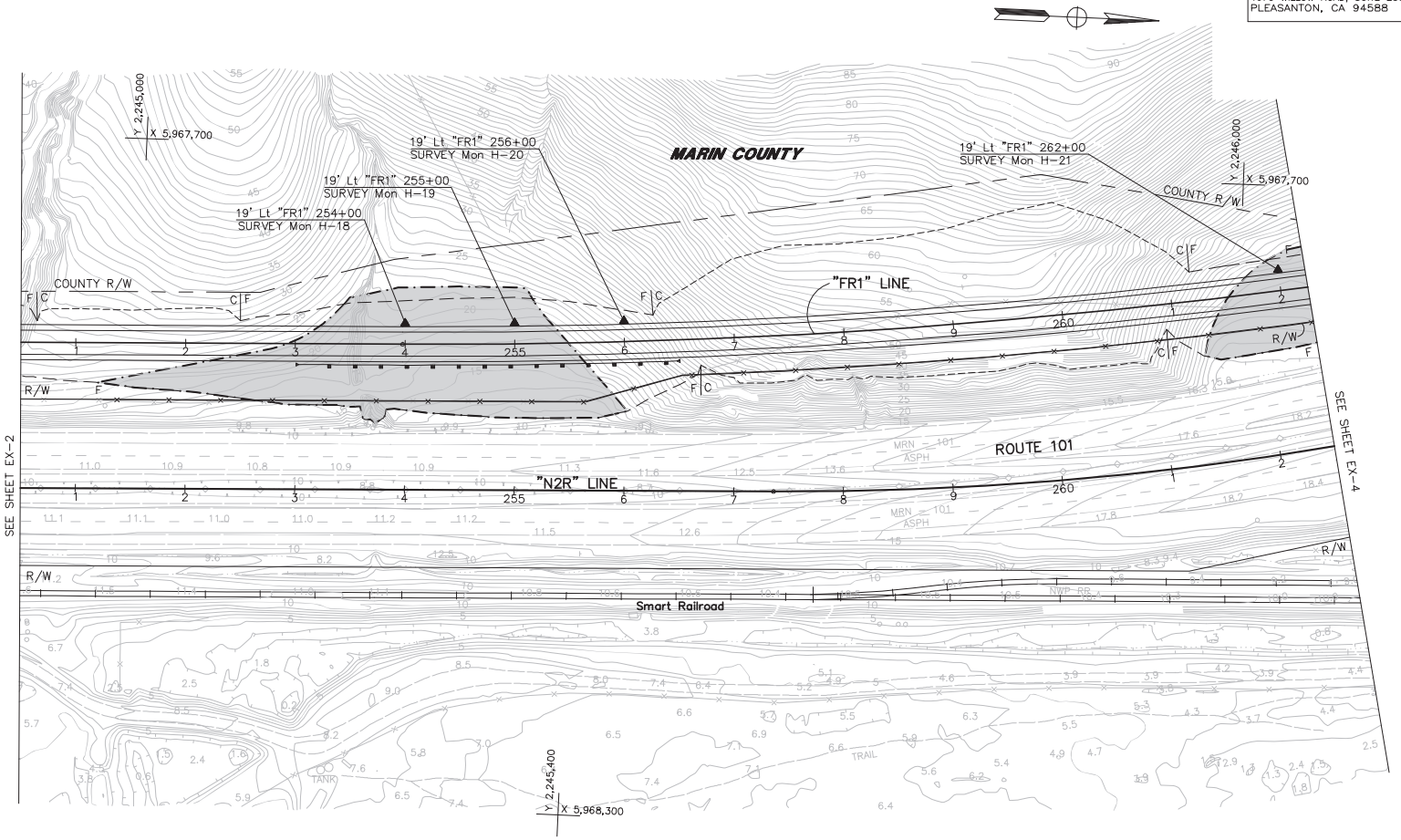
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-3

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

Parsons

LAST REVISION 10-3-11 | DATE PLOTTED => Oct. 13, 2011 | TIME PLOTTED => 4:42 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

10/3/11
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

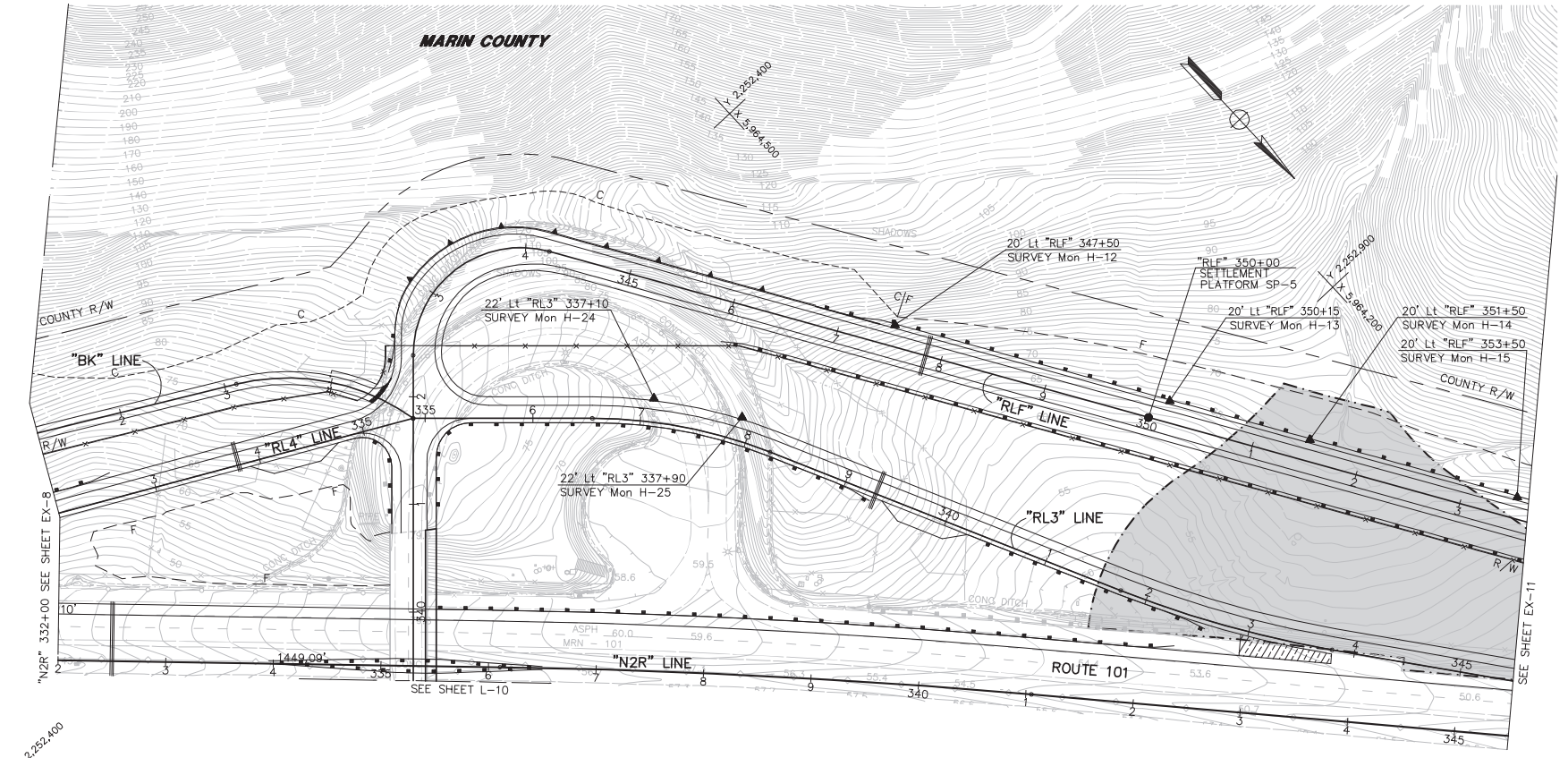
TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-9

LAST REVISION 10-3-11 | DATE PLOTTED => Oct 13, 2011 | TIME PLOTTED => 4:52 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST, SUITE 200
SAN RAFAEL, CA 94901

REVISED BY	DATE REVISED

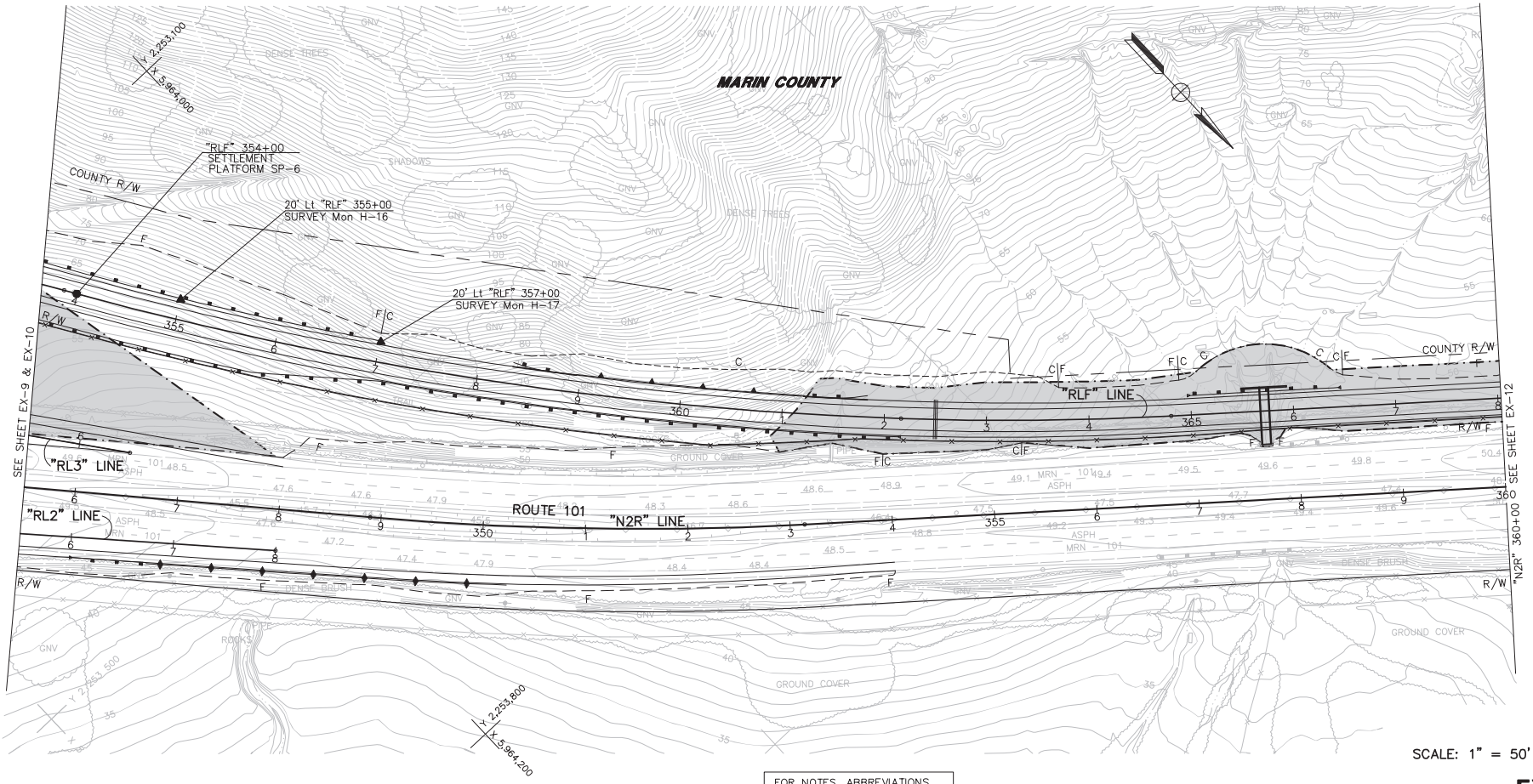
CALCULATED–DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
NATALINA V. BERNARDI

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans



SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET EX-1

EX-11

LAST REVISION	DATE PLOTTED => Oct 13, 2011
10-3-11	TIME PLOTTED => 4:54 pm

BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 04000007331

APPENDIX G

Comments & Responses to PARIKH Draft Geotechnical Report for Segment B-1 NMWD line.

NMWD File 1 7118.01

Comment		Response
GENERAL COMMENTS		
1	The District requests an opportunity to review the report before it is finalized.	Agreed.
2	Add tab dividers for each appendix.	Agreed
3	The report does not appear to present geotechnical recommendations for design of rigid and flexible pipelines, including, but not limited to, the following: dead loads from soil and bedrock, composite modulus of soil reactions (E'), and other design-related parameters for use by the Design Engineer for structural design of the pipeline.	Not in requested scope from Emily Dean. This was also not brought up during our meeting with NMWD. Our understanding was that these are all steel pipes and using the District standards.
4	The report does not appear to address trench less construction methods or recommendations for employing such construction methods. While the main transmission main within Segment B-1 does not contain any planned trench less construction locations, there is an extension of a bore and jack casing on the W3 Waterline at Station 329+48. The Design Engineer will likely require geotechnical recommendations associated with that work.	Geotechnical information has been provided in the report for design of jacked pipe casing at around Sta. 329+48
5	How are Plates 2A -2M cross referenced to Plate 2?	Agreed.. We will label the index sheet by the Plate numbers rather than the 'U' sheets
6	Plate 2G does not accurately represent the "W3" line, a 12-inch water main, that needs to be extended to connect to the new aqueduct. The "W3" line must be extended by bore and jack casing on both sides of the existing casing. The geotechnical report does not specifically address this bore and jack location, or present any trenchless construction analysis or recommendations.	Plate G now represents the jacked pipe casing location. The revised report addresses the jacked pipe casing.
7	Although the report comments that the soils are generally excavatable with conventional equipment, it does identify the presence of bimrocks and other hard rock areas. Does the geotechnical engineer or Design Engineer have any suggestions on how to deal with them during excavation? Is there a need for a special bid item to deal with rock excavation? Any other design related recommendation that must be incorporated into the design?	Bim rock discussion is there. We have added more from GDMR. We understand that the pipeline work will be part of the roadway work. The roadway will be built before the pipeline and those plans and specs also have the discussions on the bimrock excavations.
8	The report does mention that the pipeline will be welded steel pipe with C214 tape coating. There is no specific discussion about the suitability of that pipe	This is not our expertise. Corrosion consultant can assist on this.

	type and coating in the geotechnical conditions that exist. It is not inappropriate to expect some discussion of the geotechnical feasibility of the preferred pipe materials in the expected geotechnical conditions.	
9	The soil corrosivity testing that is described in the report appears to be appropriate for use in developing the corrosion and cathodic protection design for the project. However, the geotechnical report does not including corrosion-related recommendations. It is often common for a separate corrosion report to be prepared utilizing soil corrosivity test data on boring samples provided by the geotechnical engineer. Often that testing is performed by the corrosion design firm. In this case, the testing was performed by the geotechnical firm. It is, therefore, important that the Design Engineer obtain corrosion design recommendations from another source.	As indicated by the District the Designer can have a corrosion consultant do this.
10	The geotechnical report uses the term "Design Engineer" throughout the report. The term should be reviewed and a decision made between the District, CalTrans and CSW/Stuber-Stroeh as to whether this term is appropriate in the context of the contract documents.	Please decide and let us know.
11	Is this report only for work associated with the pipeline installation? How does it fit in context with other geotechnical investigations performed for the roadwork and, perhaps, other utilities? Will this report and the others be clarified in the contract documents to eliminate confusion by the bidders?	There is a separate report (GDMR) for the project grading and construction. Maybe that report should also be made available to the District.
12	The report includes discussion of the seismic design in accordance with a report by the American Lifelines Alliance, entitled "Seismic Guidelines for Water Pipelines," dated March 2005. As a result, the report contains several seismic-related recommendations for the Design Engineer.	Comment noted. Designer to do.
13	The Design Engineer should formally acknowledge that the geotechnical recommendations affecting design will be incorporated into future design submittals.	Designer to do.
	SPECIFIC COMMENTS	
TABLE OF CONTENTS	List each plate in aerial photographs.	Agreed. The report has been revised.
PAGES 2-3	The pipeline segment descriptions on Pages 2 and 3 do not match the limits in the 65% Submittal drawings. Suggest the written descriptions be modified to match the design drawings (note that Plates 2A through 2M may require modification for the same reason as there are discrepancies between the 65% drawings and these figures as well).	The limits and the descriptions have benn revised to match the latest alignment.
PAGE 4	On page 4, there is reference to a proposed Retaining	Yes, Retaining walls 4 and 7 are in the

	Wall No. 7 at approximately Station 358+00 to 360+00. We have no recollection of this proposed retaining wall in the 65% Submittal. Is this retaining wall in the latest design? Are there other retaining walls that are proposed for the project?	vicinity of the pipeline. There are 2 other walls – Wall Nos. 2 and 5. See GDMR..
PAGE 29	On Page 29, Trench Zone Material are native materials suitable for trench zone backfill?	On a project that has variable soil/rock conditions (and the contractor is performing mass grading and moving material from one location to another) it is not prudent to say which soil type will or will not meet the Trench Zone Criteria. This otherwise creates change orders. We stipulate that the contractor may use the material provided they meet the criteria. There is no "one type" of native material, so it needs to be matched by the contractors. Keep it the way it is.

7. Geotechnical Investigation Report – North Marin Water District Aqueduct Relocation

8. Hydraulics Report

DRAINAGE REPORT

Marin-Sonoma Narrows

04-MRN- 101 R23.2/27.1
Marin-Sonoma Narrows – MSN B1 – Redwood Landfill I/C Project
Project ID 04000007331

In Marin County
In and near Novato
From 1.0 Mile North of Novato Overhead
To 0.6 Mile South of Sonoma County Line

Prepared for

THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION, DISTRICT 04

April 5, 2012

Design Engineer:
BKF ENGINEERS
4670 Willow Road, Suite 250
Pleasanton, CA 94588

Job # 20087003-10

Table of Contents

1. **INTRODUCTION**
   - 1.1 Purpose and Scope 1
   - 1.2 Description & Setting 2
   - 1.3 National Flood Insurance Maps 3
   - 1.4 Methodology 3
   - 1.5 Bridge Hydraulics 3

2 **PROJECT OVERVIEW**
   - 2.1 Potential Project Impacts 4
     - 2.1.1 Flood Plain Encroachments 4
     - 2.1.2 Residences and Other Buildings 4
     - 2.1.3 Crops 4
   - 2.2 Existing Drainage System
     - 2.2.1 Creek – HEC-RAS Analyses 5
     - 2.2.2 Crossing Culverts 6
     - 2.2.3 Roadside Ditches 7
     - 2.2.4 Existing Stormwater Storage 7
     - 2.2.5 Existing Stormwater Treatment 7
   - 2.3 Proposed Improvements
     - 2.3.1 Crossing Culverts 7
     - 2.3.2 Roadside Ditches 9
     - 2.3.3 Gutter Spread 9
     - 2.3.4 Stormwater Treatment 9
     - 2.3.5 Peak Flow Attenuation 10
   - 2.4 Unusual and Special Conditions
     - 2.4.1 Existing Facility Conditions 10
     - 2.4.2 Alternative Pipes 11
     - 2.4.3 Corrosion and Abrasion 11
     - 2.4.4 Erosion 11
     - 2.4.5 National Pollutant Discharge Elimination Permit (NPDES) 11

3 **STORM WATER ROUTING PLAN**
   - 3.1 Proposed Storm Water Routing Scheme 12

4 **DESIGN CRITERIA** 12

5 **DIVERSIONS** 12

6 **REFERENCES** 12

FIGURES:

Figure 1	Project Vicinity Map
Figure 2	Project Location Aerial Map
Figure 3A through 3H	Proposed Drainage Areas and Drainage Facilities
Figure 4A through 4G	100 Year Storm Route 101 Overtopping
Figure 5A through 5H	Hydrograph Modification Facilities
Figures 6	Existing Major Drainage Areas and Keymap
Figures 6A through 6G	Existing Off-Site Drainage Areas
Figure 7A through 7D	HEC-RAS Cross Sections for Creek Crossings

TABLES:

Table 1A1	County Culvert Drainage Areas
Table 1A2	Rational Method Parameters, Area and Slope, Southern Project
Table 1A3	Rational Method Parameters, Area and Slope, Northern Project
Table 1B1	Rational Method Parameters, Runoff Coefficient, Southern Project
Table 1B2	Rational Method Parameters, Runoff Coefficient, Northern Project
Table 1C1	Rational Method Parameters, Intensity and Flow, Southern Project
Table 1C2	Rational Method Parameters, Intensity and Flow, Northern Project
Table 2A1	Creek Hydrology at Station 225+00
Table 2A2	Creek Hydrology at Station 225+00, Existing/Proposed Condition
Table 2B1	Creek Hydrology at Station 293+75
Table 2B2	Creek Hydraulics at Station 293+75, Existing Conditions
Table 2B3	Creek Hydraulics at Station 293+75, Proposed Conditions
Table 2C1	Creek Hydrology at Station 305+00
Table 2C2	Creek Hydraulics at Station 305+00, Existing Conditions
Table 2C3	Creek Hydraulics at Station 305+00, Proposed Conditions
Table 2D1	Creek Hydrology at Station 393+00
Table 2D2	Creek Hydraulics at Station 393+00, Existing Conditions
Table 2D3	Creek Hydraulics at Station 393+00, Proposed Conditions
Table 3A-3D	Existing Route 101 Culvert Capacity
Table 3E	Existing Route 101 Culvert Capacity Slip-lined
Table 3F	Route 101 Overtopping, 100-Year Peak Flow Rate
Table 4	Flow Capacity of Proposed Culverts
Table 4A	Rock Slope Protection
Table 5A	Drainage Ditch, Southern Project
Table 5B	Drainage Ditch, Northern Project
Table 5C-5D	Ditch Transition to Side Opening Inlets, 100- Year Peak Flow Rate
Table 6	Hydrograph Modification Program Facilities
Table 7	Discharge Duration for 37 Year Period, Project Wide
Table 8	County Culvert Hydrology (Tailwater Condition) - 100 Year Storm
Table 9	County Culvert Hydraulics (Tailwater Condition) - 100 Year Storm

Appendix A

Design Critertia
WinIDF Output
Exhibit 1 - Firmette of FEMA Map Number 06041 C0175D

Appendix B

HY8 Output

- Station 244, System 5b Culvert
- Station 253, System 8c Culvert
- Station 318, System 23b Culvert
- Station 351, System 43c Culvert

1 INTRODUCTION

1.1 Purpose and Scope

The California Department of Transportation (Caltrans) proposes to improve State Route 101 (Route 101), between Novato and Petaluma, California (Marin Sonoma Narrows Project). This report addresses the portion of the project designated as Section B1of the larger Route 101 improvement project between Station "N2R" 411+00 on the north (San Antonio Road) and Station "N2R" 225+80 on the south (vicinity of Birkenstock property). This Drainage Report is for facilities proposed in the project's 2011 Supplemental Project Report (2011 SPR). The 2011 SPR identifies project changes since the July 21, 2009 approval of the Final Project Report (FPR) entitled, "Project Report, Route 101 - Marin/Sonoma Narrows, In Marin and Sonoma Counties, from the Route 101/37 Separation to north of the Corona Road Overcrossing (EA 04-264000)." Besides minor alignment changes to the interchange, frontage roads, and and bike path, the focus of the 2011 SPR is a phased-improvement approach, set forth by the original and comprehensive corridor improvements approved in the July 2009 FPR and to identify the Marin Sonoma Narrows (MSN) - Segment B1, Phase 1 Project as a stand-alone project.

The original project, located in both the City of Novato and County of Marin limits, from just north of Atherton Avenue (PM R23.2) to San Antonio Road (PM 27.1) proposed to horizontally and vertically realign Route 101, incorporate high occupancy lanes (HOV) in the northbound and southbound directions, and modify the Redwood Landfill Interchange into a full-diamond interchange, including widening the existing bridge. The project also proposed to construct frontage roads (with Class II bike lane and Class III bike route), as well as a Class 1 bike path. Within the project limits and in conjunction with the other improvements, the project proposed to remove all access-control breaks and at-grade intersections.

This Segment B1, Phase 1 Project (Project) will construct a tight-diamond interchange (including widening the existing bridge) as well as the frontage roads and Class 1 bike path; however, along the two properties owned by the Olompali State Historic Park (SHP), the bike path and frontage road will be shifted westerly and placed on the park's property. Due to this shift of the bike path and frontage road onto Olompali SHP, the mainline alignment (approximately from "N2R" Sta. 261+00 to Sta. 335+00) may shift to the west, thus allowing the Project to hold the existing alignment of the Route 101, in lieu of an s-curve as proposed in the FPR. However, the Project will defer the horizontal and

vertical realignment improvements, as well as the HOV lane improvements along Route 101, until the future.

Funding constraints is the primary reason for the changes associated with the phased-improvement approach. Additionally, non-standard design features, traffic safety concerns, and Olompali SHP constraints led to renewed discussions with California State Parks, resulting in the shift and placement of the bike path and frontage road onto Olompali SHP property. The Project will not preclude future improvements that were approved in the FPR. Future improvements within the Project limits are neither funded nor programmed, but is environmentally cleared through the original PA&ED.

The Project vicinity map is shown on Figure 1 and the Project location map is shown on Figure 2.

The purpose of this drainage report is to present the following for the Project:

- Existing drainage conditions
- Capacities of the storm water facilities
- Recommended storage facilities for Hydrograph Modification
- Recommended conveyance facilities
- Recommended treatment facilities

1.2 Description and Setting

The Project is located at the northeastern portion of Marin County between South San Antonio Road and 2.1 miles south of the Sonoma County/Marin County line. Route 101 is a four-lane, divided highway with a north – south orientation. There is currently one major grade-separated Route 101 road crossing within the Project. The Project will require modifying of existing cross culverts and construction of supplemental longitudinal drainage facilities. The Project will not affect or redirect runoff.

Proposed Project improvements include modification of the existing grade-separated intersection of Route 101 overcrossing at Redwood Landfill Road**.** The Project would reconfigure the existing grade-separated intersection through the construction of the following Project features:

- Diamond type ramps to intersection
- Frontage roads to maintain property access and convey local traffic and bicycle traffic
- Stormwater collection facilities
- Stormwater treatment facilities
- Stormwater storage facilities for hydrograph modification

1.3 National Flood Insurance Maps

The Project is designated as Federal Emergency Management Agent (FEMA) Flood Hazard Zone X. Zone X is defined as an area of 1% chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile. This project is mapped on the following FEMA Flood Insurance Rate Map, attached as Exhibit 1 in Appendix A.

Exhibit 1 – Marin County, California (unincorporated areas), Panel 175. The map is Community Panel number 06041C0175D and was revised May 4, 2009.

1.4 Methodology

The Project improvements within the future County Right-of-Way are evaluated using Tile 24, 24.04 Section VI Drainage Facilities of the Marin County Code. Improvements within the Caltrans right-of-way are evaluated using Caltrans Standard Methodology as modified and supplemented using drainage criteria presented in Appendix A and are based on the Technical Memorandum, "Highway 101 Marin-Sonoma Narrows Section B1, proposed Project-wide Drainage Criteria" dated May 8, 2009.

Water levels through the Project area are analyzed using the Rational Method and normal depth flow calculations. Project highway drainage improvements are sized to convey the 25-year storm event, following Caltrans standards as presented in Appendix A.

Bike path and frontage road drainage improvements are sized to convey a 100-year storm event consistent with County design storm criteria.

Additional requirement from the County Code 24.04.520 are as follows:

- Closed conduit systems must pass seventy percent of the 100-year flow as open channel flow with no head allowed at the inlet. The remaining thirty percent may be allowed to enter the conduit with head over the inlet provided that a minimum of two feet of freeboard is maintained in all inlet structures.
- Open channel systems shall be designed to carry the 100-year flow with a minimum freeboard equal to the velocity head.

There are over 40 proposed cross culverts within the Project that convey runoff from the west to the east across the frontage roads. The drainage ditch cross sections used for these analyses are developed from the Project's frontage roads grading cross sections.

1.5 Bridge Hydraulics

Creek crossings through the Project are within culverts. Existing large facilities include a series of culverts: a 6-foot by 6-foot box culvert, a 12-foot by 4.5-foot box culvert and

five 48-inch pipes at Station 225+50, a 6-foot by 3-foot box culvert at Station 293+50, a 12-foot by 4-foot box culvert at Station 305+20, a 8-foot by 7-foot box culvert at Station 357+70 and a 6-foot by 5-foot box culvert at Station 393+00.

2 PROJECT OVERVIEW

2.1 Potential Project Impacts

2.1.1 Flood Plain Encroachments

The Project encroaches on a FEMA designated floodplain in the area of the east frontage road south of the intersection.

2.1.2 Residences and Other Buildings

There is one building within the Project site. The building is an existing cell tower structure on a local high point. The building is not impacted by Project drainage.

2.1.3 Crops

The Project will require abandonment of existing farm and ranch lands primarily used for dairy cattle. The Project drainage system will maintain current drainage overflow rates to farm/ranch land areas. No change in flow depth across remaining farm and ranch lands is proposed as a part of the Project.

2.2 Existing Drainage System

Runoff through the Project area flows from the northwest toward the southeast, ultimately discharging to the Petaluma River in creeks, ditches and as overland flow. The Petaluma River drains to the North San Pablo Bay, which is an extension of San Francisco Bay. Discharge points are shown on Figures 3A through 3H.

The Project drainage areas consist primarily of grassed open fields, with a large percentage of the drainage area as grazing lands, with minor amounts of paved roadways and vegetated roadway side-slopes. Offsite slopes west of the Project are steep, with typical slopes between 2:1 and 10:1. The area downstream of the Project is relatively flat with drainage ditch slopes ranging between 0.01 and 0.005 feet per foot. Currently, the hillside areas drain in natural drainage ditches to a network of pipes and ditches that serve and cross beneath the Route 101 travel way.

Ditches located adjacent to the outside shoulders of the travel way convey flows south-easterly generally, with few exceptions. Downstream of the Project area, runoff enters unlined ditches that are adjacent to the Sonoma Marin Area Rail Transit (SMART)

railroad tracks. During significant storm events, runoff will pond behind the railroad culverts.

Historical flooding has occurred adjacent to Route 101 within the Project segment. Minor flooding has been recorded in the immediate sections of Route 101 north and south of this Project. (See Preliminary Drainage Report for Marin Sonoma Narrows, by Caltrans, dated January 2006.)

Drainage areas for the Project cross culverts and ditches are shown on Figures 3A through 3H and summarized on Table 1A1. The drainage area characteristics such as overland sheet flow, rill flow and concentrated flow are presented in Tables 1A2 and 1A3. Drainage area runoff coefficients for the 25 and 100-year storm evens are presented in Tables 1B1 and 1B2. Flows for the 25 and 100-year storm events are presented in Tables 1C1 through 1C2.

During typical storm events, runoff from the hillsides west of the Project will flow through one of more than 30 existing drainage facilities that convey flow under Route 101. Locations of the existing Route 101 crossings culverts are shown on Figures 3A through 3H. Route 101 currently acts as a barrier to overland flow. Roadside drainage ditches collect surface flows and convey these flows to one of the cross culverts. Runoff from existing drainage areas upstream of Route 101 are shown on Figures 6A through 6G. Runoff from the outside lane and shoulder along southbound Route 101 is also conveyed by roadside ditches to these cross culverts.

2.2.1 Cross Culverts – HEC-RAS Analyses

Four drainage ditches that convey flow through the Project area are evaluated using the U.S. Army Corps of Engineers HEC-RAS River Analysis System computer model. The three drainage ditches are selected because tailwater from the ditches will affect the flow capacity of culverts crossing under Route 101. The following describes the three systems evaluated using the HEC-RAS model.

- FR1 Station 225+00 – Labeled as Basalt Creek on USGS maps. A 6 by 6-foot box culvert conveys water to a 12 by 4.5-foot cross culvert which then is conveyed by a system of five 48-inch pipes which does not have adequate capacity to convey the 25-year event with at least one foot freeboard to the edge of travelway. A total of 77 cfs will spill upstream of the 6 by 6-foot culvert during a 25-year storm event. A total of 41 cfs will spill before the five 48-inch pipes. During a 100-year storm event, the peak water level will be elevation 12.8, ignoring spill to the south.

- FR1 Station 293+50 – un-named creek. The existing Route 101 6-foot by 3-foot cross culvert does not have adequate capacity to convey the 25-year

event. Runoff in excess of the flow capacity of the culvert would flow longitudinal to Route 101 to adjacent cross culverts.

- FR1 Station 305+25 - un-named creek. The existing Route 101 12-foot by 4-foot cross culvert conveys the 25-year event with at least one foot freeboard to the edge of travelway.

- RLF station 393+00 - un-named creek. The existing Route 101 6-foot by 5-foot cross culvert conveys the 25-year event with at least one foot freeboard to the edge of travelway.

The HEC-RAS modeling results for the three creeks listed above are presented in Tables 2A1 through 2D3. The cross section locations of the above creeks are presented in Figures 7A through 7D. Creek analyses start at the railroad tracks downstream of the Project. For purpose of these studies, the starting water level at the downstream limit of the study is based on all flows overtopping the railroad tracks (ignoring culvert flow). Using the railroad as control isolates the system from tidal variations.

2.2.2 Crossing Culverts

Runoff from the Project area flows easterly toward the Petaluma River. Cross culverts convey flow from upstream drainage areas under Route 101. The locations of the existing culverts are shown on Figures 4A through 4E. Many of the CMP crossing culverts have been noted by Caltrans as failing due to rusting and abrasion. In areas where direct connection to a failing Caltrans facility is proposed, CMP lining will be provided. The lining is proposed at seven locations. No action is proposed as a part of the Project to correct the failing CMP lines where there is no direct connection. The Storm-CAD modeling results for the crossing culvert systems are presented in Table 3A through 3D.

Where culverts discharge to one of the major creeks, the creek tailwater is used as the starting water level. Where culverts discharge to hills upstream of the major Creeks, the tailwater is set to the soffit of the outfall pipe.

In most cases, the 25-year event peak flow rate to the existing culverts can be conveyed by the existing culverts. Runoff in excess of the culvert capacity will either be stored within low-lying areas upstream of the culvert or will bypass the culvert as overland flow to the next downstream facility. Tables 3C and 3D presents an evaluation of culvert flow capacity and notes where the flow capacity is not adequate. Figures 4A through 4G were developed to show the overflow routing parallel to and over (overtopping) of Route 101 during the 100-year event to establish tailwater elevations for upstream county culverts.

2.2.3 Roadside Ditches

Surface flows from the hillsides west of Route 101 to the crown of southbound Route 101 are collected in roadside ditches adjacent to Route 101 and convey runoff to the cross culverts. As noted previously, there are locations where the existing cross culvert cannot convey the peak flow rate during a 25-year event. In some locations, the excess flow is conveyed in the roadside ditch to the next downstream cross culvert.

2.2.4 Existing Stormwater Storage

There is no intentional existing storage within the Project area.

2.2.5 Existing Stormwater Treatment

There are no designated existing stormwater treatment facilities in the Project site area.

2.3 Proposed Improvements

Drainage improvements are proposed to accommodate roadway, overcrossing, interchange/ramps, frontage road, and bike path improvements.

2.3.1 Crossing Culverts

Existing flow patterns to existing cross culverts will be maintained. Existing crossing culverts will be extended under roadways and bike path improvements where necessary. Where right-of-way makes it infeasible, Project culverts will make direct connection to existing storm drain lines via a new junction structure. In these locations, the Project storm drain will discharge through a rock energy dissipater and flow through an existing ditch or graded area to the existing Route 101 cross culvert, as shown on Figures 3A through 3H. Proposed culvert will connect to the existing Route 101 cross culverts at a drainage structure, (i.e., manhole inlet, junction box), where available right-of-way does not allow for a discharge structure and ditch flow. Where direct connection occurs, the existing Route 101 culvert will be lined where failing culverts (typically CMP) are identified; video survey of these facilities is currently underway by Caltrans Maintenance to confirm failed culverts. Seven culverts are proposed to have pipe liners. Six will consist of a machine spiral wound PVC pipe liner with an expandable diameter while the seventh will be a fixed diameter HDPE plastic liner. Locations are shown on Figures 3A through 3H. Table 3E presents the hydraulic performance of the seven lined CMP lines. In all cases, the proposed 25-year even water level will be less than for existing conditions.

No replacement of storm drain lines under the existing Route 101 travelway are proposed as a part of this Project. Where analyses identify that frontage road culvert will connect to

an undersized Caltrans culvert, a catch basin is proposed in the vicinity of the existing inlet or outfall. In the future, the undersized lines under the Route 101 travel way will be replaced as a part of the future project. Analyses of culverts under the proposed frontage road and bike path are presented in Table 4.

There are four low points between the frontage roads and southbound Route 101 where highway culverts are undersized creating adverse backwater conditions within the proposed frontage road culverts. County storm drain systems with a tailwater condition are analyzed in Tables 8 and 9. Runoff will overtop Route 101 during the 100-year storm event at these locations. Modeling of the corresponding Route 101 overtopping are presented in Table 3F and shown in Figures 4A through 4G. Four frontage road culverts FR1 station 244+00, FR1 station 245+56, FR1 station 275+00 and RLF station 378+42 will be completely inundated, though still function as inlet control culverts with sufficient conveyance capacity without raising above the edge of pavement as shown in Table 4. Upsizing the Caltrans cross culverts to a 25-year storm capacity will have no effect on the overtopping during the 100-year storm event. To reduce backwater effects within County culverts, Caltrans would have to increase the culverts sizes to match the County's upstream cross culverts which are sized for the 100-year event.

There are four existing box culvert creek crossings; FR1 225+00, BK station 293+50, BK station 305+44 and RLF 393+55. Runoff in excess of the culvert capacity currently spills from the creek and flows parallel to the roadway as overland flow. Flow is conveyed to downstream cross culverts contributing to the Route 101 flood overtopping mentioned above. Long-term plans call for the replacement of the existing under-sized box culverts with culverts sized to convey a 25-year storm event. Until long-term improvements are installed, there is a potential that runoff will spill from the channel and flow to adjacent culverts.

Due to the close proximity between the frontage road and southbound Route 101 around RLF stations 385+00 to 392+00, some filling of Caltrans roadside ditches will occur. The roadside ditches capacity will be diminished to the point where flooding of the upstream Caltrans culverts during the 100-year event would flow overland back towards the frontage road if no longitudinal improvements are provided. For this reason, a pair of inlets and culverts are proposed as part of the current project downstream of the Route 101 existing 12-inch plastic pipe cross culvert. The same conditions would occur just upstream of the 12-inch plastic pipe however, no additional inlets are proposed there. There, the 6-foot by 5-foot cross culvert has sufficient capacity for the 25-year event.

During a 100-year event, flow will pond upstream of Route 101 and in some cases will cause a tailwater for the frontage road and bike path culverts. Frontage road and bike path improvements are sized to pass the 100-year event with this tailwater. In some cases, flow will be parallel to Route 101 and the frontage road/bike path improvements. In all cases, the frontage road and Bike Path are above Route 101 inundation.

If future Route 101 widening restricts the longitudinal overland flow path, corresponding improvements would be needed. The potential for overland flow back towards the frontage road and bike path during the 100-year event associated with reducing the overland flow path would be addressed with the future project. During the future project, which includes highway widening work, it is assumed all roadside ditches will be replaced with formal underground storm drainage systems.

2.3.2 Roadside Ditches

As a part of the Project, ditches are proposed parallel to the frontage roads and bike paths and at the top of cut slopes greater than 5 feet. The proposed ditches are designed to meet the County's design criteria. The roadside ditches will be either lined ditches or bioretention swales and will convey runoff to the cross culverts. Where ditches would not meet County freeboard criteria, additional side-opening inlets have been proposed to collect ditch flows. Collected flows will be conveyed in proposed longitudinal pipe systems that will be located between the ditch and the frontage road. Results for roadside ditch analyses are presented in Tables 5A and 5B. Where ditches outfall to side opening inlets the ditch will transitioned over a five foot segment of lined ditch from the ditch geometry to the geometry of the side opening. Results for ditch transition into side-opening inlets are presented in Tables 5C and 5D.

All proposed ditches next to frontage road and/or bike paths are sized to carry the 100-year flow with a minimum freeboard equal to the velocity head. Ditches located away from the frontage road and/or bike path may not meet this freeboard requirement. Specifically, lined brow ditches at the top of cut slopes experience high velocities for a short distance as they conform down to roadside ditches. In some cases, the velocity head is three times that of the flow depth. In these cases, ditches are sized for the 100-hundred year flow with nominal freeboard of a few inches. At these locations, there is a ditch located downstream of the brow ditch that has adequate capacity. Overtopping of a brow ditch would not contribute to overtopping of the frontage road and/or bike path, as all those ditches meet the desired freeboard requirements.

2.3.3 Gutter Spread

No dikes are proposed as part of the Project improvements that will convey drainage longitudinally. Therefore, gutter spread calculations are not included and are not necessary.

2.3.4 Stormwater Treatment

Stormwater treatment will be by biofiltration strips and linear bioretention areas that will double as conveyance swales. These measures will treat by filtration through vegetation and model biotreatment soil mix (as presented in the Regional Water Quality Control board web site) that consists of a blend of compost and sand. Stormwater runoff from

improved impervious surfaces may not be treated, where limitations to available treatment areas prohibit treatment. Additional treatment of runoff from existing impervious surfaces is provided to compensate for untreated discharge of runoff from proposed impervious surfaces.

2.3.5 Peak Flow Attenuation

The Project is required to attenuate runoff associated with the increase in Project impervious area. Stormwater attenuation will be by a combination of a detention basin located in the northwest quadrant of the interchange between the southbound off-ramp and the southbound mainline, and roadside biofiltration strips. The Bay Area Hydrology Model (BAHM) program is used to analyze system flows. Rainfall from the Petaluma Airport is used for developing the 30 year period of record. Onsite and limited offsite runoff will flow through the biofiltration strips consisting of modified sand compost soils that will detain runoff. Further detention will occur within a detention basin. Where there are limits to available detention areas, stormwater runoff from proposed impervious surfaces may not be treated directly. In these areas, runoff from existing pervious and impervious areas will be detained to compensate for lack of local stormwater detention.

The goal of the stormwater detention is to match peak runoff flows that occur in the pre-project condition. Drainage areas to the Hydrograph Modification (HM) facilities are summarized in Table 6 and mapped in Figures 5A through 5H. BAHM model output demonstrating compliance with HM is summarized in Table 7.

The detention basin includes the following facilities for HM:

48-inch high riser with 2 by 3-foot grated opening

Orifice opening – 3-inch at flowline

2.4 Unusual and Special Conditions

2.4.1 Existing Facility Conditions

Several of the existing facilities under Route 101 in the Project area have been documented by Caltrans staff as either undersized, failing structurally or both. Improvements to these undersized facilities are not included within this scope of work. To the extent that these facilities constrict flows, Project recommendations are based on upsizing of these facilities as a part of the future project. Where the Project connects directly to existing failing structures, the project will line the cross culverts. Nine locations are proposed for pipe lining.

2.4.2 Alternative Pipes

Corrosion tests were conducted at 22 locations within the project area. Alternate pipe analyses indicate that several alternative pipe options exist. Results and conclusions are presented in the Draft Geotechnical Design and Materials Report by Parikh Consultants, Inc. dated February 2010. Alternative Pipes are allowed and further discussed in the GDMR.

2.4.3 Corrosion and Abrasion

Caltrans staff has documented that many Corrugated Metal Pipe (CMP) cross culverts within the Project have failed due to corrosion and abrasion in the vicinity of the Project. CMP pipes are permitted as summarized in GDMR provided that they are steel with Polymeric Sheet (PS) or Polymerized Asphalt (PA) coating.

2.4.4 Erosion

Rock slope protection (RSP) is proposed at culvert discharge locations to minimize scour at pipe outfalls. The proposed RSP outlet facilities are sized using the HEC-14 methodology. Outfall facility sizes are presented in Table 4A.

2.4.5 National Pollutant Discharge Elimination Permit (NPDES)

The Project is subject to the conditions of the Caltrans' NPDES Permit for Storm Water Management during General Construction Activities. This Permit requires that the Project Resident Engineer (RE) submit a Notice of Construction (NOC) to the Regional Water Quality Control Board at least 30 days prior to the start of construction. A California Department of Fish and Game Streambed Alteration Permit, a Regional Water Quality Control Board 401 Permit and a United States Army Corps of Engineers 404 Permit are required.

Project specifications will require that the Contractor prepare a Storm Water Pollution Prevention Plan (SWPPP). The Contractor will not be allowed to start work on the project until Caltrans has deemed that the SWPPP meets the conditions of their General Permit. During the construction period, the Contractor shall be responsible for the implementation of the SWPPP. Caltrans will monitor compliance with the SWPPP. Water Pollution Control Details and Specifications will be provided to the Contractor as a part of the PS&E to be used in the development of the SWPPP.

3 STORM WATER ROUTING PLAN

3.1 Proposed Storm Water Routing Scheme

Existing flow paths will be maintained. No diversions in the natural flow path are planned for the improvements in the Project area.

4 DESIGN CRITERIA

Design criteria are presented in Appendix A.

5 DIVERSION

No diversion of runoff is proposed.

6 REFERENCES

Publications on drainage design manuals, design charts and Caltrans "as-built" plans used in the design of the Project Drainage System include the following:

1. Highway Design Manual, Fifth Edition, (1995 with updates), State of California, Department of Transportation, Sacramento, California.

2. Standard Plans, (2006), State of California, Department of Transportation, Sacramento, California.

3. Standard Specifications, (2006), State of California, Department of Transportation, Sacramento, California.

4. Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22, U.S Department of Transportation, Federal Highway Administration

© BKF Engineers

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-VICINITY-FIG1+2.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

NOT TO SCALE

FIGURE 1
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
VICINITY MAP

BKF

© BKF Engineers

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-VICINITY-FIG1+2.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

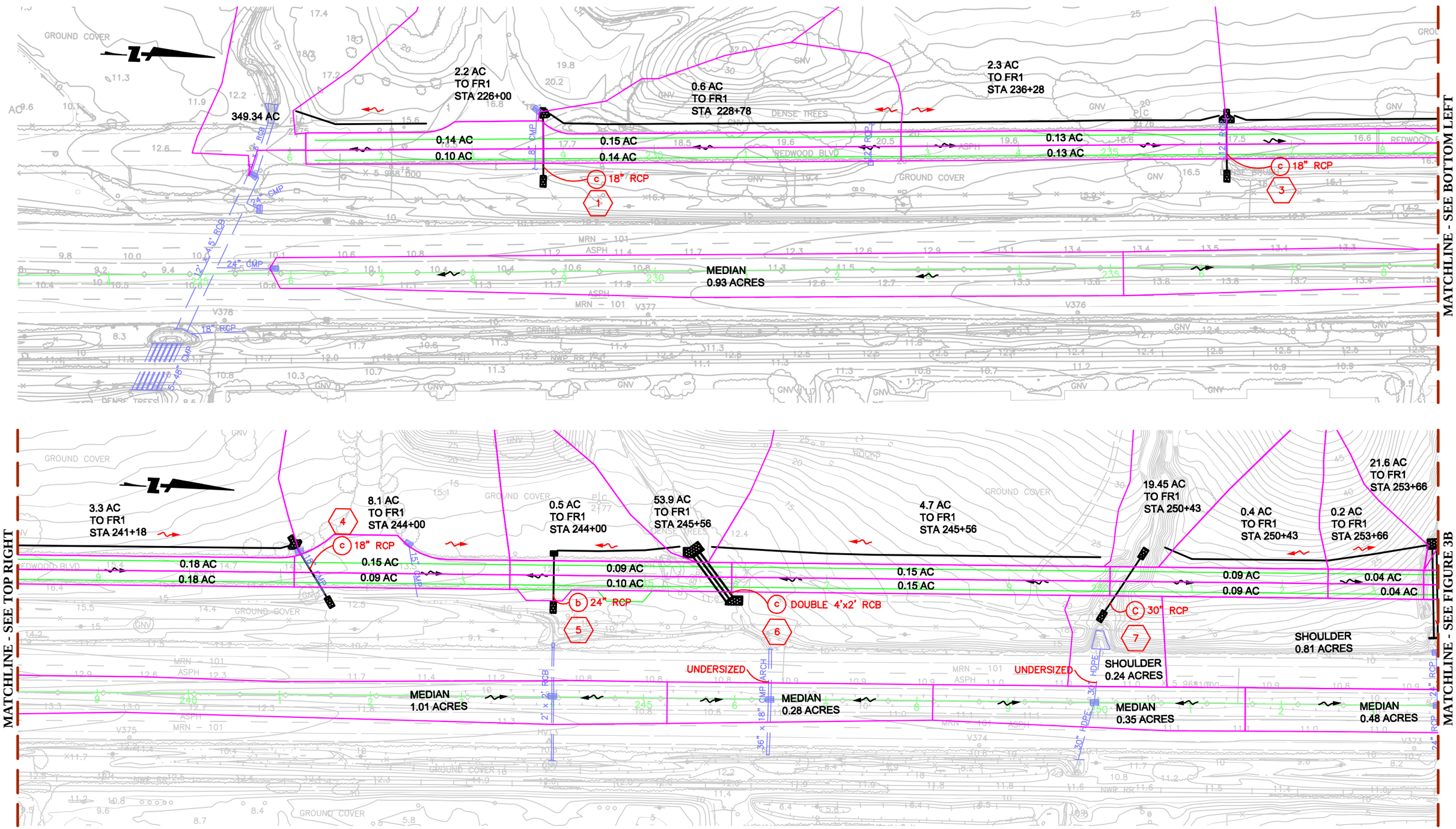
JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

NOT TO SCALE

FIGURE 2
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
LOCATION AERIAL MAP

BkF

© BKF Engineers



DRAWING NAME: C:\Temp\AcPublish_3740\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

FIGURE 3A

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3A

53+66

9.9 AC
TO FR1
STA 253+66

0.04 AC
0.04 AC

c DOUBLE 30" RCP

8

UNDERSIZED

24" RCP

18" RCP

AN
ACRES

4.09 AC

0.17 AC

0.22 AC

0.58 AC

0.16 AC
0.16 AC

SHOULDER
1.58 ACRES

MEDIAN
0.99 ACRES

0.20 AC
0.19 AC

2.4 AC
TO FR1
STA 263+70

SHOULDER
0.46 ACRES

18" CMP

18" CMP

33.8
AC
T0 FR1
STA 263+70

SHOULDER
0.17 ACRES

UNDERSIZED

18" RCP

c DOUBLE 30" RCP

11

0.16 AC
0.17 AC

2.9 AC
TO FR1
STA 267+50

MEDIAN
0.56 ACRES

SLIPLINE
UNDERSIZED

a

92

12" RCP

15" CMP

18" CMP

b 24" RCP

12

6.0 AC
TO FR
STA 2

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

6.0 AC
TO FR1
STA 267+50

2.46 AC

32.2 AC
TO FR1
STA
270+34

0.2 AC
TO FR1
STA 270+34

0.09 AC

0.11 AC
0.11 AC

b 4' x 2' RCB

79

RCP

0.3 AC
TO FR1
STA 275+00

1.8 AC
TO FR1
STA 275+00

0.16 AC
0.16 AC

d DOUBLE 5' x 2' RCB

14

MEDIAN
0.54 ACRES

MEDIAN
1.31 ACRES

4' x 2' RCB

15" RCP

12" RCP

73.1 AC
TO FR1
STA 275+00

0.12 AC
0.12 AC

0.29 AC

0.09 AC

15" CMP

b 4' x 2' RCB

d 4' x 2' RCB

15

15

SHOULDER
0.44 ACRES

UNDERSIZED

MEDIAN
0.29 ACRES

12" CMP

15" RCP

15" CMP

MATCHLINE - SEE FIGURE 3C

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

FIGURE 3B

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3B

18.8 AC
TO BK
STA 281+50

0.26 AC
0.26 AC

SHOULDER
1.47 ACRES

MEDIAN
1.27 ACRES

369.0 AC
TO BK
STA 293+48

SHOULDER
0.42 ACRES

UNDERSIZED

MEDIAN
0.56 ACRES

d DOUBLE 7'x4' RCB

16

SHOULDER
0.40 ACRES

MEDIAN
0.21 ACRES

9.7 AC
TO BK
STA 293+48

0.12 AC
0.12 AC

SHOULDER
0.49 ACRES

MEDIAN
0.49 ACRES

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

6.0 AC TO BK STA 303+00

0.08 AC
0.08 AC

SHOULDER
1.32 ACRES

3.8 AC TO BK
STA 304+30

0.12 AC

b 18" RCP

17

526.8 AC TO BK
STA 305+39

b 18" RCP

18

0.3 AC
TO BK
STA 305+39

d DOUBLE 8'x4' RCB

19

0.8 AC
TO BK
STA 310+10

0.12 AC

SHOULDER
1.00 ACRES

2.6 AC
TO BK
STA 310+10

1.4 AC TO BK
STA 310+10

0.07 AC

b 18" RCP

21

MEDIAN
1.27 ACRES

SHOULDER
1.18 ACRES

0.44 AC

20

d DOUBLE 8'x4' RCB

MEDIAN
1.05 ACRES

MATCHLINE - SEE FIGURE 3D

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE
100 0 100 200

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

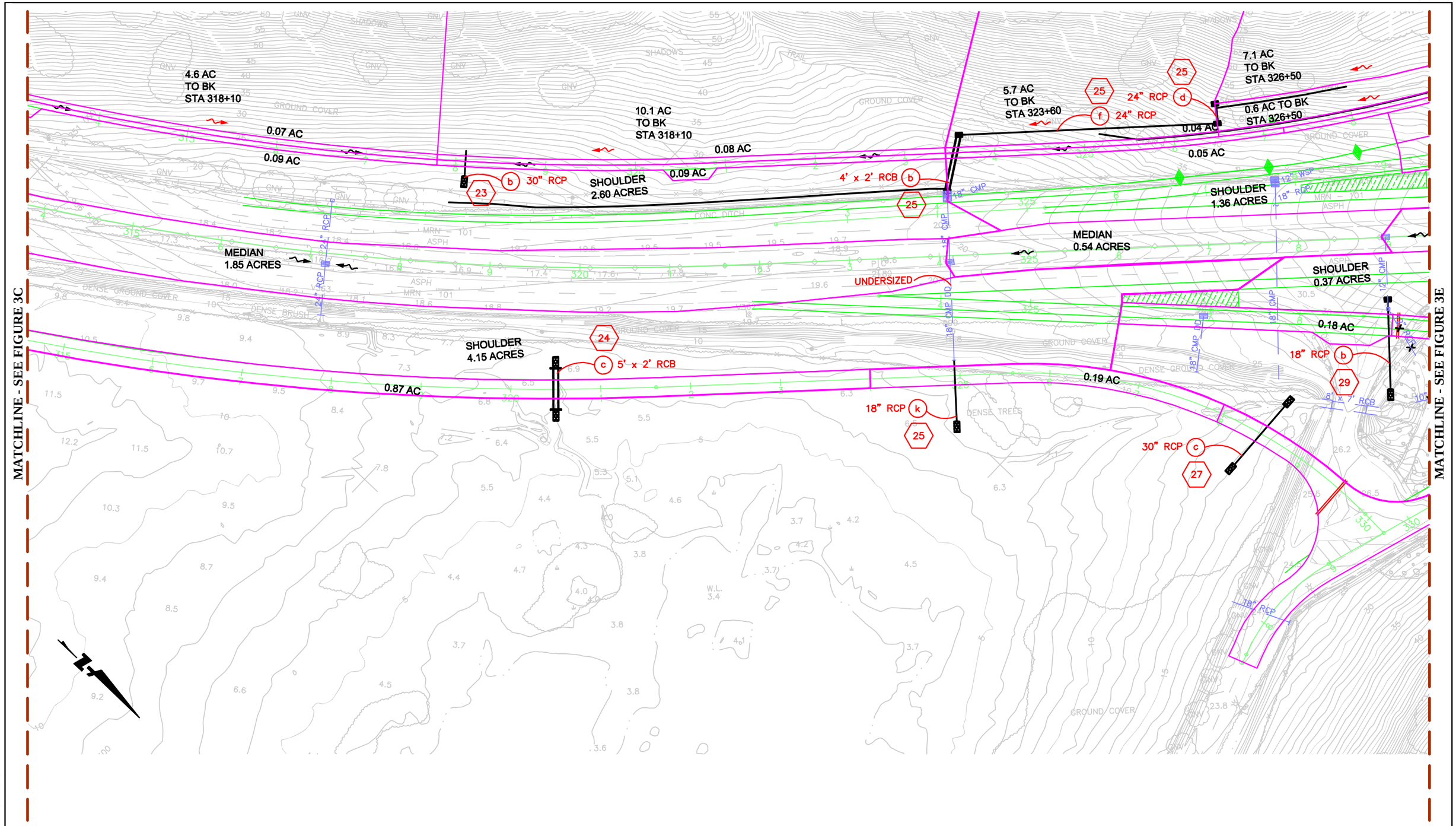
DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

FIGURE 3C

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers



DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE

100 0 100 200

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

FIGURE 3D

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3D

MATCHLINE - SEE FIGURE 3F

1.3 AC TO BK STA 332+50

3.2 AC TO RLF STA 334+07

0.09 AC

12.5 AC TO RLF STA 347+00

0.2 AC TO RLF STA 347+00

0.12 AC

0.12 AC

4.8 AC TO RLF STA 351+74

18.4 AC TO RLF STA 351+74

SHOULDER 0.31 ACRES

SHOULDER 0.49 ACRES

18" RCP b 87

18" RCP b 32

0.07 AC

0.07 AC

0.08 AC

SHOULDER 0.57 ACRES

18" RCP d 32

SHOULDER 1.28 ACRES

6" CMP

18" RCP b 36

BASIN 1.37 AC

0.29 AC

b 4' x 2' RCB 37

0.18 AC

0.18 AC

5' x 2' RCB b 43

SHOULDER 0.74 ACRES

5' x 2' RCB e

5' x 2' RCB g 43

39

f 5' x 2' RCB

18" RCP b 39

d 4' x 2' RCB

SHOULDER 0.22 ACRES

18" RCP d

24" PP

SHOULDER 0.55 ACRES

h 18" RCP

b SLIPLINE 92

MEDIAN 0.55 ACRES

12" RCP

UNDERSIZED

12" RCP

18" RCP

MEDIAN 0.57 ACRES

MEDIAN 0.35 ACRES

SHOULDER 1.51 ACRES

6" PPP

c 30" RCP 30

SHOULDER 2.53 ACRES

0.68 AC

SHOULDER 0.84 ACRES

40 c 18" RCP

0.11 AC

0.10 AC

0.09 AC

SHOULDER 0.54 ACRES

41 f 18" RCP

18" RCP b

18" RCP d

18" RCP d

18" RCP h 41

b 18" RCP 93

HILLSIDE 0.52 ACRES

HILLSIDE 4.13 ACRES

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

FIGURE 3E

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3E

6.5 AC
TO RLF
STA 351+74

0.16 AC
0.16AC

SHOULDER
1.58 ACRES

18" RCP
b
44

0.4 AC
TO RLF
STA 356+00

0.04 AC
0.04 AC

1.3 AC
TO RLF
STA 358+50

0.06 AC
0.06 AC

18" RCP
b
46

0.7 AC
TO RLF
STA 358+50

0.03 AC
TO RLF
STA 358+50

0.04 AC
0.04 AC

SHOULDER
1.41 ACRES

1.8 AC
TO RLF
STA 361+50

0.1 AC
TO RLF
STA 361+50

0.08 AC
0.08 AC

18" RCP
b
47

18" CMP SD

MEDIAN
0.49 ACRES

SLIPLINE
UNDERSIZED
c
92

d 18" RCP

25.0 AC
TO RLF
STA 365+72

0.31 AC

45.9 AC
TO RLF
STA 365+72

8'x7' RCB
c
48

18" RCP
b
80

7' x 8' RCB

ME
0.7

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

5.4 AC
TO RLF
STA 365+72

0.52 AC

MEDIAN
0.79 ACRES

49
c 18" RCP

1.3 AC
TO RLF
STA 373+35

0.23 AC

MEDIAN
0.37 ACRES

6.5 AC
TO RLF
STA 378+42

0.22 AC

MEDIAN
0.68 ACRES

50
d 4'x2' RCB
4'x2' RCB
b

10.3 AC
TO RLF
STA 378+42

85
0.18 AC

18" RCP
b
86

85
f 36" RCP
d 36" RCP

8.8 AC
TO RLF
STA 38

30" R

0.20 AC

18" RCP
d
86

4' x 2' RCB

MATCHLINE - SEE FIGURE 3G

DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

FIGURE 3F

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3F

8.8 AC TO RLF STA 380+90

1.6 AC TO RLF STA 383+60

15.1 AC TO RLF STA 385+85

23.3 AC TO RLF STA 388+50

1.7 AC TO RLF STA 388+50

351.7 AC TO RLF STA 393+55

0.48 AC

0.16 AC

0.20 AC

0.29 AC

SHOULDER 1.15 ACRES

MEDIAN 0.55 ACRES

SHOULDER 0.34 ACRES

MEDIAN 1.24 ACRES

18" RCP (j)

30" RCP (h)

30" RCP (l)

30" RCP (n)

36" RCP (b)

18" RCP (d)

18" RCP (f)

18" RCP (h)

DOUBLE 7'x4' RCB (d)

10'x5' RCB (f)

85

86

51

52

"NZ" STA 374+25N OFFSITE 1.2 ACRES STA 374+25

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

3.9 AC TO RLF STA 393+55

3.5 AC TO RLF STA 402+50

3.4 AC TO RLF STA 402+50

5.5 AC TO RLF STA 404+50

7.20 AC TO RLF STA 409+33

0.3 AC

0.8 AC TO RLF STA 412+00

4.0 AC TO RLF STA 412+00

0.17 AC

0.11 AC

0.17 AC

0.31 AC

0.22 AC

0.15 AC

0.2 AC TO RLF STA 409+33

SHOULDER 0.93 ACRES

MEDIAN 0.37 ACRES

SHOULDER 0.23 ACRES

MEDIAN 0.28 ACRES

SHOULDER 0.36 ACRES

MEDIAN 0.45 ACRES

SHOULDER 0.24 ACRES

MEDIAN 0.32 ACRES

SHOU 0.20 A

MEDIAN 0.27 ACR

18" RCP (c)

24" RCP (b)

SLIPLINE UNDERSIZED (d)

SLIPLINE (e)

24" RCP (b)

24" RCP (b)

SLIPLINE UNDERSIZED (f)

18" RCP (b)

SLIPLINE UNDERSIZED (g)

53

54

55

56

57

92

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

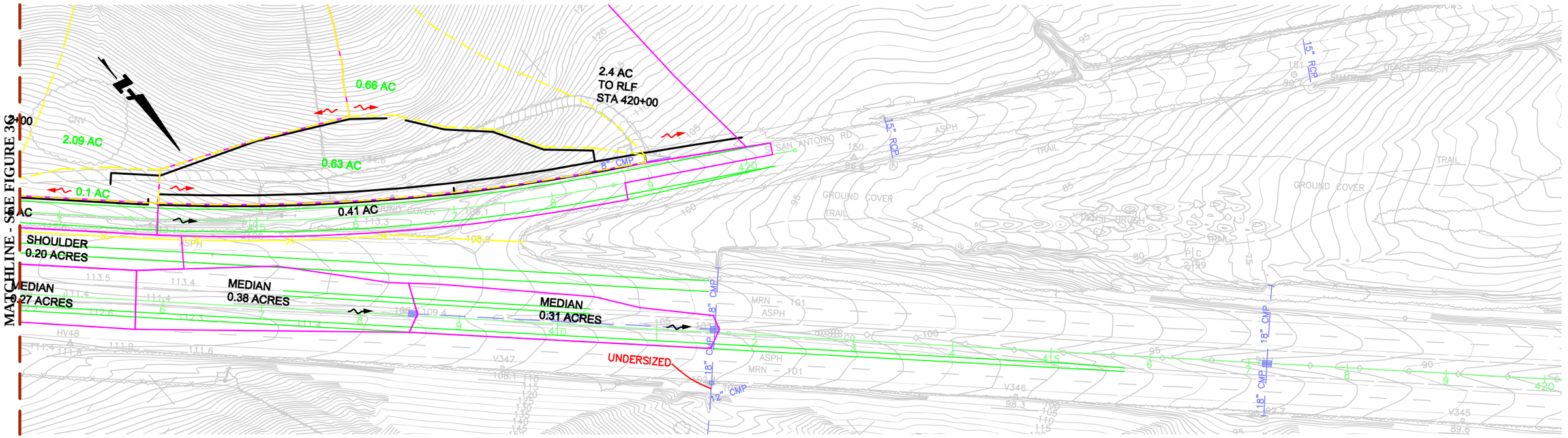
FIGURE 3G

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BkF

DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

© BKF Engineers



DRAWING NAME: K:\Eng08\087003\FIGURES\MSN-Figure-3-for county.dwg
PLOT DATE: 12-09-11
PLOTTED BY: smit

JOB No: 20087003
DATE: DEC, 2011
BY: R.A.M
REV: E.B.

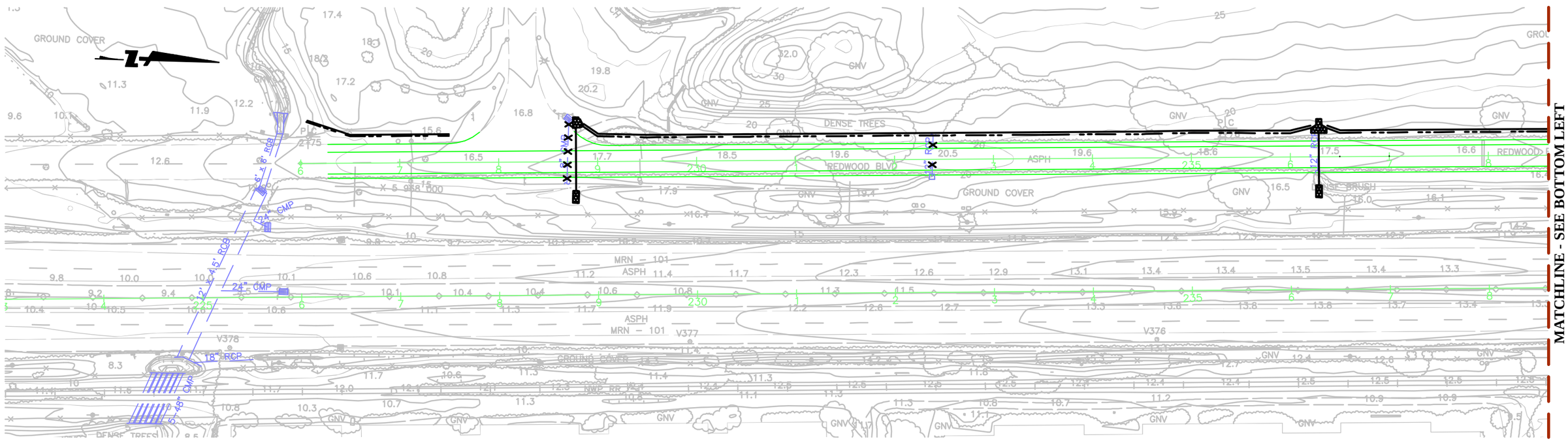
GRAPHIC SCALE
100 0 100 200

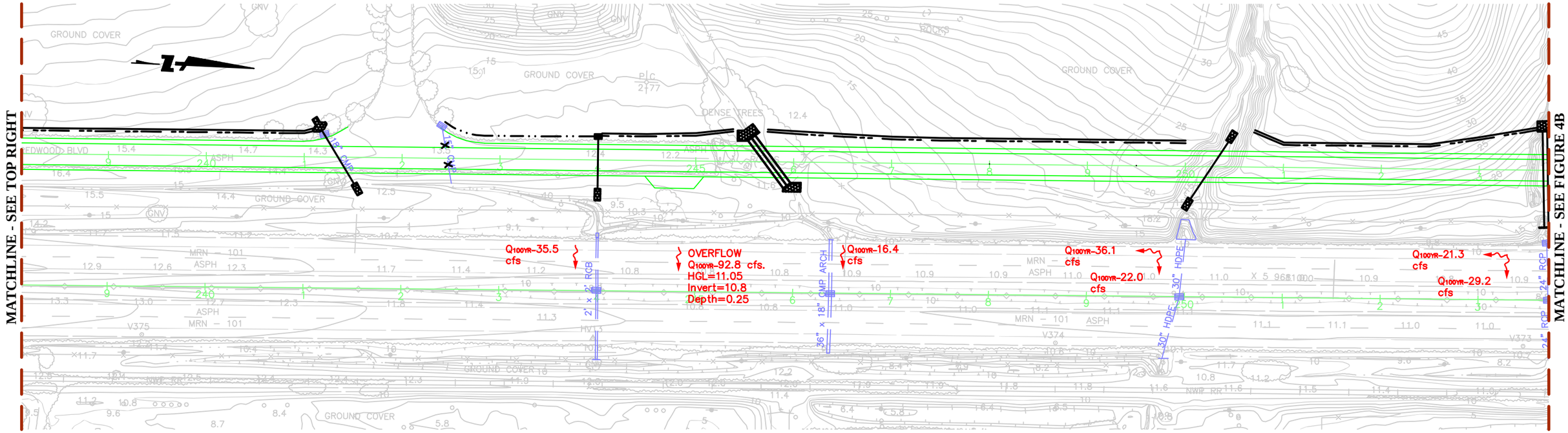
LEGEND:
EXISTING STORM DRAIN FACILITIES
PROPOSED STORM DRAIN FACILITIES
PROPOSED DITCH FLOW DIRECTION

FIGURE 3H
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers





LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES

GRAPHIC SCALE
100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

FIGURE 4A
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

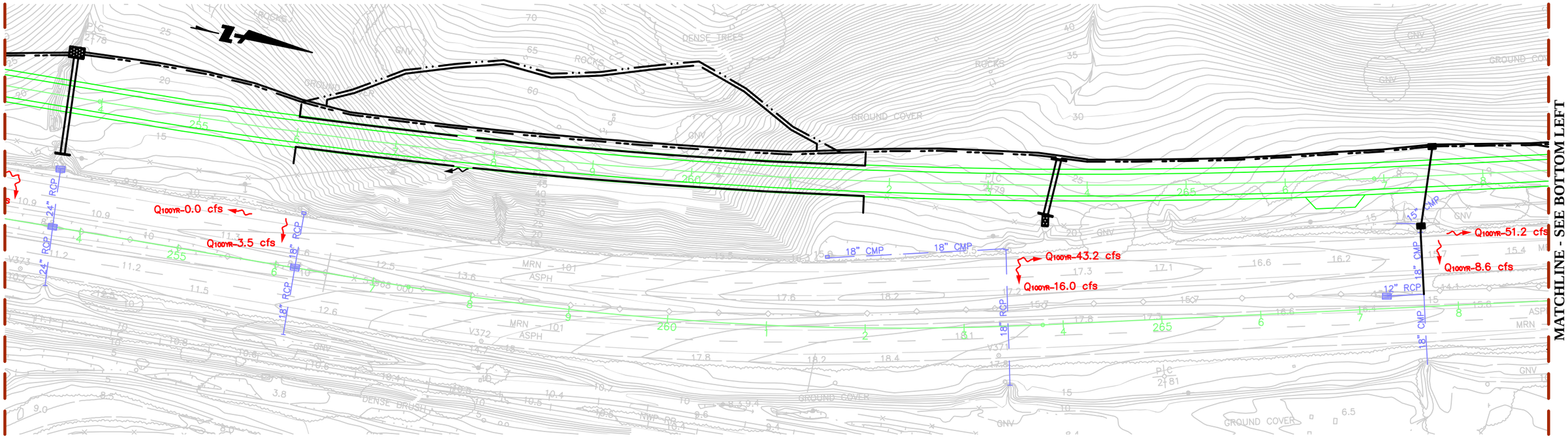
BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

© BKF Engineers

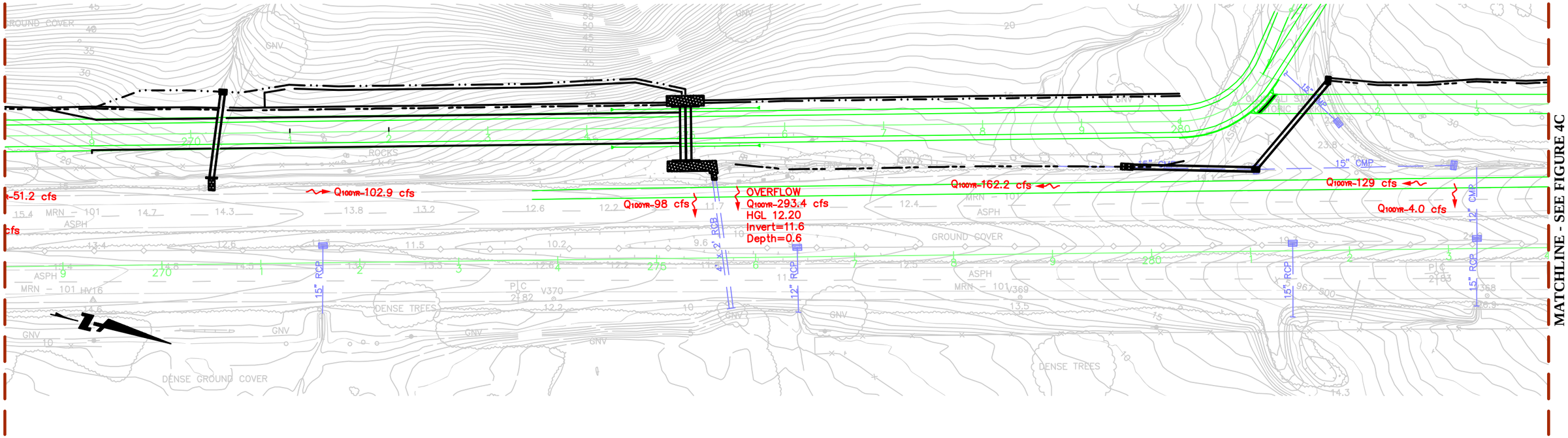
MATCHLINE - SEE FIGURE 4A

MATCHLINE - SEE BOTTOM LEFT



MATCHLINE - SEE TOP RIGHT

MATCHLINE - SEE FIGURE 4C



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE

100 0 100 200

LEGEND:

EXISTING STORM DRAIN FACILITIES

PROPOSED STORM DRAIN FACILITIES

FIGURE 4B

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 4B

MATCHLINE - SEE BOTTOM LEFT

Q_{100YR}=133 cfs

Q_{100YR}=4.0 cfs

12" CMP

18" RCP

Q_{100YR}=137 cfs

Q_{100YR}=319 cfs

6' x 3' RCB

12" RCP

Q_{100YR}=0.0 cfs

Q_{100YR}=1.1 cfs

12" CMP

18" RCP

MATCHLINE - SEE TOP RIGHT

MATCHLINE - SEE FIGURE 4D

Q_{100YR}=35 cfs

Q_{100YR}=617 cfs

12' x 4' RCB

Q_{100YR}=33.7 cfs

Q_{100YR}=12 cfs

18" CMP

18" CMP

LEGEND:

EXISTING STORM DRAIN FACILITIES

PROPOSED STORM DRAIN FACILITIES

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

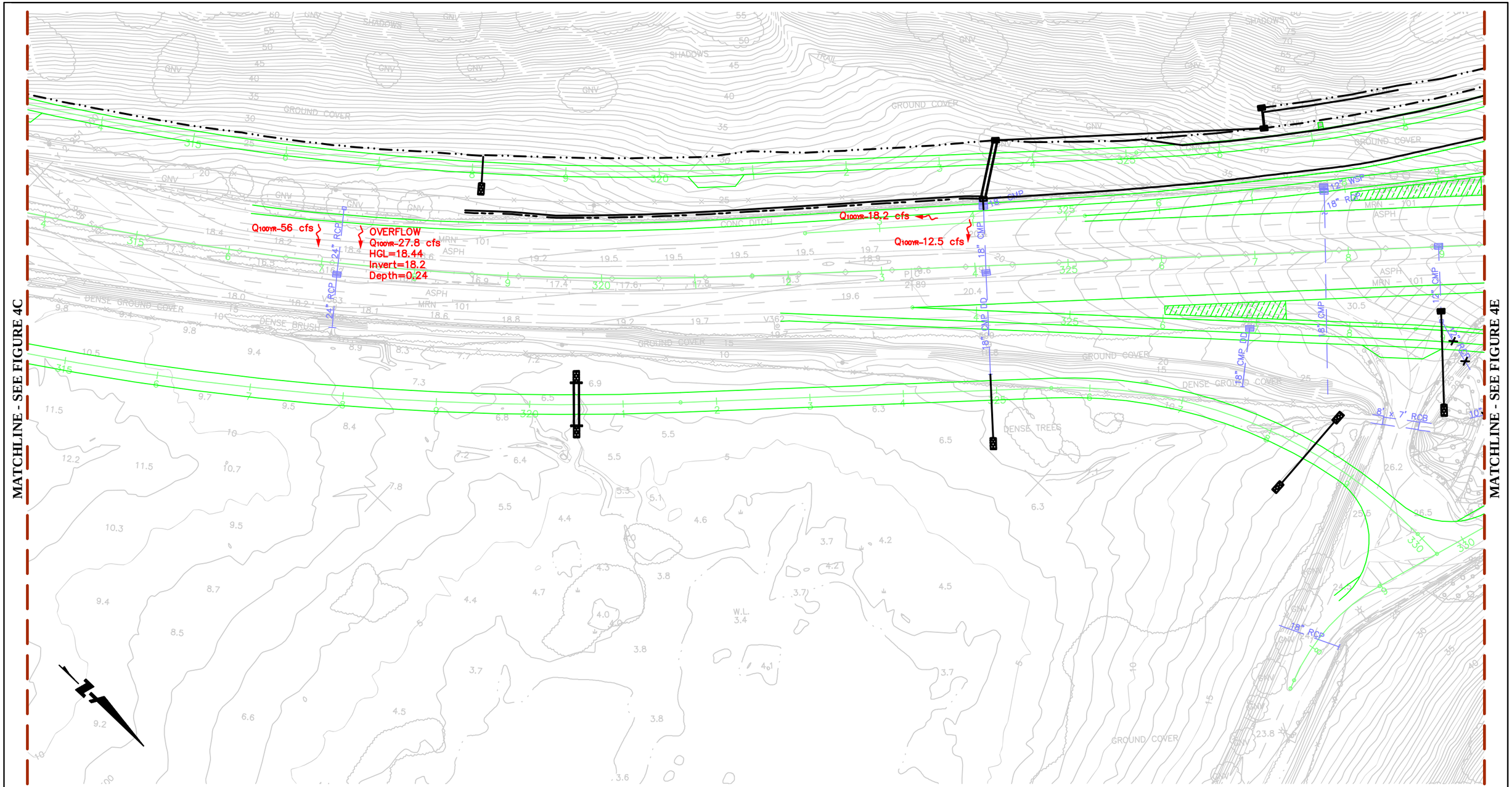
FIGURE 4C

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

BKF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

© BKF Engineers



LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES

GRAPHIC SCALE
100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

FIGURE 4D
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

© BKF Engineers

MATCHLINE - SEE FIGURE 4D

MATCHLINE - SEE FIGURE 4F

Q_{100YR}-0.0 cfs

Q_{100YR}-9.2 cfs

Q_{100YR}-41.9 cfs

Q_{100YR}-21.7 cfs

LEGEND:

EXISTING STORM DRAIN FACILITIES

PROPOSED STORM DRAIN FACILITIES

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

FIGURE 4E

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 4E

MATCHLINE - SEE BOTTOM LEFT

Q100YR-31.8 cfs

OVERFLOW
Q100YR-0.0 cfs

24" CMP

12" CMP

18" CMP

12" RCP

Q100YR-0.0. cfs

Q100YR-151.6 cfs

8' x 1' RCB

12" RCP

MATCHLINE - SEE TOP RIGHT

MATCHLINE - SEE FIGURE 4G

18" RCP

12" RCP

Q100YR-68.3 cfs

4' x 2' RCB

OVERFLOW
Q100YR-54.7 cfs
HGL=65.08
Invert=64.9
Depth=0.18

12" RCP

LEGEND:

EXISTING STORM DRAIN FACILITIES

PROPOSED STORM DRAIN FACILITIES

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

FIGURE 4F

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

© BKF Engineers

MATCHLINE - SEE FIGURE 4F

MATCHLINE - SEE BOTTOM LEFT

Q_{100YR}=42.7 cfs

Q_{100YR}=12.2 cfs

12" RCP

18" CMP

Q_{100YR}=0.0 cfs

Q_{100YR}=479.5 cfs

6' x 5' RCB

MATCHLINE - SEE TOP RIGHT

MATCHLINE - SEE FIGURE 4H

Q_{100YR}=17.1 cfs

Q_{100YR}=13.0 cfs

18" CMP

Q_{100YR}=14.2 cfs

Q_{100YR}=14.7 cfs

18" RCP

Q_{100YR}=16 cfs

Q_{100YR}=6.7 cfs

18" CMP

Q_{100YR}=5.9 cfs

Q_{100YR}=5.0 cfs

18" CMP

LEGEND:

EXISTING STORM DRAIN FACILITIES

PROPOSED STORM DRAIN FACILITIES

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

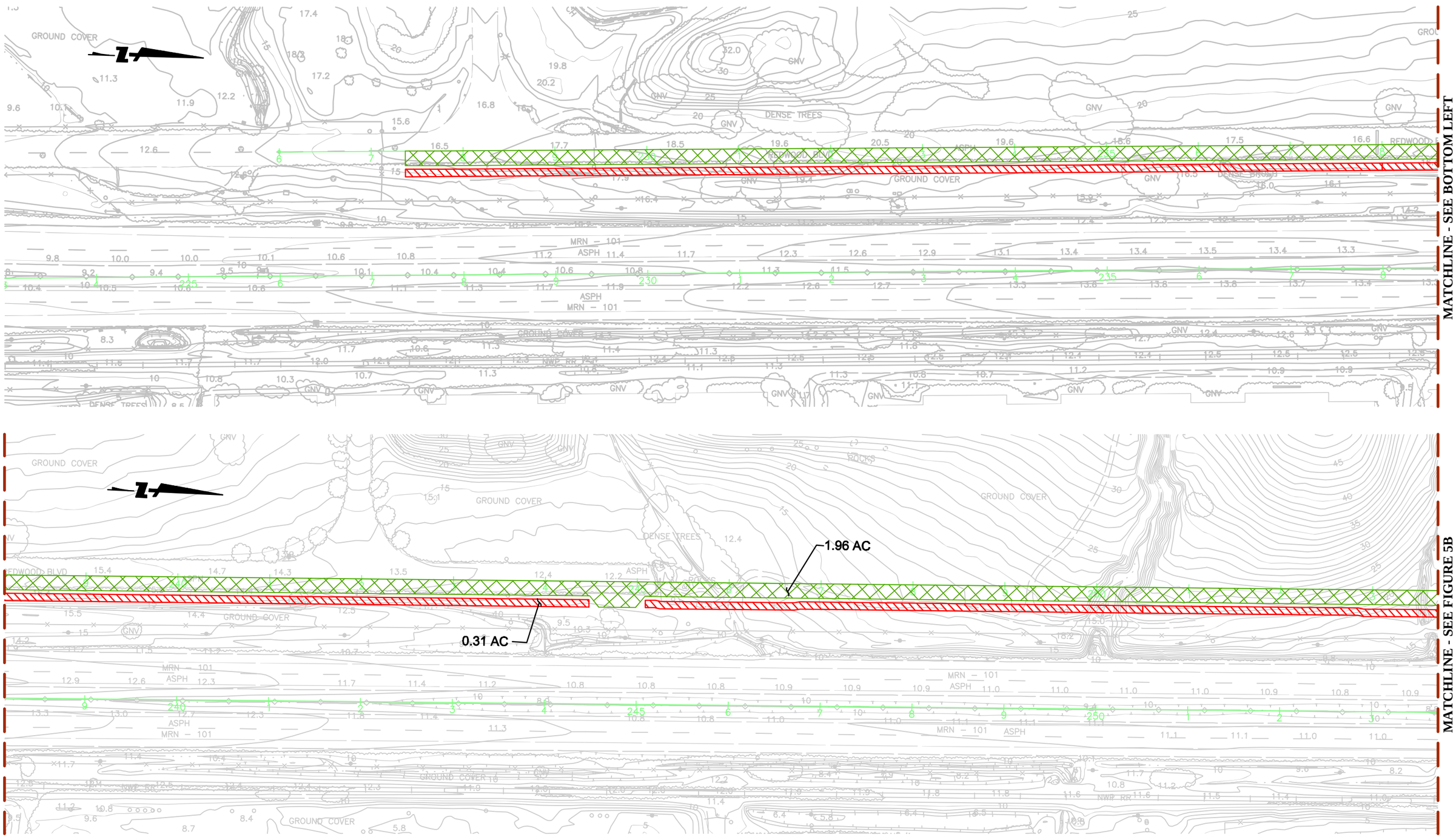
FIGURE 4G

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
100 YEAR STORM ROUTE 101 OVERTOPPING

BKF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-4.dwg
PLOT DATE: 10-10-11
PLOTTED BY: muro

© BKF Engineers



JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE

100 0 100 200

LEGEND:

- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

FIGURE 5A

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

© BKF Engineers

MATCHLINE - SEE FIGURE 5A

MATCHLINE - SEE BOTTOM LEFT

0.39 AC

MATCHLINE - SEE TOP RIGHT

MATCHLINE - SEE FIGURE 5C

0.24 AC

0.06 AC

0.03 AC

0.10 AC

0.01 AC

LEGEND:

- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

FIGURE 5B

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILIITES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 5B

MATCHLINE - SEE BOTTOM LEFT

0.51 AC

0.15 AC

0.11 AC

MATCHLINE - SEE TOP RIGHT

MATCHLINE - SEE FIGURE 5D

0.02 AC

0.19 AC

1.41 AC

0.66 AC

LEGEND:

- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

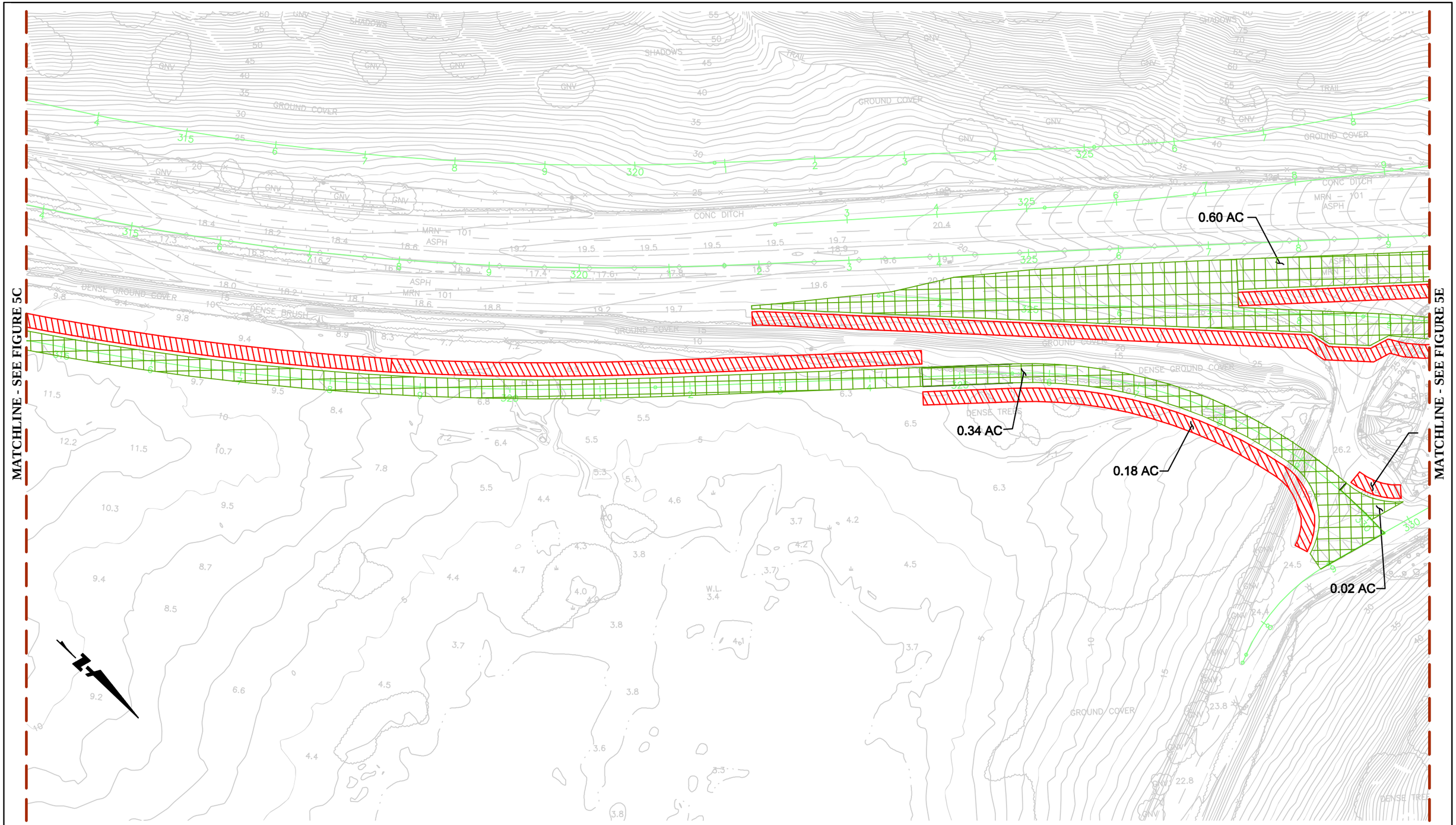
DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

FIGURE 5C

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

FIGURE 5D

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 5D

MATCHLINE - SEE FIGURE 5F

0.12 AC

0.07 AC

0.03 AC

0.02 AC

DRAINAGE AREA TO DETENTION BASIN 15.41 AC TOTAL

0.20 AC

0.34 AC

0.40 AC

0.16 AC

0.26 AC

0.44 AC

1.10 AC

0.02 AC

0.10 AC

0.05 AC

LEGEND:

- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

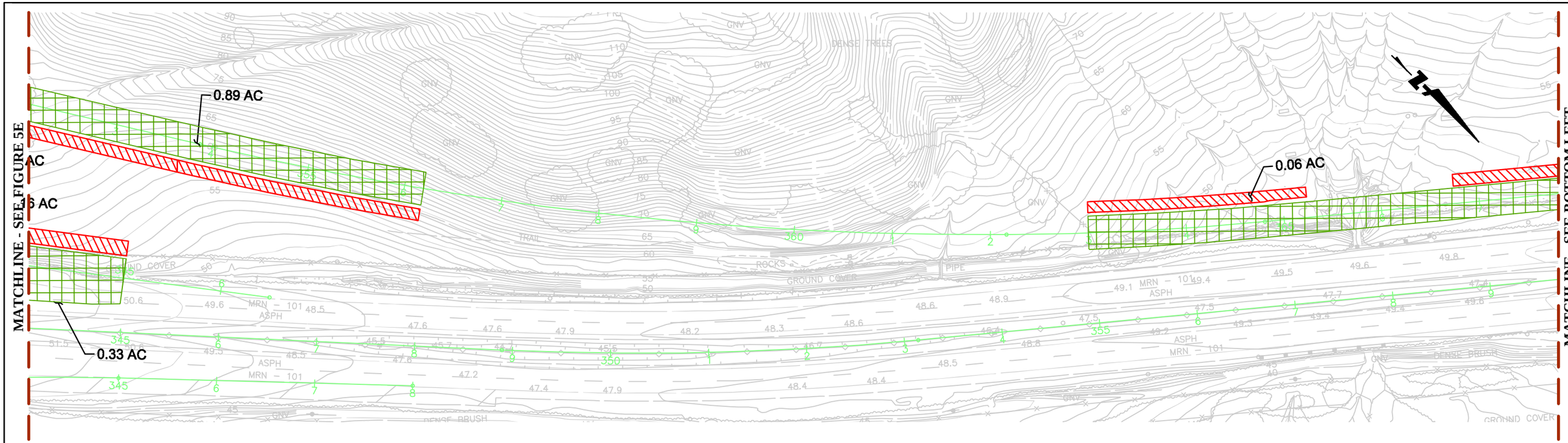
DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

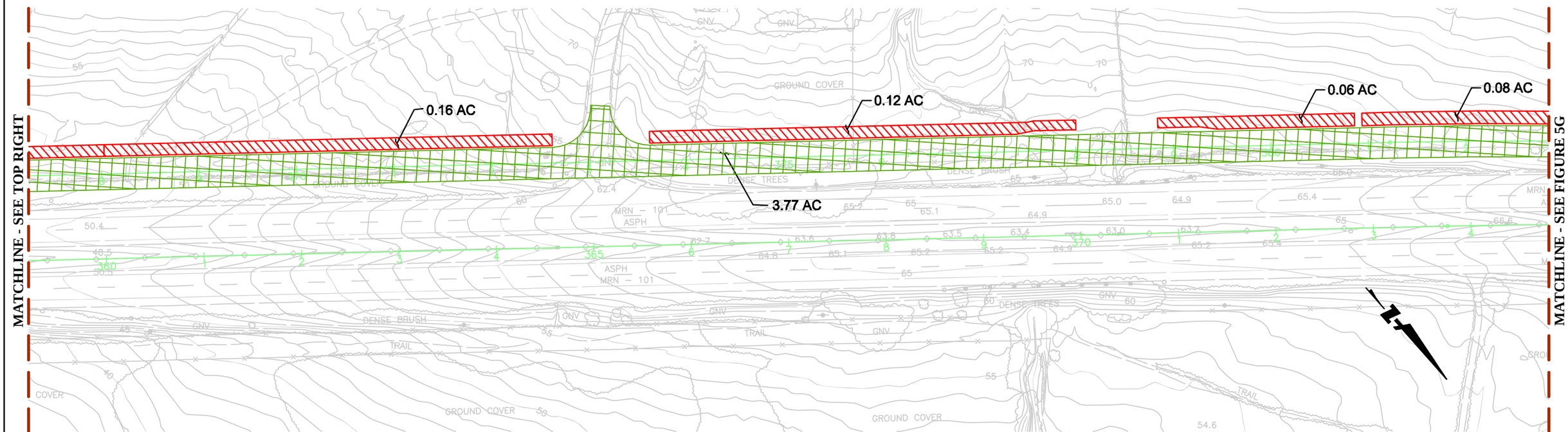
FIGURE 5E

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BKF

© BKF Engineers





DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

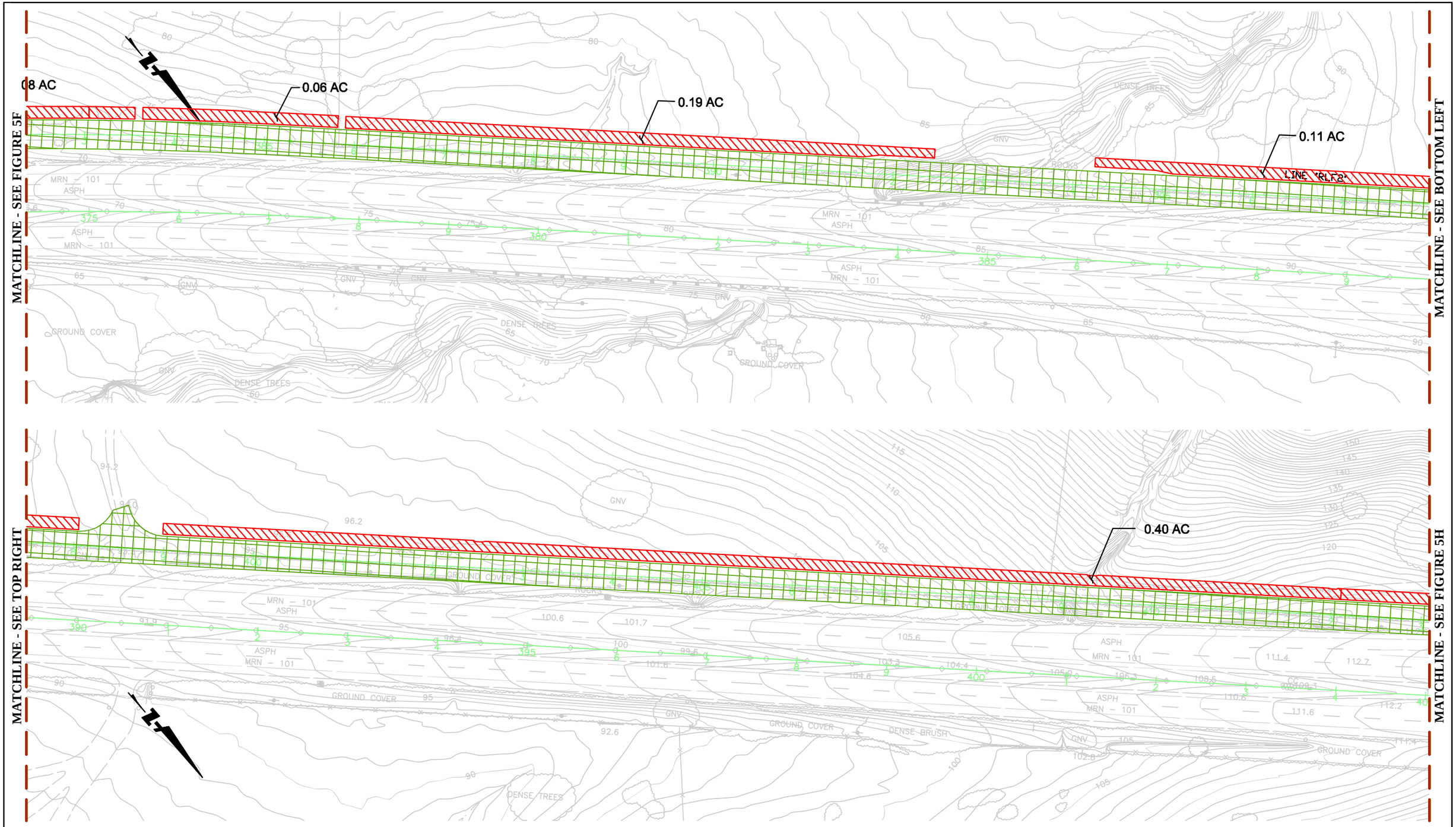
NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

FIGURE 5F

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

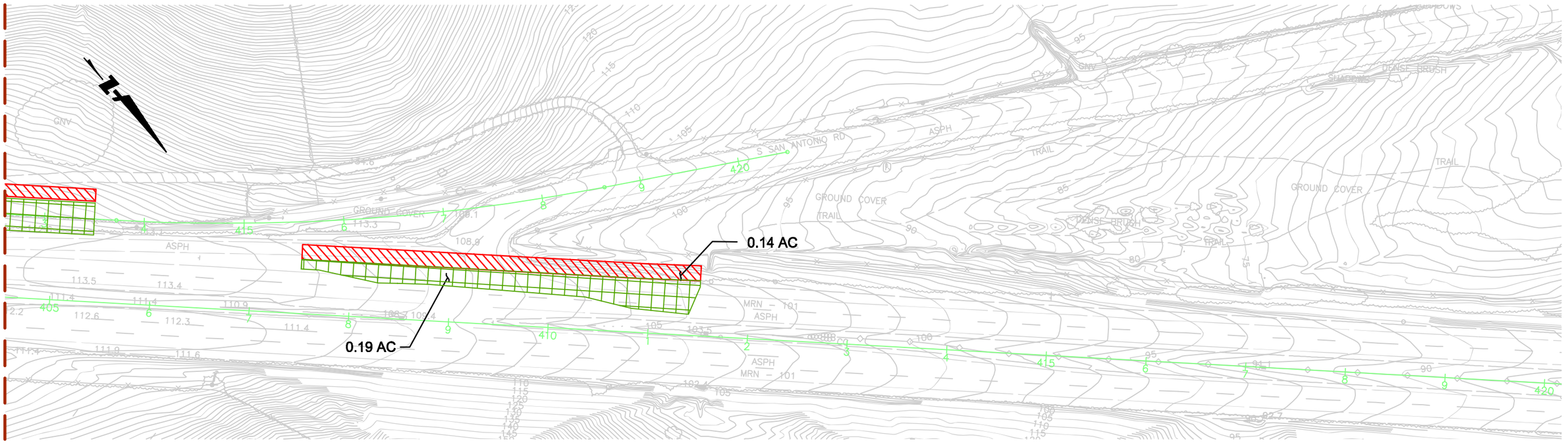
LEGEND:
- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

FIGURE 5G
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-5.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- PROPOSED IMPERVIOUS DRAINAGE AREA TO HM FACILITY
- PROPOSED BIOSTRIP (HM FACILITY)
- PROPOSED DETENTION BASIN (HM FACILITY)

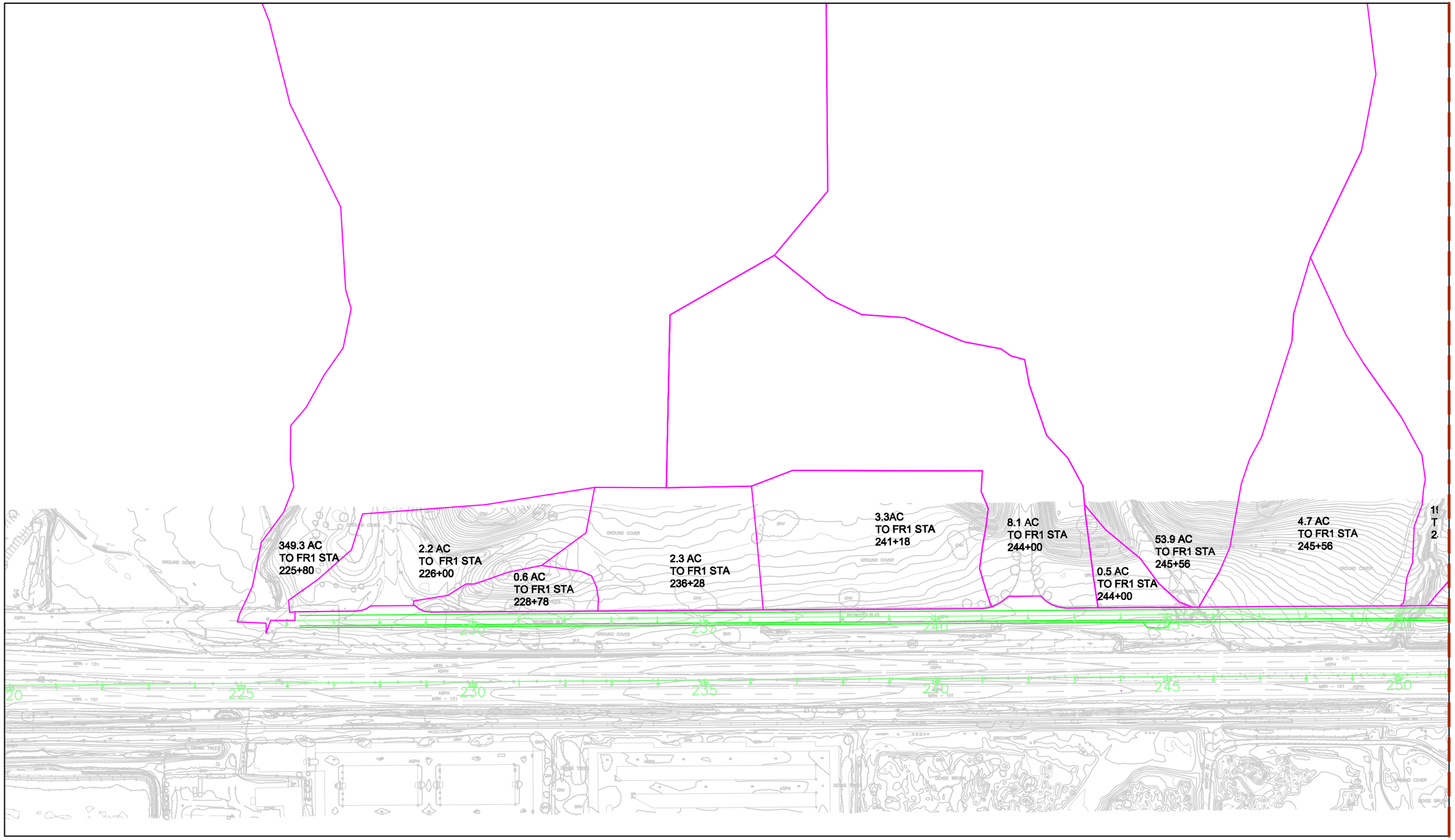
NOTE:
11.1 ACRES OF ADDITIONAL IMPERVIOUS AREA WITHIN PROJECT SITE

FIGURE 5H

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HYDROGRAPH MODIFICATION FACILITIES

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-6.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
200 0 200 400

FIGURE 6A

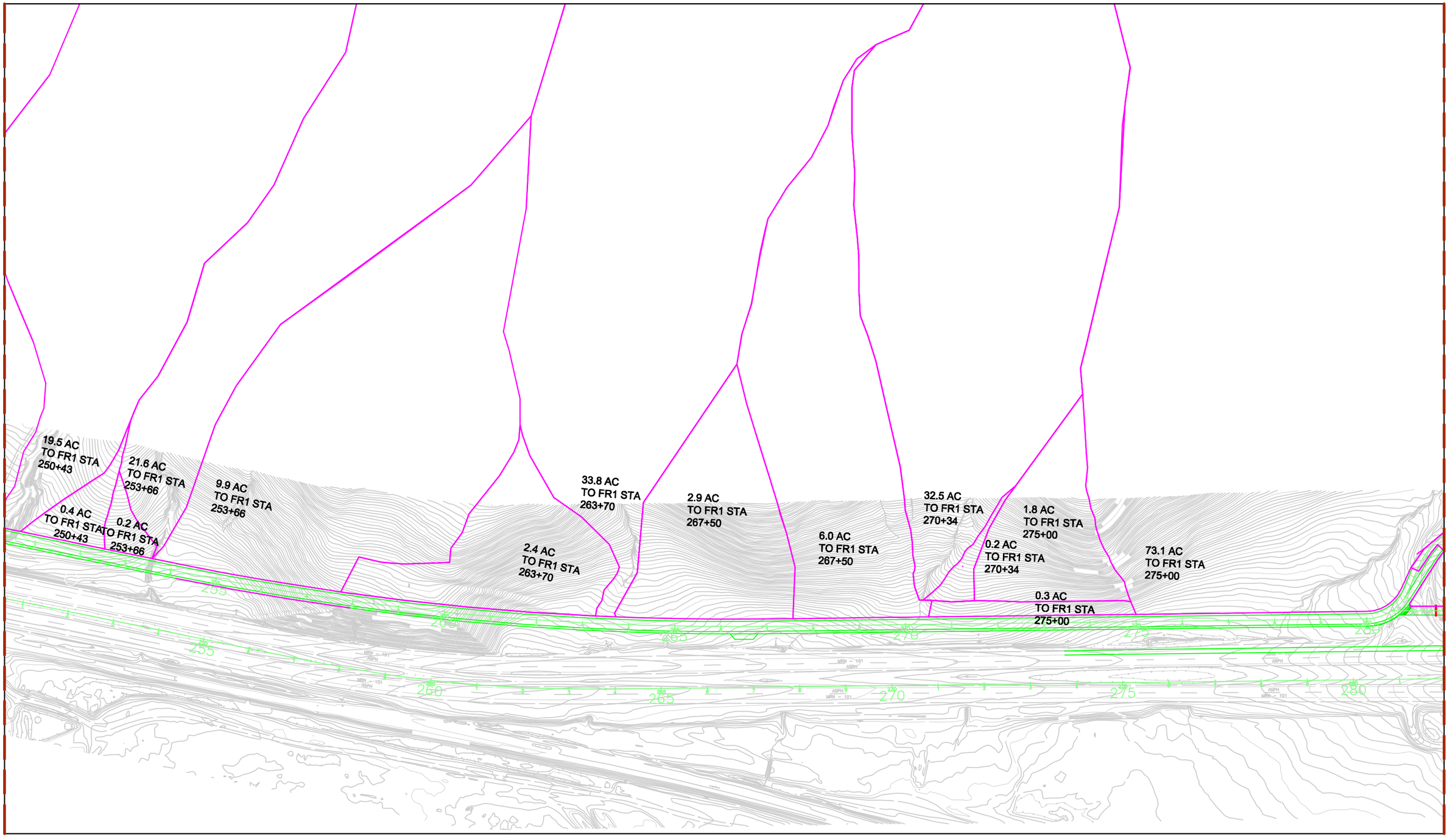
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 6A

MATCHLINE - SEE FIGURE 6C



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-6.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE

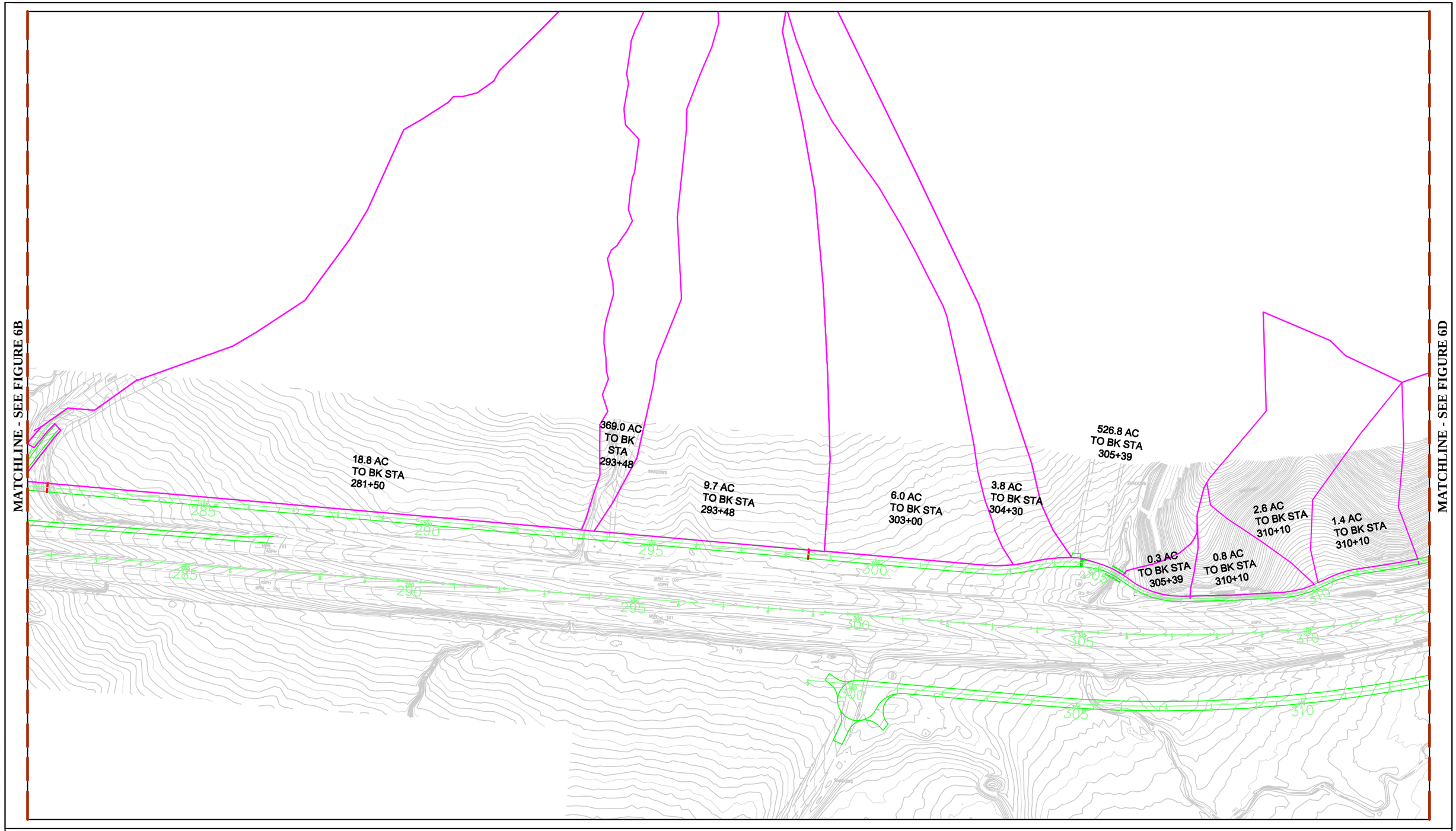
200 0 200 400

FIGURE 6B

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-6.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

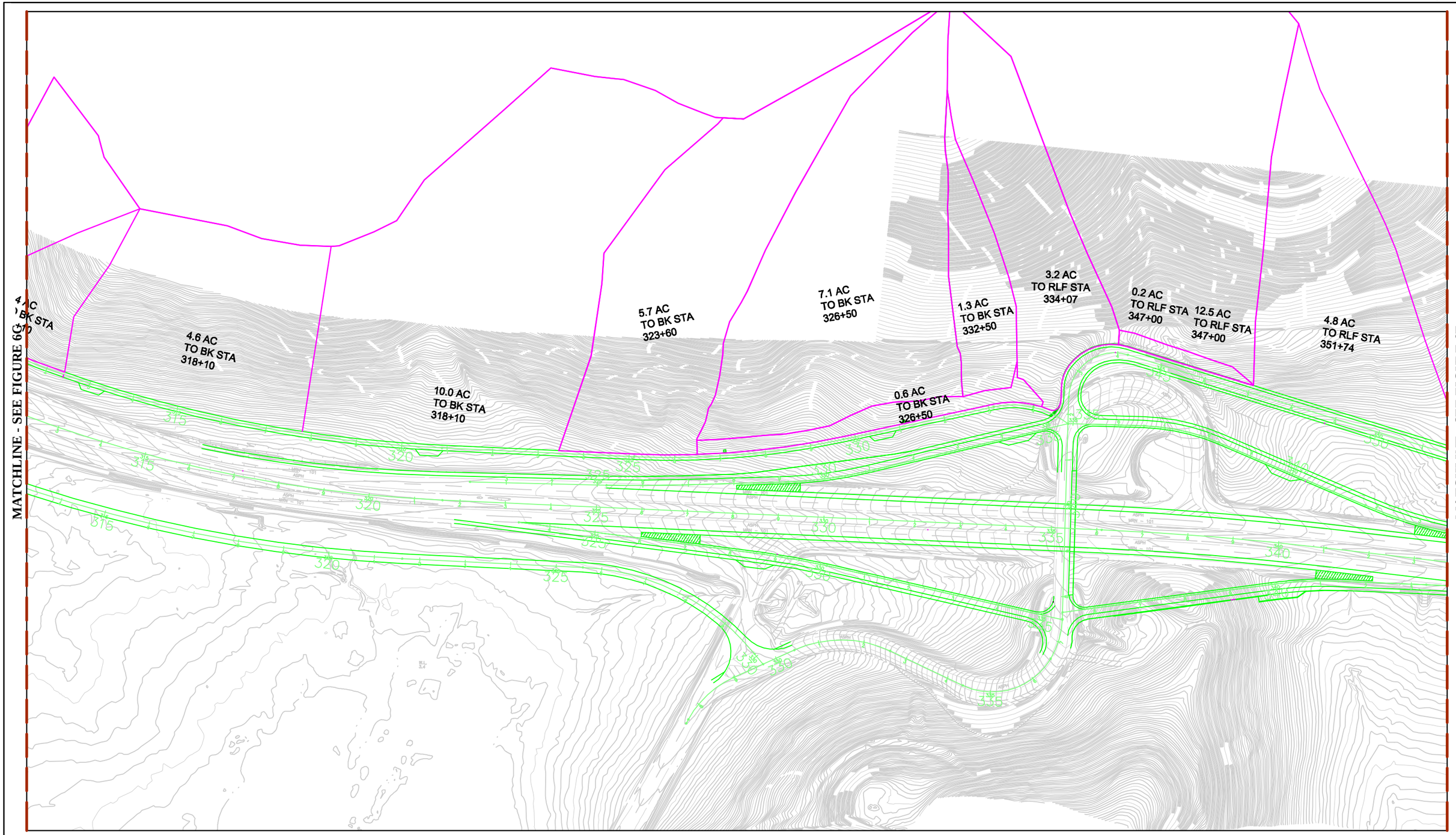
GRAPHIC SCALE
200 0 200 400

FIGURE 6C

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-6.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

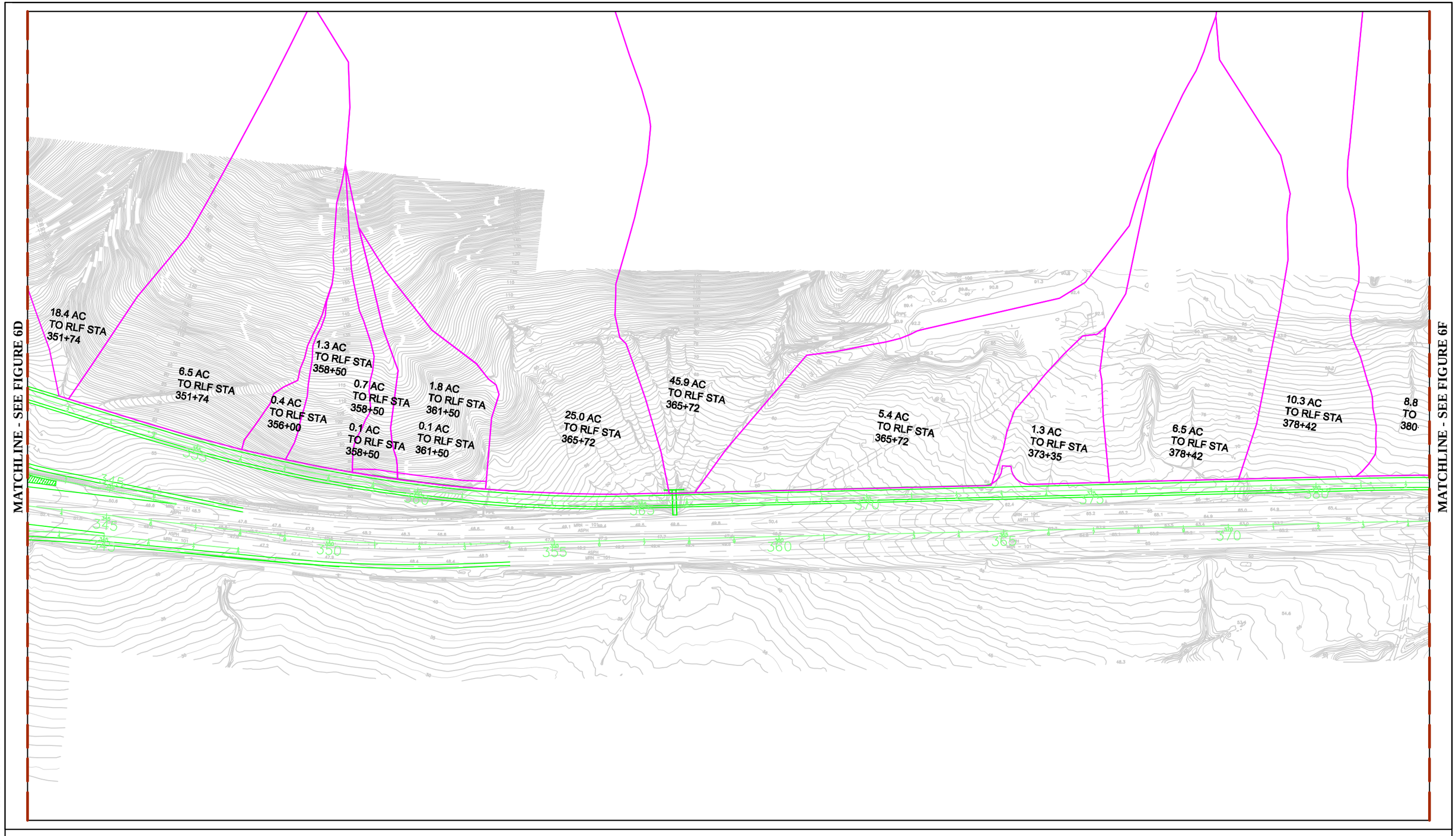
GRAPHIC SCALE
200 0 200 400

FIGURE 6D

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

BkF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-6.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
200 0 200 400

FIGURE 6E

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

BkF

© BKF Engineers

MATCHLINE - SEE FIGURE 6E

MATCHLINE - SEE FIGURE 6G

3.8 AC
TO RLF STA
380+90

1.6 AC
TO RLF STA
383+60

15.1 AC
TO RLF STA
385+85

23.3 AC
TO RLF STA
388+50

1.7 AC
TO RLF STA
388+50

351.7 AC
TO RLF STA
393+55

3.9 AC
TO RLF STA
393+55

3.5 AC
TO RLF STA
402+50

3.4 AC
TO RLF STA
402+50

5.5 AC
TO RLF STA
404+50

0.8 AC
TO RLF STA
412+00

0.2 AC
TO RLF STA
409+33

7.2 AC
TO RLF STA
409+33

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-6.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
200 0 200 400

FIGURE 6F

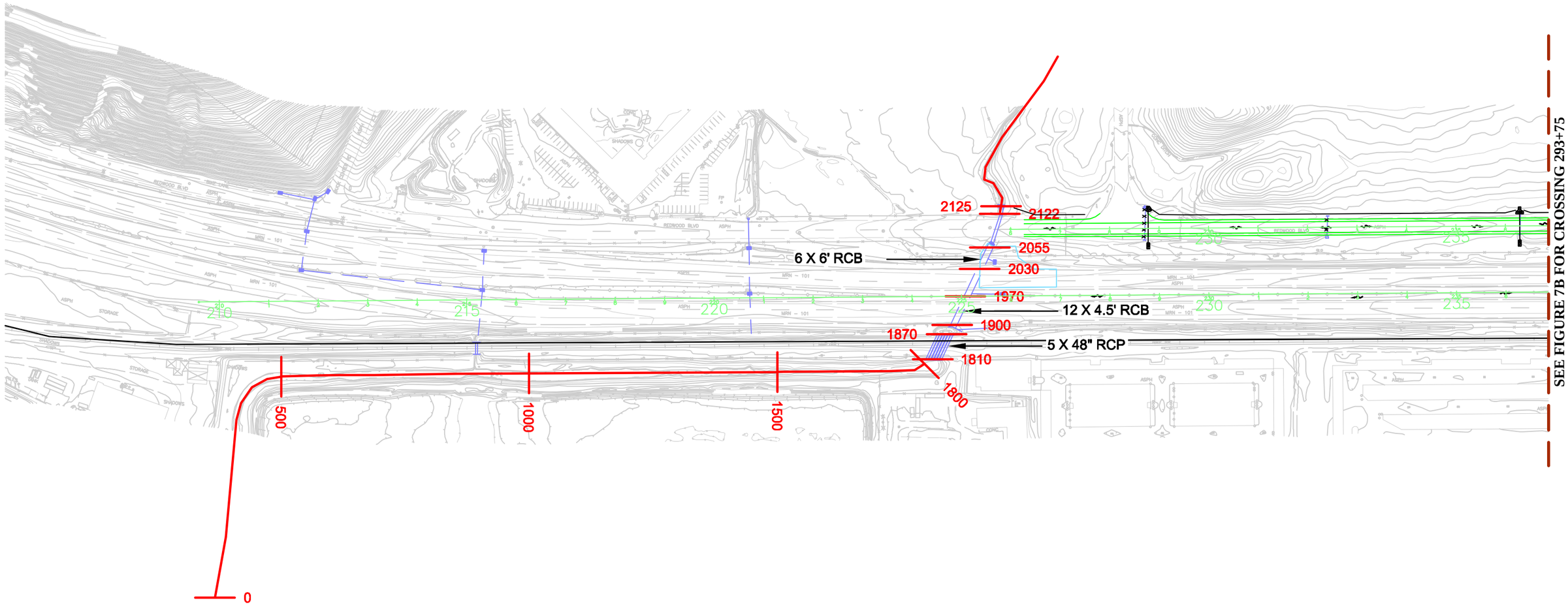
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

BKF

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

FIGURE 6G
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
OFF-SITE DRAINAGE AREAS

© BKF Engineers



JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

SEE FIGURE 3 FOR HIGWAY DRAINAGE AREAS

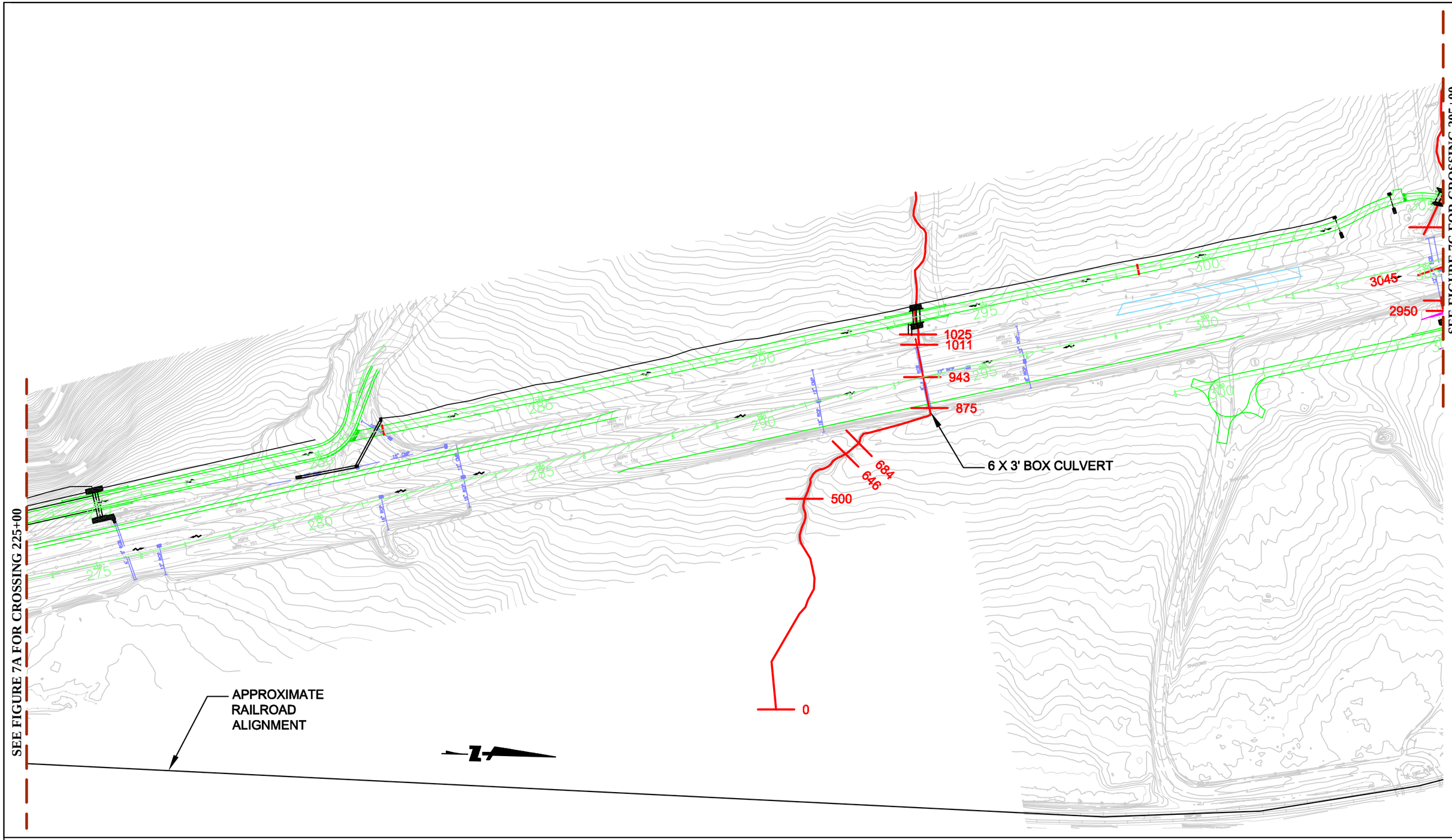
GRAPHIC SCALE
200 0 200 400

FIGURE 7A
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HEC-RAS CROSS SECTIONS FOR CREEK CROSSINGS 225+00

BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-AREAS-FIG7.dwg
PLOT DATE: 10-11-11
PLOTTED BY: muro

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-AREAS-FIG7.dwg
PLOT DATE: 10-11-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

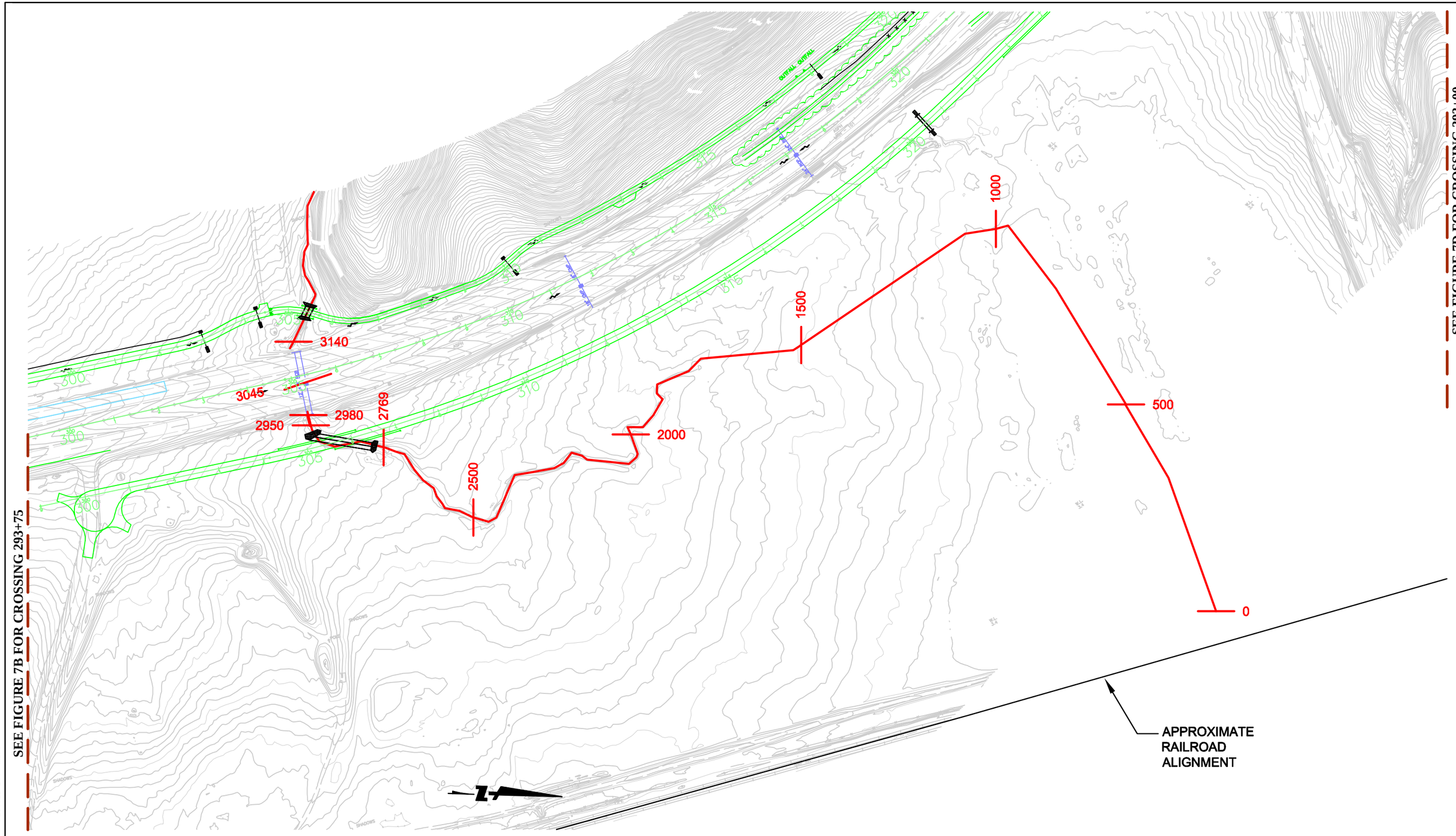
SEE FIGURE 3 FOR
HIGWAY DRAINAGE AREAS

FIGURE 7B

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HEC-RAS CROSS SECTIONS FOR CREEK CROSSINGS 293+75

BKF

© BKF Engineers



DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-AREAS-FIG7.dwg
PLOT DATE: 10-11-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

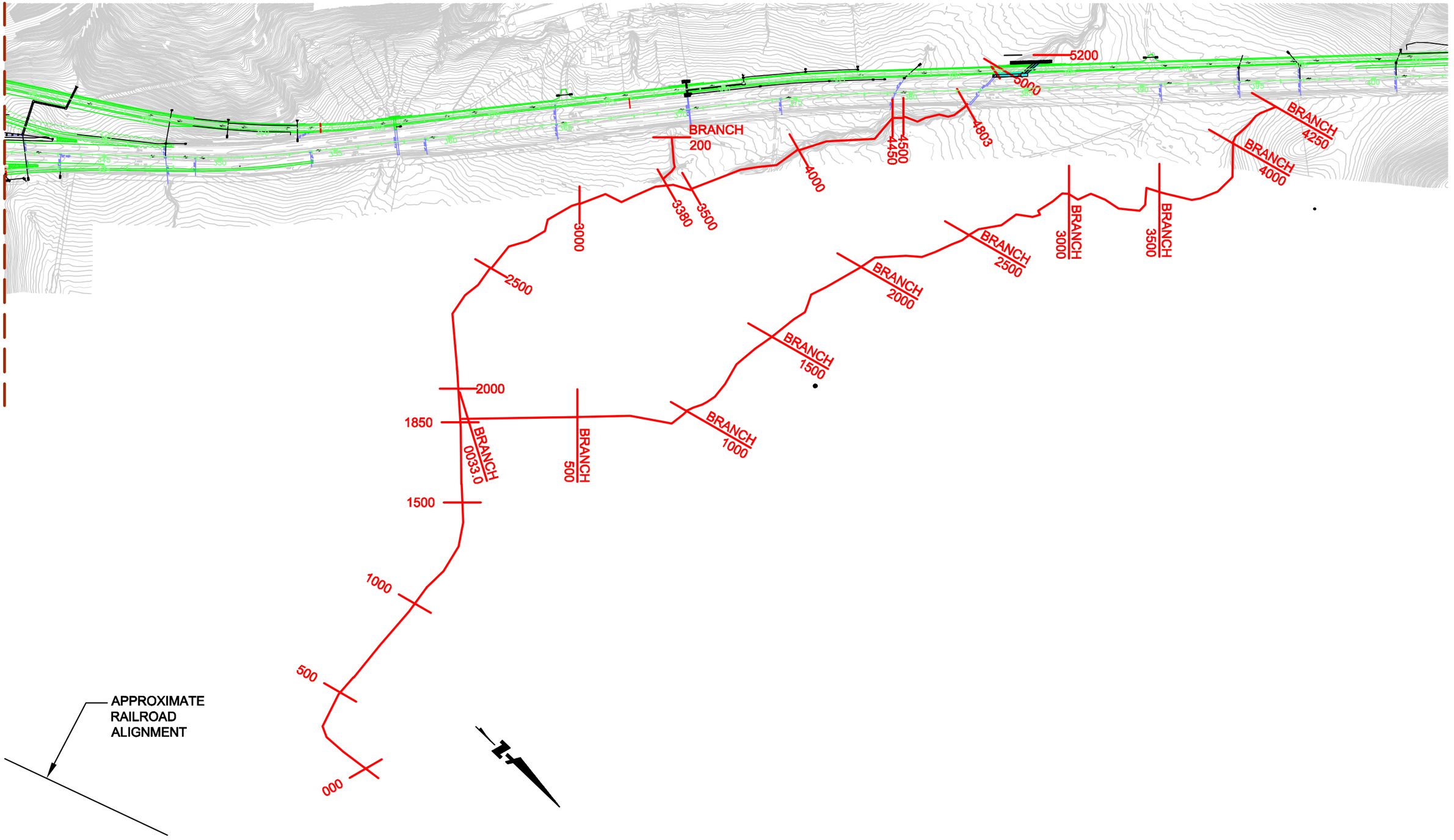
SEE FIGURE 3 FOR
HIGWAY DRAINAGE AREAS

GRAPHIC SCALE
200 0 200 400

FIGURE 7C
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HEC-RAS CROSS SECTIONS FOR CREEK CROSSINGS 305+00

BkF

© BKF Engineers



JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

SEE FIGURE 4 FOR HIGWAY DRAINAGE AREAS

GRAPHIC SCALE
400 0 400 800

FIGURE 7D

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
HEC-RAS CROSS SECTIONS FOR CREEK CROSSINGS 393+00

BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-AREAS-FIG7.dwg
PLOT DATE: 10-11-11
PLOTTED BY: muro

Marin Sonoma Narrows Improvement Project

TABLE 1A1
County Culvert Drainage Areas

Culvert Statoin	Alignment	Drainage Plan System	Drainage Areas								Total Culvert Drainage Area (acres)
			Hillside (acres)			Frontage Road (acres)			Shoulder/Median (acres)		
228+78	FR1	1c	0.62			0.15					0.77
236+28	FR1	3c	2.30			0.13					2.43
241+18	FR1	4c	3.30			0.18					3.48
244+00	FR1	5b	8.10	0.47		0.15	0.09				8.81
245+56	FR1	6c	53.90	4.70		0.15					58.75
250+43	FR1	7c	19.50	0.40		0.09					19.99
253+66	FR1	8c	0.20	21.60	9.90	0.04	0.16				31.9
263+70	FR1	11c	2.40	33.80		0.20					36.4
267+50	FR1	12b	2.90	6.00		0.16	0.11				9.17
270+34	FR1		32.20	0.20							32.4
270+34	FR1		32.20	0.20							32.4
Area included from FR1 270+34											- 32.40
275+00	FR1	14d	1.80	0.30	73.10	0.16	0.12				75.48
281+50	BK	15b	18.80			0.26					19.06
293+48	BK	16d	369.00	9.70		0.12					378.82
303+00	BK	17b	6.00			0.08					6.08
304+30	BK	18b	3.80			0.12					3.92
305+39	BK	19d	526.80	0.30							527.1
310+10	BK	12b	0.80	2.60	1.40	0.12	0.07				4.99
318+10	BK	23b	4.60	10.10		0.07	0.08				14.85
323+60	BK	25b	5.70	7.10	1.30	0.04	0.07				14.81
			0.60								
326+50	BK	25d	7.10								7.1
326+50	BK	25f	0.60	7.10	1.30	0.07					9.07
Area included from BK 326+50											- 7.10
Area included from BK 332+50											- 1.30
332+50	BK	87b	1.30								1.3
334+07	BK	32b	3.20			0.09					3.29
347+00	RLF	37b	12.60	0.20		0.12					12.92
351+74	RLF	43b	4.80	18.40	6.50	0.18	0.16				30.04
356+00	RLF	44b	0.40			0.04					0.44
358+50	RLF	46b	1.30	0.70	0.03	0.06	0.04				2.13
361+50	RLF	47b	1.80	0.10		0.08					1.98
365+72	RLF	48c	25.00	45.90	5.40	0.31	0.52				78.66
			1.30			0.23					
Area included from RLF 373+35											- 1.53
373+35	RLF	49c	1.30			0.23					1.53
378+42	RLF	50d	6.50	10.30		0.22	0.18				17.2
380+90	RLF	85b	8.80			0.20					9
383+60	RLF	85d	1.60			0.16					1.76
385+85	RLF	85f	15.10			0.20					15.3
388+50	RLF	51b	23.30	1.70		0.29					25.29
393+55	RLF	52d	351.60	3.90		0.48	0.17				356.15
393+55	RLF	52d	351.60	3.90		0.48	0.17		0.93		357.08
Area included from RLF 393+55											- 356.15
Area included from RLF 398+68											- 4.07
398+68	RLF	53c	3.90			0.17					4.07
402+50	RLF	54b	3.50	3.40		0.11	0.17				7.18
404+50	RLF	55b	5.50			0.31					5.81
409+33	RLF	56b	7.20	0.20		0.22					7.62
412+00	RLF	57b	0.80	4.00		0.15					4.95
305+22	FR2	20d	6.00	3.80	526.80	0.08	0.08	0.12	1.27	1.18	541.39
			0.30			0.44			1.32		
Area included from BK 305+39											- 527.10
Area included from BK 304+30											- 3.92
Area included from BK 303+00											- 6.08
320+50	FR2	24c	0.80	2.60	1.40	0.12	0.07	0.07	1.00	1.05	31.54
			4.60	10.10		0.09	0.08	0.09	2.60	1.85	
						0.87			4.15		
Area included from BK 310+10											- 4.99
Area included from BK 318+10											- 14.85
328+57	FR2	27c				0.18	0.68		0.37	1.28	12.96
									0.35	0.57	
									1.51	2.53	
									0.84	4.13	
									0.52		

P line mapped 1,860 = Table 1,868
99.6%

TABLE 1A2
Rational Method Parameters, Area and Slope, Southern Project

Alignment	Drainage Area Station Outfall	Overland + Rill			Transition Elevation (feet)	End of Rill Elevation (feet)	Overland Slope (feet/ft)	Overland Length (feet)	Rill Flow Length (feet)	Rill Flow Slope (feet/ft)	Concentrated Flow Distance (feet)
		Drainage Area (acres)	Flow Path (feet)	Upstream Elevation (feet)							
FR1	225+80	349.30	1,642	1,560	1,440	880	0.400	300	1,342	0.42	6,180
FR1	226+00	2.20	252	30	19	19	0.037	128	124	0.00	0
FR1	228+78	.62	200	30	19	19	0.037	128	72	0.00	0
FR1	236+28	2.30	275	30	17	17	0.043	139	136	0.00	0
FR1	241+18	3.30	279	45	14	13	0.103	214	65	0.02	0
FR1	244+00	8.10	300	40	35	34	0.017	86	214	0.00	779
FR1	244+00	.47	230	35	23	23	0.040	133	97	0.00	0
FR1	245+56	53.90	2,468	740	680	120	0.200	298	2,170	0.26	1,370
FR1	245+56	4.70	938	120	70	10	0.167	272	666	0.09	0
FR1	250+43	19.50	819	440	360	200	0.267	300	519	0.31	1,290
FR1	250+43	.40	276	50	15	14	0.117	228	48	0.02	0
FR1	253+66	.20	225	40	14	14	0.087	196	29	0.00	0
FR1	253+66	21.60	2,376	760	675	150	0.283	300	2,076	0.25	782
FR1	253+66	9.90	1,094	220	180	55	0.133	243	851	0.15	293
FR1	263+70	2.40	1,146	240	200	45	0.133	243	903	0.17	0
FR1	263+70	33.80	1,762	800	700	360	0.333	300	1,462	0.23	1,429
FR1	267+50	2.90	625	130	60	15	0.233	300	325	0.14	0
FR1	267+50	6.00	1,370	260	100	20	0.533	300	1,070	0.07	0
FR1	270+34	32.20	1,890	800	680	340	0.400	300	1,590	0.21	1,470
FR1	270+34	.20	330	85	30	30	0.183	285	45	0.00	0
FR1	275+00	1.80	557	160	59	13	0.337	300	257	0.18	0
FR1	275+00	.30	350	24	13	13	0.037	128	222	0.00	0
FR1	275+00	73.10	1,420	600	420	230	0.600	300	1,120	0.17	1,700
BK	281+50	18.80	775	105	75	49	0.100	211	564	0.05	405
BK	293+48	369.00	1,050	1,560	1,440	1,080	0.400	300	750	0.48	7,142
BK	293+48	9.70	1,450	160	130	60	0.100	211	1,239	0.06	270
BK	303+00	6.00	980	90	70	40	0.067	172	808	0.04	0
BK	304+30	3.80	980	90	70	40	0.067	172	808	0.04	0
BK	305+39	526.80	1,560	1,420	1,280	800	0.467	300	1,260	0.38	7,370
BK	305+39	.30	260	77	38	38	0.130	240	20	0.00	0
BK	310+10	.80	310	87	26	26	0.203	300	10	0.00	0
BK	310+10	2.60	350	120	80	62	0.133	243	107	0.17	310
BK	310+10	1.40	345	110	70	58	0.133	243	102	0.12	0

TABLE 1A3
Rational Method Parameters, Area and Slope, Northern Project

Alignment	Drainage Area Station Outfall	Overland + Rill			Transition Elevation (feet)	End of Rill Elevation (feet)	Overland Slope (feet/ft)	Overland Length (feet)	Rill Flow Length (feet)	Rill Flow Slope (feet/ft)	Concentrated Flow Distance (feet)
		Drainage Area (acres)	Flow Path (feet)	Upstream Elevation (feet)							
BK	318+10	4.60	475	120	50	18	0.233	300	175	0.18	0
BK	318+10	10.00	1,120	300	240	18	0.200	298	822	0.27	0
BK	323+60	5.70	800	420	370	50	0.167	272	528	0.61	450
BK	326+50	7.10	800	420	370	50	0.167	272	528	0.61	450
BK	326+50	.60	770	90	39	39	0.170	275	495	0.00	0
BK	332+50	1.30	630	400	300	80	0.333	300	330	0.67	0
BK	334+07	3.20	760	420	315	120	0.350	300	460	0.42	0
RLF	347+00	12.60	595	440	315	235	0.417	300	295	0.27	432
RLF	347+00	.20	312	108	83	83	0.083	192	120	0.00	0
RLF	351+74	4.80	770	340	285	90	0.183	285	485	0.40	0
RLF	351+74	18.40	450	360	280	240	0.267	300	150	0.27	930
RLF	351+74	6.50	880	280	200	85	0.267	300	580	0.20	270
RLF	356+00	.40	350	150	73	73	0.257	300	50	0.00	0
RLF	358+50	1.30	620	280	200	85	0.267	300	320	0.36	270
RLF	358+50	.70	620	280	200	85	0.267	300	320	0.36	270
RLF	358+50	.03	110	81	73	73	0.027	109	1	0.00	0
RLF	361+50	1.80	440	175	120	70	0.183	285	155	0.32	0
RLF	361+50	.10	200	81	60	60	0.070	176	24	0.00	0
RLF	365+72	25.00	1,350	410	310	105	0.333	300	1,050	0.20	380
RLF	365+72	45.90	795	560	440	320	0.400	300	495	0.24	1,500
RLF	365+72	5.40	300	200	80	79	0.400	300		NA	442
RLF	373+35	1.30	390	87	72	68	0.050	149	241	0.02	0
RLF	378+42	6.50	740	240	120	79	0.400	300	440	0.09	740
RLF	378+42	10.30	900	560	440	280	0.400	300	600	0.27	1,310
RLF	380+90	8.80	900	500	440	280	0.200	298	602	0.27	0
RLF	383+60	1.60	875	130	75	75	0.183	285	590	0.00	0
RLF	385+85	15.10	900	560	440	280	0.400	300	600	0.27	1,310
RLF	388+50	23.30	1,290	480	360	95	0.400	300	990	0.27	526
RLF	388+50	1.70	300	95	90	80	0.017	86	214	0.05	100
RLF	393+55	351.60	920	1,210	1,120	85	0.300	300	620	1.67	6,920
RLF	393+55	3.90	1,040	360	240	96	0.400	300	740	0.19	0
RLF	402+50	3.50	1,160	400	320	96	0.267	300	860	0.26	0
RLF	402+50	3.40	1,160	400	320	96	0.267	300	860	0.26	0
RLF	404+50	5.50	860	360	240	105	0.400	300	560	0.24	0
RLF	409+33	7.20	584	450	320	240	0.433	300	284	0.28	560
RLF	409+33	.20	215	124	107	107	0.057	159	56	0.00	0
RLF	412+00	.80	320	190	118	114	0.240	300	20	0.20	0
RLF	412+00	4.00	670	350	215	117	0.450	300	370	0.26	0
RLF	420+00	2.40	540	215	129	103	0.287	300	240	0.09	0

TABLE 1B1
Rational Method Parameters, Runoff Coefficient, Southern Project

Alignment	Drainage Area Station Outfall	Drainage Area (acres)	Upstream Elevation (feet)	Downstream Elevation (feet)	HDM C -COEFFICENT COMPONENTS								Treatment Flow Coefficient	25-Year Runoff Coefficient	100-Year Runoff Coefficient
					Overall Length (feet)	Overall Slope (feet/feet)	Relief "C"	Soil Infiltration "C"	Vegetal Cover "C"	Surface Storage "C"	Overall Pervious "C"	Percent Impervious (%)			
FR1	225+80	349.3	1,560	10	7,822	.20	0.240	0.140	0.070	0.11	0.56	5	0.13	0.63	0.70
FR1	226+00	2.2	30	20	252	.04	0.110	0.140	0.070	0.11	0.43	0	0.10	0.47	0.70
FR1	228+78	.6	30	16	200	.20	0.240	0.140	0.070	0.11	0.56	0	0.10	0.62	0.70
FR1	236+28	2.3	30	17	275	.20	0.240	0.140	0.070	0.11	0.56	0	0.10	0.62	0.70
FR1	241+18	3.3	45	13	279	.11	0.240	0.140	0.070	0.11	0.56	0	0.10	0.62	0.70
FR1	244+00	8.1	40	14	1,079	.02	0.110	0.140	0.070	0.11	0.43	55	0.43	0.76	0.70
FR1	244+00	.5	35	13	230	.10	0.170	0.140	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	245+56	53.9	740	9	3,838	.19	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	245+56	4.7	120	10	938	.12	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	250+43	19.5	440	7	2,109	.21	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	250+43	.4	50	14	276	.13	0.240	0.140	0.070	0.11	0.56	0	0.10	0.62	0.70
FR1	253+66	.2	40	14	225	.12	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	253+66	21.6	760	14	3,158	.24	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	253+66	9.9	220	55	1,387	.12	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	263+70	2.4	240	15	1,146	.20	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	263+70	33.8	800	15	3,191	.25	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	267+50	2.9	130	16	625	.18	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	267+50	6.0	220	10	1,370	.15	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	270+34	32.2	800	28	3,360	.23	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	270+34	.2	85	30	330	.17	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	275+00	1.8	160	12	557	.27	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
FR1	275+00	.3	24	12	350	.03	0.110	0.070	0.070	0.11	0.36	0	0.10	0.40	0.70
FR1	275+00	73.1	600	12	3,120	.19	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
BK	281+50	18.8	105	41	1,180	.05	0.170	0.100	0.070	0.11	0.45	0	0.10	0.50	0.70
BK	293+48	369.0	1,560	45	8,192	.18	0.240	0.070	0.070	0.11	0.49	5	0.13	0.56	0.70
BK	293+48	9.7	160	48	1,720	.07	0.170	0.100	0.070	0.11	0.45	5	0.13	0.52	0.70
BK	303+00	6.0	90	41	980	.05	0.110	0.100	0.070	0.11	0.39	0	0.10	0.43	0.70
BK	304+30	3.8	90	42	980	.05	0.110	0.100	0.070	0.11	0.39	0	0.10	0.43	0.70
BK	305+39	526.8	1,420	33	8,930	.16	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
BK	305+39	.3	77	38	260	.15	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
BK	310+10	.8	87	36	310	.16	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
BK	310+10	2.6	120	26	660	.14	0.240	0.070	0.070	0.11	0.49	1	0.11	0.54	0.70
BK	310+10	1.4	110	28	345	.24	0.240	false	0.070	0.11	0.42	0	0.10	0.46	0.70

Marin Sonoma Narrows Improvement Project

TABLE 1B2
Rational Method Parameters, Runoff Coefficient, Northern Project

Alignment	Drainage Area Station Outfall	Drainage Area (acres)	Upstream Elevation (feet)	Downstream Elevation (feet)	HDM C -COEFFICENT COMPONENTS										
					Overall Length (feet)	Overall Slope (feet/feet)	Relief "C"	Soil Infiltration "C"	Vegetal Cover "C"	Surface Storage "C"	Overall Pervious "C"	Percent Impervious (%)	Treatment Flow Coefficient	25-Year Runoff Coefficient	100-Year Runoff Coefficient
BK	318+10	4.6	120	46	475	.156	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
BK	318+10	10.0	300	47	1,120	.226	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
BK	323+60	5.7	420	50	1,250	.296	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
BK	326+50	7.1	420	50	1,250	.296	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
BK	326+50	.6	90	39	770	.066	0.170	0.070	0.070	0.11	0.42	0	0.10	0.46	0.70
BK	332+50	1.3	400	80	630	.508	0.315	0.070	0.070	0.11	0.57	0	0.10	0.62	0.70
BK	334+07	3.2	420	116	760	.400	0.315	0.070	0.070	0.11	0.57	0	0.10	0.62	0.70
RLF	347+00	12.6	440	112	1,027	.319	0.315	0.070	0.070	0.11	0.57	0	0.10	0.62	0.70
RLF	347+00	.2	108	83	312	.080	0.170	0.070	0.070	0.11	0.42	0	0.10	0.46	0.70
RLF	351+74	4.8	340	67	770	.355	0.315	0.070	0.070	0.11	0.57	0	0.10	0.62	0.70
RLF	351+74	18.4	360	67	1,380	.212	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	351+74	6.5	280	67	1,150	.185	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	356+00	.4	150	67	350	.237	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	358+50	1.3	280	67	890	.239	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	358+50	.7	280	67	890	.239	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	358+50	.0	81	68	110	.118	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	361+50	1.8	175	87	440	.200	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	361+50	.1	81	58	200	.115	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	365+72	25.0	410	58	1,730	.203	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	365+72	45.9	560	68	2,295	.214	0.240	0.070	0.070	0.11	0.49	10	0.16	0.58	0.70
RLF	365+72	5.4	200	67	742	.179	0.240	0.100	0.070	0.11	0.52	10	0.16	0.61	0.70
RLF	373+35	1.3	87	68	390	.049	0.110	0.100	0.070	0.11	0.39	30	0.28	0.60	0.70
RLF	378+42	6.5	240	69	1,480	.116	0.240	0.100	0.070	0.11	0.52	15	0.19	0.63	0.70
RLF	378+42	10.3	560	77	2,210	.219	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	380+90	8.8	500	78	900	.469	0.315	0.070	0.070	0.11	0.57	0	0.10	0.62	0.70
RLF	383+60	1.6	130	78	875	.059	0.170	0.070	0.070	0.11	0.42	0	0.10	0.46	0.70
RLF	385+85	15.1	560	80	2,210	.217	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	388+50	23.3	480	77	1,816	.222	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	388+50	1.7	95	80	400	.038	0.110	0.070	0.070	0.11	0.36	0	0.10	0.40	0.70
RLF	393+55	351.6	1,210	80	7,840	.144	0.240	0.070	0.070	0.11	0.49	0	0.10	0.54	0.70
RLF	393+55	3.9	360	95	1,040	.255	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	402+50	3.5	400	97	1,160	.261	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	402+50	3.4	400	97	1,160	.261	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	404+50	5.5	360	106	860	.295	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	409+33	7.2	450	107	1,144	.300	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	409+33	.2	124	107	215	.079	0.170	0.100	0.070	0.11	0.45	0	0.10	0.50	0.70
RLF	412+00	.8	190	120	320	.219	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70
RLF	412+00	4.0	350	119	670	.345	0.315	0.070	0.070	0.11	0.57	0	0.10	0.62	0.70
RLF	420+00	2.4	215	105	540	.204	0.240	0.100	0.070	0.11	0.52	0	0.10	0.57	0.70

Marin Sonoma Narrows Improvement Project

TABLE 1C1
Rational Method Parameters, Intensity and Flow, Southern Project

Alignment	Drainage Area Station Outfall	Overland + Rill								Treatment	25-Year	100-Year	Treatment	25-Year	100-Year
		Drainage Area (acres)	Overland Flow Travel (minutes)	Rill Velocity (fps)	Shallow Conc. Flow (minutes)	Conc. Flow (minutes)	Time of Conc (minutes)	25-Year Rainfall Intensity (in/hour)	100-Year Rainfall Intensity (in/hour)	Runoff Coef.	Runoff Coef.	Runoff Coef.	Flow Rate (cfs)	Peak Flow Rate (cfs)	Peak Flow Rate (cfs)
FR1	225+80	349.3	6.81	4.5	5.0	21	32	1.46	1.82	.13	0.63	0.70	9.08	324.0	445.0
FR1	226+00	2.2	8.94	.0	.0		10	2.51	3.12	.10	0.47	0.70	.04	2.6	4.8
FR1	228+78	.6	8.94	.0	.0		10	2.51	3.12	.10	0.62	0.70	.01	1.0	1.4
FR1	236+28	2.3	8.94	.0	.0		10	2.51	3.12	.10	0.62	0.70	.05	3.6	5.0
FR1	241+18	3.3	8.94	.9	1.2		10	2.49	3.10	.10	0.62	0.70	.07	5.1	7.2
FR1	244+00	8.1	8.94	.5	7.5	3	19	1.87	2.33	.43	0.76	0.70	.70	11.5	13.2
FR1	244+00	.5	8.94	.0	.0		10	2.51	3.12	.10	0.54	0.70	.01	.6	1.0
FR1	245+56	53.9	8.94	3.5	10.2	5	24	1.69	2.10	.10	0.54	0.70	1.08	49.0	79.3
FR1	245+56	4.7	8.94	2.1	5.3		14	2.13	2.66	.10	0.54	0.70	.09	5.4	8.7
FR1	250+43	19.5	8.01	3.9	2.2	4	15	2.11	2.63	.10	0.54	0.70	.39	22.2	35.9
FR1	250+43	.4	8.94	1.0	.8		10	2.51	3.12	.10	0.62	0.70	.01	.6	.9
FR1	253+66	.2	8.94	.0	.0		10	2.51	3.12	.10	0.54	0.70	.00	.3	.4
FR1	253+66	21.6	7.81	3.5	9.8	3	20	1.81	2.26	.10	0.54	0.70	.43	21.1	34.1
FR1	253+66	9.9	8.94	2.7	5.3	1	15	2.07	2.58	.10	0.54	0.70	.20	11.0	17.9
FR1	263+70	2.4	8.94	2.9	5.2		14	2.14	2.66	.10	0.54	0.70	.05	2.8	4.5
FR1	263+70	33.8	7.32	3.4	7.2	5	19	1.85	2.31	.10	0.54	0.70	.68	33.8	54.6
FR1	267+50	2.9	8.44	2.6	2.1		11	2.45	3.05	.10	0.54	0.70	.06	3.8	6.2
FR1	267+50	6.0	6.07	1.9	9.3		15	2.06	2.56	.10	0.54	0.70	.12	6.6	10.8
FR1	270+34	32.2	6.81	3.2	8.2	5	20	1.83	2.28	.10	0.54	0.70	.64	31.7	51.3
FR1	270+34	.2	8.94	.0	.0		10	2.51	3.12	.10	0.54	0.70	.00	.3	.4
FR1	275+00	1.8	7.29	3.0	1.4		10	2.51	3.12	.10	0.54	0.70	.04	2.4	3.9
FR1	275+00	.3	8.94	.0	.0		10	2.51	3.12	.10	0.40	0.70	.01	.3	.7
FR1	275+00	73.1	5.79	2.9	6.5	6	18	1.92	2.39	.10	0.54	0.70	1.46	75.5	122.2
BK	281+50	18.8	8.94	1.5	6.3	1	17	1.99	2.48	.10	0.50	0.70	.38	18.5	32.6
BK	293+48	369.0	6.81	4.8	2.6	24	33	1.44	1.80	.13	0.56	0.70	9.59	299.3	464.6
BK	293+48	9.7	8.94	1.7	12.4	1	22	1.74	2.16	.13	0.52	0.70	.25	8.7	14.7
BK	303+00	6.0	8.94	1.3	10.0		19	1.87	2.33	.10	0.43	0.70	.12	4.8	9.8
	304+30	3.8	8.94	1.3	10.0		19	1.87	2.33	.10	0.43	0.70	.08	3.0	6.2
BK	305+39	526.8	6.40	4.3	4.9	25	36	1.39	1.74	.10	0.57	0.70	10.54	420.1	640.3
BK	305+39	.3	8.94	.0	.0		10	2.51	3.12	.10	0.57	0.70	.01	.4	.7
BK	310+10	.8	8.92	.0	.0		10	2.51	3.12	.10	0.54	0.70	.02	1.1	1.7
BK	310+10	2.6	8.94	2.9	.6	1	11	2.44	3.04	.11	0.54	0.70	.06	3.5	5.5
BK	310+10	1.4	.00	2.4	.7		10	2.51	3.12	.10	0.46	0.70	.03	1.6	3.1

Intercept Coefficient (Shallow) n =	0.15	(short pasture grass)	Rainfall Intensity, 2-yr 24-hour	3.5	
Intercept Coefficient (Sheet) k =	0.213	(short grass prairie)	Sheeting flow distance is 300-feet		

Marin Sonoma Narrows Improvement Project

TABLE 1C2

Rational Method Parameters, Intensity and Flow, Northern Project

Alignment	Drainage Area Station Outfall	Overland + Rill			Shallow Conc. Flow (minutes)	Conc. Flow (minutes)	Time of Conc (minutes)	25-Year Rainfall Intensity (in/hour)	100-Year Rainfall Intensity (in/hour)	Treatment Runoff Coef.	25-Year Runoff Coef.	100-Year Runoff Coef.	Treatment Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
		Drainage Area (acres)	Overland Flow Travel (minutes)	Rill Velocity (fps)											
BK	318+10	4.6	8.4	3.0	1.7		10.12	2.49	3.11	.10	0.54	0.70	.1	6.2	10.0
BK	318+10	10.0	8.9	3.6	1.4		10.31	2.47	3.08	.10	0.54	0.70	.2	13.3	21.6
BK	323+60	5.7	8.9	5.4	.8	2	11.27	2.37	2.96	.10	0.54	0.70	.1	7.3	11.8
BK	326+50	7.1	8.9	5.4	.8	2	11.27	2.37	2.96	.10	0.54	0.70	.1	9.1	14.7
BK	326+50	.6	8.9	.0	.0		10.00	2.51	3.12	.10	0.46	0.70	.0	.7	1.3
BK	332+50	1.3	7.3	5.7	.9		10.00	2.51	3.12	.10	0.62	0.70	.0	2.0	2.8
BK	334+07	3.2	7.2	4.5	1.1		10.00	2.51	3.12	.10	0.62	0.70	.1	5.0	7.0
RLF	347+00	12.6	6.7	3.6	1.4	1	10.00	2.51	3.12	.10	0.62	0.70	.3	19.6	27.6
RLF	347+00	.2	8.9	.0	.0		10.00	2.51	3.12	.10	0.46	0.70	.0	.2	.4
RLF	351+74	4.8	8.9	4.4	1.1		10.01	2.51	3.12	.10	0.62	0.70	.1	7.5	10.5
RLF	351+74	18.4	8.0	3.6	1.4	3	12.49	2.26	2.82	.10	0.54	0.70	.4	22.5	36.3
RLF	351+74	6.5	8.0	3.1	1.6	1	10.51	2.45	3.05	.10	0.54	0.70	.1	8.6	13.9
RLF	356+00	.4	8.1	.0	.0		10.00	2.51	3.12	.10	0.54	0.70	.0	.5	.9
RLF	358+50	1.3	8.0	4.2	1.2	1	10.10	2.50	3.11	.10	0.54	0.70	.0	1.7	2.8
RLF	358+50	.7	8.0	4.2	1.2	1	10.10	2.50	3.11	.10	0.54	0.70	.0	.9	1.5
RLF	358+50	.0	8.9	.0	.0		10.00	2.51	3.12	.10	0.54	0.70	.0	.0	.1
RLF	361+50	1.8	8.9	4.0	1.2		10.13	2.49	3.10	.10	0.54	0.70	.0	2.4	3.9
RLF	361+50	.1	8.9	.0	.0		10.00	2.51	3.12	.10	0.54	0.70	.0	.1	.2
RLF	365+72	25.0	7.3	3.1	1.6	1	10.21	2.48	3.09	.10	0.54	0.70	.5	33.5	54.1
RLF	365+72	45.9	6.8	3.4	1.5	5	13.26	2.20	2.74	.16	0.58	0.70	1.5	59.1	88.1
RLF	365+72	5.4	6.8	.0	.0	1	10.00	2.51	3.12	.16	0.61	0.70	.2	8.3	11.8
RLF	373+35	1.3	8.9	.9	2.8		11.70	2.33	2.91	.28	0.60	0.70	.1	1.8	2.6
RLF	378+42	6.5	6.8	2.1	2.3	2	11.62	2.34	2.92	.19	0.63	0.70	.2	9.7	13.3
RLF	378+42	10.3	6.8	3.6	1.4	4	12.56	2.26	2.81	.10	0.54	0.70	.2	12.5	20.3
	380+90	8.8	8.9	3.6	1.4		10.32	2.47	3.08	.10	0.62	0.70	.2	13.5	19.0
RLF	383+60	1.6	8.9	.0	.0		10.00	2.51	3.12	.10	0.46	0.70	.0	1.9	3.5
	385+85	15.1	6.8	3.6	1.4	4	12.56	2.26	2.81	.10	0.54	0.70	.3	18.4	29.7
RLF	388+50	23.3	6.8	3.6	1.4	2	10.00	2.51	3.12	.10	0.57	0.70	.5	33.4	50.9
RLF	388+50	1.7	8.9	1.5	.9		10.22	2.48	3.09	.10	0.40	0.70	.0	1.7	3.7
RLF	393+55	351.6	7.6	9.0	.6	23	31.26	1.48	1.85	.10	0.54	0.70	7.0	281.4	455.1
RLF	393+55	3.9	6.8	3.1	1.6		10.00	2.51	3.12	.10	0.57	0.70	.1	5.6	8.5
	402+50	3.5	8.0	3.6	1.4		10.00	2.51	3.12	.10	0.57	0.70	.1	5.0	7.7
RLF	402+50	3.4	8.0	3.6	1.4		10.00	2.51	3.12	.10	0.57	0.70	.1	4.9	7.4
RLF	404+50	5.5	6.8	3.4	1.5		10.00	2.51	3.12	.10	0.57	0.70	.1	7.9	12.0
RLF	409+33	7.2	6.6	3.7	1.3	2	10.00	2.51	3.12	.10	0.57	0.70	.1	10.3	15.7
	409+33	.2	8.9	.0	.0		10.00	2.51	3.12	.10	0.50	0.70	.0	.2	.4
RLF	412+00	.8	8.4	3.1	1.6		10.00	2.51	3.12	.10	0.57	0.70	.0	1.1	1.7
RLF	412+00	4.0	6.5	3.6	1.4		10.00	2.51	3.12	.10	0.62	0.70	.1	6.2	8.7
RLF	420+00	2.4	7.8	2.1	2.4		10.16	2.49	3.10	.10	0.57	0.70	.0	3.4	5.2

Intercept Coefficient (Shallow) n = 0.15 (short pasture grass) Rainfall Intensity, 2-yr 24-hour 3.5

Intercept Coefficient (Sheet) k = 0.213 (short grass prairie) Sheeting flow distance is 300-feet

Marin Sonoma Narrows Improvement Project

Table 2A1
Creek Hydrology at Station 225+00

Creek Station	Draiange Area	Drainage Area (acres)	100-Year Runoff Coefficient "C"	25-Year Runoff Coefficient "C"	C * A 100-Year (acres)	C * A 25-Year (acres)	Time of Concentration (minutes)	Rainfall Intensity 100-Year (in/hour)	Rainfall Intensity 25-Year (in/hour)	Peak Flow Rate 100-Year (cfs)	Peak Flow Rate 25-Year (cfs)	Spill Out 100-Year (cfs)	Spill Out 25-Year (cfs)	Return Spill 100-Year (cfs)	Return Spill 25-Year (cfs)	HEC-RAS Modeled Flow 100-Year (cfs)	HEC-RAS Modeled Flow 25-Year (cfs)	Channel Length (feet)	Flow Velocity (fps)	Travel Time (minutes)
	225+80																			
2125		349.1	0.7	0.63	244.4	219.9	32.4	1.82	1.46	445	321					445	321			
																		3	0.99	0.1
2122		349.1			244.4	219.9	32.5	1.82	1.46	444	321					445	321			
																		66	11.84	0.1
2056		349.1			244.4	219.9	32.5	1.82	1.46	444	321					445	321			
																		1	11.84	0.0
2055		349.1			244.4	219.9	32.5	1.82	1.46	444	321					445	321			
																		155	5.05	0.5
1900		349.1			244.4	219.9	33.1	1.80	1.45	440	318					445	321			
																		30	4.3	0.1
1870		349.1			244.4	219.9	33.2	1.80	1.44	440	318					445	321			
																		60	1.23	0.8
1810		349.1			244.4	219.9	34.0	1.78	1.43	435	314					445	321			
																		10	1.63	0.1
1800		349.1			244.4	219.9	34.1	1.78	1.43	434	314					445	321			
																		300	1.56	3.2
1500		349.1			244.4	219.9	37.3	1.71	1.37	417	301					445	321			
																		500	1.87	4.5
1000		349.1			244.4	219.9	41.7	1.62	1.30	396	286					445	321			
																		500	1.38	6.0
500		349.1			244.4	219.9	47.8	1.52	1.22	372	269					445	321			
																		500	1.17	7.1
0		349.1			244.4	219.9	54.9	1.43	1.15	349	252					445	321			

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.
Culvert at 1840 is 5 x 48" steel pipes conveying flow past the NWPRR tracks
This creek reach is the upper reach of the Creek labeled as Basalt Creek on USGS Topo maps.

Marin Sonoma Narrows Improvement Project

Table 2A2
Creek Hydraulics at Station 225+00, Existing Conditions

River Station (feet)	Contributing Drainage Area	100-Year Peak Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level 100-Year (ft)	Water Level 25-Year (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity 100-Year (fps)	Channel Velocity 25-Year (fps)	Flow Area 25-Year (sqft)	Top Width 25-Year (ft)	Froude Number 25-Year	Top of Bank Elevation (ft)	Length (ft)	Notes
2125	225+80	445	324	7.0	15.3	14.3	14.3	0.0012	1.8	1.9	170.7	72.2	0.2	12.2		
2122		445	324	7.0	15.4	14.3	14.3	0.0003	1.0	1.0	325.9	122.0	0.1	15.0	3	
2089			Culvert													6' x 6' RCB
2056		445	324	7.2	12.7	11.6	13.8	0.0570	13.2	11.8	27.4	6.3	1.0	11.2	66	
2055		445	324	5.2	12.8	10.5	10.9	0.0058	4.8	5.1	64.2	12.2	0.4	11.2	1	
1965			Culvert													12' x 4.5' RCB
1900		445	324	3.0	9.4	8.8	9.1	0.0038	5.1	4.3	75.3	13.1	0.3	10.0	155	
1870		445	324	3.5	9.7	9.0	9.0	0.0003	1.4	1.2	262.4	87.5	0.1	10.0	30	
1840			Culvert													5 x 48" Steel Pipes
1810		445	324	3.5	9.0	8.6	8.6	0.0008	2.0	1.6	198.7	78.3	0.2	8.5	60	
1800		445	324	3.9	9.0	8.6	8.6	0.0005	1.9	1.6	207.3	64.1	0.2	10.0	10	
1500		445	324	3.0	8.7	8.4	8.4	0.0008	2.3	1.9	173.4	61.5	0.2	10.0	300	
1000		445	324	3.0	8.3	8.1	8.2	0.0004	1.8	1.4	235.5	72.3	0.1	10.0	500	
500		445	324	3.0	8.0	8.0	8.0	0.0002	1.6	1.2	277.4	74.8	0.1	11.1	500	
0		445	324	1.6	8.0	8.0	8.0	0.0000	0.4	0.3	1025.4	202.5	0.0	7.5	500	

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.
Culvert at 1840 is 5 x 48" steel pipes conveying flow past the NWPRR tracks
This creek reach is the upper reach of the Creek labeled as Basalt Creek on USGS Topo maps.
During 25-Year Event, Spill will occur to South.

Marin Sonoma Narrows Improvement Project

Table 2B1
Creek Hydrology at Station 293+75

Creek Station	Draiange Area	Drainage Area (acres)	100-Year Runoff Coefficient "C"	25-Year Runoff Coefficient "C"	C * A 100-Year (acres)	C * A 25-Year (acres)	Time of Concentration (minutes)	Rainfall Intensity 100-Year (in/hour)	Rainfall Intensity 25-Year (in/hour)	Peak Flow Rate 100-Year (cfs)	Peak Flow Rate 25-Year (cfs)	Spill Out 100-Year (cfs)	Spill Out 25-Year (cfs)	Return Spill 100-Year (cfs)	Return Spill 25-Year (cfs)	HEC-RAS Modeled Flow 100-Year (cfs)	HEC-RAS Modeled Flow 25-Year (cfs)	Channel Length (feet)	Flow Velocity (fps)	Travel Time (minutes)
1025		378.7	0.70	0.53	265.1	200.0	37.0	1.71	1.37	454	275									
	293+48	.1	0.50	0.50	.0	.2						135	115			454	275	14	7.51	0.0
1011		378.8			265.1	200.2	37.0	1.71	1.37	454	275									
		.1	0.95	0.95	.1	.9										319	160	135	5.5	0.4
944		378.9			265.2	201.1	37.4	1.70	1.37	451	275									
		.2	0.95	0.95	.2	.9										319	160	1	9.44	0.0
876		379.1			265.5	202.0	37.4	1.70	1.37	452	276			135	115					
																454	275	191	4.9	0.6
875		379.1			265.5	202.0	38.1	1.69	1.36	448	274									
																454	275	37	2.83	0.2
684		379.1			265.5	202.0	38.3	1.68	1.35	447	273									
																454	275	1	7.62	0.0
647		379.1			265.5	202.0	38.3	1.68	1.35	447	273									
																454	275	146	5.75	0.4
646		379.1			265.5	202.0	38.7	1.68	1.35	445	272									
																454	275	500	8.42	1.0
500		379.1			265.5	202.0	39.7	1.66	1.33	440	269									
																454	275	0	2.51	0.0
0		379.1			265.5	202.0	39.7	1.66	1.33	440	269									

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.

Marin Sonoma Narrows Improvement Project

Table 2B2
Creek Hydraulics at Station 293+75, Existing Conditions

River Station (feet)	Contributing Drainage Area	100-Year Peak Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level 100-Year (ft)	Water Level 25-Year (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity 100-Year (fps)	Channel Velocity 25-Year (fps)	Flow Area 25-Year (sqft)	Top Width 25-Year (ft)	Froude Number 25-Year	Top of Bank Elevation (ft)	Length (ft)	Notes
1025	29348	454	275	45.0	51.6	47.9	48.8	0.0270	1.3	7.5	36.6	21.5	1.0		14	
1011		319	160	42.9	50.9	47.7	48.2	0.0120	6.5	5.5	29.1	6.2	0.5	46.5	135	
944			Culvert						17.7	8.9	18.0					6' x 3' RCB
876		319	160	41.5	45.9	44.3	45.7	0.0491	11.8	9.4	17.0	6.2	1.0		1	
875		454	275	41.5	44.7	44.4	44.8	0.0346	5.7	4.9	56.1	77.6	1.0		191	
684		454	275	34.4	37.4	36.5	36.6	0.0074	2.5	2.8	97.3	96.3	0.5	36.0	37	
647		454	275	31.5	35.9	35.2	36.1	0.0292	8.9	7.6	36.1	20.7	1.0		1	
646		454	275	31.5	35.3	34.8	35.3	0.0301	6.3	5.8	47.8	46.6	1.0		146	
500		454	275	24.5	29.8	28.5	29.6	0.0283	6.6	8.4	32.6	15.0	1.0		500	
0		454	275	7.9	8.6	8.5	8.6	0.0640	2.7	2.5	109.4	662.4	1.1		0	

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.
During 25-Year Event, Spill will occur to South. Top of Bank is at Elevation 46.5 and reenters Creek at Station 875.
Overflow about 20-feet long, Use Weir Coefficient = 3

	Calced Spill		Spill used		Total Q	Flow rec	Flow Used
Q 100-year spill	133	cfs	135	134.0	454	320.0	319
Q 25-year spill	110		115	112.6	275	162.4	160

	25-Year	100-Year
C	3	3
L	20	20
H	1.5	1.7
Q	110.2	133.0

Marin Sonoma Narrows Improvement Project

Table 2B3
Creek Hydraulics at Station 293+75, Proposed Conditions

River Station (feet)	Contributing Drainage Area	100-Year Peak Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level 100-Year (ft)	Water Level 25-Year (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity 100-Year (fps)	Channel Velocity 25-Year (fps)	Flow Area 25-Year (sqft)	Top Width 25-Year (ft)	Froude Number 25-Year	Top of Bank Elevation (ft)	Length (ft)	Notes
1025	293+48	454	275	45.0	48.8	47.9	48.8	0.0266	5.8	7.5	36.8	21.5	1.0		14	Twin 7' x 4" RCB
1011		319	160	42.9	48.9	47.3	48.2	0.0017	3.8	2.6	61.1	6.2	0.5	46.5	135	
944			Culvert						7.6	3.8	42.0					Twin 6' x 3' RCB
876		319	160	41.5	45.9	44.3	45.7	0.0491	11.8	9.4	17.0	6.2	1.0		1	
875		454	275	41.5	44.7	44.4	44.8	0.0346	5.7	4.9	56.1	77.6	1.0		191	
684		454	275	34.4	37.4	36.5	36.6	0.0074	2.5	2.8	97.3	96.3	0.5	36.0	37	
647		454	275	31.5	35.9	35.2	36.1	0.0292	8.9	7.6	36.1	20.7	1.0		1	
646		454	275	31.5	35.3	34.8	35.3	0.0301	6.3	5.8	47.8	46.6	1.0		146	
500		454	275	24.5	29.8	28.5	29.6	0.0283	6.6	8.4	32.6	15.0	1.0		500	
0		454	275	7.9	8.6	8.5	8.6	0.0640	2.7	2.5	109.4	662.4	1.1		0	

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.
During 25-Year Event, Spill will occur to South. Top of Bank is at Elevation 46.5 and reenters Creek at Station 875

Marin Sonoma Narrows Improvement Project

Table 2C1
Creek Hydrology at Station 305+00

Creek Station	Draiange Area	Drainage Area (acres)	100-Year Runoff Coefficient "C"	100-Year Runoff Coefficient "C"	C * A 100-Year (acres)	C * A 25-Year (acres)	Time of Concentration (minutes)	Rainfall Intensity 100-Year (in/hour)	Rainfall Intensity 25-Year (in/hour)	Peak Flow Rate 100-Year (cfs)	Peak Flow Rate 25-Year (cfs)	Spill Out 100-Year (cfs)	Spill Out 25-Year (cfs)	Return Spill 100-Year (cfs)	Return Spill 25-Year (cfs)	HEC-RAS Modeled Flow 100-Year (cfs)	HEC-RAS Modeled Flow 25-Year (cfs)	Channel Length (feet)	Flow Velocity (fps)	Travel Time (minutes)
3140	305+39	536.9	0.70	0.65	375.8	349.5	35.9	1.74	1.39	652	487					652	487			
												35	0					14	1.0	0.2
3126		536.9			375.8	349.5	36.1	1.73	1.39	650	485					617	487			
		1.6	0.95	0.95	1.5	.9												146	8.0	0.3
3053		538.5			377.4	350.4	36.4	1.72	1.38	650	485					617	487			
		.2																30	10.9	0.0
2980		538.8			377.4	350.4	36.5	1.72	1.38	650	485					617	487			
																		450	6.3	1.2
2950		538.8			377.4	350.4	37.7	1.70	1.36	640	477					617	487			
																		250	1.2	3.5
2500		538.8			377.4	350.4	41.2	1.63	1.31	615	458					617	487			
																		250	6.9	0.6
2250		538.8			377.4	350.4	41.8	1.62	1.30	611	455					617	487			
																		500	2.3	3.7
2000		538.8			377.4	350.4	45.5	1.56	1.25	587	438					617	487			
																		500	4.7	1.8
1500		538.8			377.4	350.4	47.3	1.53	1.23	577	430					617	487			
														35	0			500	0.2	41.7
1000		538.8			377.4	350.4	88.9	1.14	0.92	431	322					652	487			
																		500	0.2	55.6
500		538.8			377.4	350.4	144.5	0.91	0.73	345	257					652	487			
																		0	0.2	0.0
0		538.8			377.4	350.4	144.5	0.91	0.73	345	257					652	487			

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.

Marin Sonoma Narrows Improvement Project

Table 2C2
Creek Hydraulics as Station 305+00, Existing Conditions

River Station (feet)	Contributing Drainage Area	100-Year Peak Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level 100-Year (ft)	Water Level 25-Year (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity 100-Year (fps)	Channel Velocity 25-Year (fps)	Flow Area 25-Year (sqft)	Top Width 25-Year (ft)	Froude Number 25-Year	Top of Bank Elevation (ft)	Length (ft)	Notes
3140	305+39	652	487	31.0	39.4	38.1	38.1	0.0002	0.8	1.0	537	212	0.1		14	
3126		617	487	32.0	38.4	37.0	38.0	0.0151	8.0	8.0	61	12	0.6	37.5	146	
3053									12.9	10.1	48					12' x 4' RCB
2980		617	487	27.0	31.3	30.7	32.5	0.0359	11.8	10.9	45	12	1.0		30	
2950		617	487	27.0	29.9	29.7	30.3	0.0279	6.6	6.3	78	64	1.0		450	
2500		617	487	19.0	22.2	22.0	22.1	0.0014	1.3	1.2	410	434	0.2		250	
2250		617	487	16.0	19.6	19.4	20.1	0.0287	7.4	6.9	71	48	1.0		250	
2000		617	487	14.8	16.7	16.6	16.7	0.0055	2.5	2.3	216	244	0.4		500	
1500		617	487	8.9	10.6	10.6	10.9	0.0359	4.9	4.7	103	157	1.0		500	
1000		652	487	3.5	10.0	10.0	10.0	0.0000	0.3	0.2	2398	396	0.0		500	
500		652	487	2.5	10.0	10.0	10.0	0.0000	0.2	0.2	3239	508	0.0		500	
0		652	487	2.8	10.0	10.0	10.0	0.0000	0.2	0.2	2710	466	0.0		0	

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.
During 100-Year Event, Spill will occur to North. Top of Bank is at Elevation 37.5 and reenters Creek at Station 1000.

Marin Sonoma Narrows Improvement Project

Table 2C3
Creek Hydraulics at Station 305+00, Proposed Conditions

River Station (feet)	Contributing Drainage Area	100-Year Peak Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level 100-Year (ft)	Water Level 25-Year (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity 100-Year (fps)	Channel Velocity 25-Year (fps)	Flow Area 25-Year (sqft)	Top Width 25-Year (ft)	Froude Number 25-Year	Top of Bank Elevation (ft)	Length (ft)	Notes
3140	305+39	652	487	31.0	39.7	39.0	39.1	0.0001	0.8	0.7	737	220	0.1		14	
3126		617	487	30.3	37.7	37.8	38.5	0.0229	8.6	6.6	73	12	0.4	37.5	146	
3053			Culvert						12.9	10.1	48					12' x 4' RCB
2980		617	487	27.0	35.3	33.1	33.8	0.0088	6.1	6.6	74	12	0.5		30	
2950		617	487	26.6	35.7	33.6	33.6	0.0002	0.9	1.1	448	96	0.1		5	
2945		617	487	26.6	35.7	33.6	33.6	0.0003	1.2	1.4	339	80	0.1		26	
2919			Culvert													
2883		617	487	25.5	28.7	28.5	29.1	0.0344	0.0	6.4	97	80	1.0		383	
			Culvert													Double 8'x4' RCB
2500		617	487	19	22.2	22.0	22.1	0.0014	1.3	1.2	410	434	0.2		250	
2250		617	487	16	19.6	19.4	20.1	0.0287	7.4	6.9	71	434	1.0		250	
2000		617	487	14.8	22.2	16.6	16.7	0.0055	2.5	2.3	216	434	0.4		500	
1500		617	487	8.9	10.7	10.6	10.9	0.0359	4.9	4.7	103	0	1.0		500	
1000		652	487	3.5	10.0	10.0	10.0	0.0000	0.3	0.2	2398	48	0.0		500	
500		652	487	2.5	10.0	10.0	10.0	0.0000	0.2	0.2	3239	48	0.0		500	
0		652	487	2.8	10.0	10.0	10.0	0.0000	0.2	0.2	3240	0	0.0		0	

Note:
Tailwater is set Petaluma River elevation 7. Railroad tracks do not act as a barier to flow and are higher in elevation then Highway 101 at creek crossing.
During 100-Year Event, Spill will occur to North. Top of Bank is at Elevation 37.5 and reenters Creek at Station 1000.

Marin Sonoma Narrows Improvement Project

Table 2D1
Creek Hydrology at Station 383+00

Creek Station	Draiange Area	Drainage Area (acres)	Runoff Coefficient "C"	C * A (acres)	Time of Concentration (minutes)	25-Year Rainfall Intensity (in/hour)	25-Year Peak Flow Rate (cfs)	Channel Length (feet)	Flow Velocity (fps)	Travel Time (minutes)
Lateral	396+75 396+85									
4250		649.9	0.40	260.1	20.0	1.82	**474**			
	394+25	3.2	0.72	2.3				250	5.0	0.8
4000		653.1		262.4	20.8	1.79	474			
	390+75	.4	0.95	.3				500	3.7	2.2
3000		653.5		262.7	23.1	1.71	474			
								500	4.7	1.8
2500		653.5		262.7	24.8	1.65	474			
								500	3.6	2.3
2000		653.5		262.7	27.1	1.58	474			
								500	4.7	1.8
1000		653.5		262.7	28.9	1.54	474			
								500	3.2	2.6
500		653.5		262.7	31.5	1.48	474			
								500	9.0	0.9
33		653.5		262.7	32.4	1.46	474			
								500	4.7	1.8
creek										
5000		2.5	0.57	1.4	33.8	1.43	**2**			
	383+00	23.6	0.60	14.1				0	1.0	0.0
4977		26.1		15.6	33.8	1.43	22			
								23	2.4	0.2
4969		26.1		15.6	34.0	1.43	22			
								8	7.3	0.0
4884		26.1		15.6	34.0	1.43	22			
								85	16.9	0.1
4804		26.1		15.6	34.1	1.43	22			
								80	8.5	0.2
4803		26.1		15.6	34.2	1.42	22			
								1	8.6	0.0
4800		26.1		15.6	34.2	1.42	22			
								3	5.7	0.0
4500		26.1		15.6	34.2	1.42	22			
	379+50	41.1	0.57	23.3				300	6.7	0.7
4450		67.2		38.9	35.0	1.41	55			
	374+25	1.8	0.68	1.2				50	4.9	0.2
4000		69.0		40.1	35.1	1.41	56			
								450	6.9	1.1
3500		69.0		40.1	36.2	1.39	56			
								500	4.4	1.9
3380		69.0		40.1	38.1	1.36	56			
	370+50	54.8	0.62	33.9				120	5.5	0.4
3000		123.7		73.9	38.5	1.35	100			
								380	6.4	1.0
2500		123.7		73.9	39.5	1.33	100			
								500	5.8	1.4
2000		123.7		73.9	40.9	1.31	100			
								500	7.8	1.1
1850		123.7		73.9	42.0	1.30	100			
								150	3.8	0.7
lower creek										
1500		777.2		336.7	42.6	1.29	**574**			
								350	3.1	1.9
1000		777.2		336.7	44.5	1.26	574			
								500	4.1	2.0
500		777.2		336.7	46.5	1.24	574			
								500	3.8	2.2
0		777.2		336.7	48.8	1.21	574			

Note:
Tailwater is set to elevation 10.8. Railroad tracks act as a barier to flow.

Marin Sonoma Narrows Improvement Project

Table 2D2
Creek Hydraulics Station 383+00, Existing Conditions

River Station (feet)	Contributing Drainage Area	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level (ft)	Depth of Water (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number	Top of Bank Elevation (ft)	Length (ft)	Notes
Lateral Branch 1850														Lateral
4250		320	91.7	93.1	1.4	93.3	0.006	2.7	119	115	0.47	95.0		
4000		322	85.0	87.5	2.5	87.9	0.021	5.0	64	59	0.85	88.8	250	
3500		322	77.9	79.5	1.6	79.7	0.013	3.7	87	89	0.67	83.7	500	
3000		322	70.5	71.8	1.3	72.2	0.017	4.7	68	58	0.77	78.7	500	
2500		322	63.0	64.8	1.8	65.0	0.012	3.6	89	89	0.64	66.3	500	
2000		322	54.1	55.0	0.9	55.4	0.034	4.7	69	104	1.01	56.5	500	
1500		322	44.3	46.1	1.8	46.2	0.009	3.2	101	101	0.56	46.8	500	
1000		322	32.8	37.3	4.5	38.6	0.028	9.0	36	14	1.01	40.5	500	
500		322	27.9	31.0	3.1	31.3	0.008	4.7	68	33	0.59	32.8	500	
33		322	19.7	23.9	4.2	24.9	0.026	8.0	40	20	1	24.7	467	
creek														
5000		271	76.0	83.2	7.2	83.2	9E-05	1.0	308	64	0.07	83.0	0	
4977		277	74.9	83.1	8.2	83.2	0.001	2.4	117	37	0.24	84.0	23	
4969		277	76.0	82.3	6.3	83.1	0.011	7.3	38	6	0.51	83.0	8	
4884		Culvert						16.9					85	6' x 5' RCB
4804		277	67.2	72.5	5.3	73.7	0.027	8.5	33	6	0.66	75.0	80	
4803		277	68.9	72.5	3.6	73.6	0.028	8.6	32	14	1.01	78.0	1	
4800		277	68.0	71.6	3.6	72.1	0.011	5.7	49	21	0.66	80.0	3	
4500		277	64.5	66.6	2.1	67.3	0.027	6.7	41	30	1.01	75.0	300	
4450		297	62.0	65.4	3.4	65.7	0.01	4.9	60	32	0.64	75.0	50	
4000		297	56.0	58.0	2.0	58.8	0.027	6.9	43	30	1.01	62.0	450	
3500		297	42.7	46.4	3.7	46.7	0.007	4.4	67	30	0.53	51.6	500	
3380		297	42.7	45.0	2.3	45.4	0.02	5.5	55	42	0.84	51.8	120	
3000		326	34.4	38.8	4.4	39.5	0.013	6.4	51	21	0.72	44.3	380	
2500		326	28.4	33.3	4.9	33.8	0.01	5.8	57	22	0.63	37.7	500	
2000		326	21.3	25.2	3.9	26.2	0.026	7.8	42	22	1	26.2	500	
1850		326	18.4	23.5	5.1	23.8	0.007	3.8	86	54	0.53	24.6	150	
lower creek														Combined
1500		648	16.4	21.5	5.1	21.7	0.005	3.1	239	161	0.45	20.8	350	in Junction
1000		648	12.3	17.7	5.4	17.9	0.011	4.1	184	139	0.62	16.4	500	
500		648	10.7	13.8	3.1	14.1	0.006	3.8	198	104	0.48	13.1	500	
0		648	7.4	10.8	3.4	11.0	0.006	3.3	228	162	0.49	8.2	500	

Note:
Tailwater was set to 1-foot above downstream Railroad tracks which act as a barier to flow, 10.8 feet
Edge of Pavement elevation is 84.04 nearest the creek.
Edge of Travelway is about elevation 84.2 nearest the creek.
Freeboard at Station 4977 is about 1.1 feet between Edge of Travelway and Creek Water Level

Marin Sonoma Narrows Improvement Project

Table 2D3
Creek Hydraulics at Station 383+00, Proposed Conditions

River Station (feet)	Contributing Drainage Area	25-Year Peak Flow Rate (cfs)	Minimum Channel Elevation (ft)	Water Level (ft)	Depth of Water (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number	Top of Bank Elevation (ft)	Length (ft)	Notes
Lateral Branch 1850														Lateral
4250		320	91.7	93.1	1.4	93.3	0.006406	2.7	119	115	0.47	95.0	0	
4000		322	85.0	87.5	2.5	87.9	0.020738	5.0	64	59	0.85	88.8	250	
3500		322	77.9	79.5	1.6	79.7	0.013283	3.7	87	89	0.67	83.7	500	
3000		322	70.5	71.8	1.3	72.2	0.017057	4.7	68	58	0.77	78.7	500	
2500		322	63.0	64.8	1.8	65.0	0.012146	3.6	89	89	0.64	66.3	500	
2000		322	54.1	55.0	0.9	55.4	0.034467	4.7	69	104	1.01	56.5	500	
1500		322	44.3	46.1	1.8	46.2	0.009342	3.2	101	101	0.56	46.8	500	
1000		322	32.8	37.3	4.5	38.6	0.028363	9.0	36	14	1.01	40.5	500	
500		322	27.9	31.0	3.1	31.3	0.008235	4.7	68	34	0.58	32.8	500	
33		322	19.7	23.9	4.2	24.9	0.026774	8.1	40	20	1.01	24.7	467	
creek														
5200		255	79.0	86.7	7.7	86.7	0.000017	1.0	827	246	0.03	86.6		
5199		255	78.4	86.3	7.9	86.6	0.004884	4.4	58	8	0.29	86.6	1	
5089		Culvert						8.5					110	6' x 5' RCB
5000		260	76.0	85.0	9.0	85.3	0.008649	4.6	56	0	0.27	84.0	89	
4977		260	79.4	83.1	3.7	84.8	0.044076	10.4	25	7	1	84.4	23	
4969		282	76.0	82.4	6.4	83.2	0.017973	7.2	39	6	0.5	83.0	8	
4884		Culvert						7.6					85	6' x 5' RCB
4804		282	67.2	72.5	5.3	73.7	0.028175	8.7	33	6	0.67	75.0	80	
4803		282	68.9	72.5	3.6	73.7	0.02812	8.6	33	14	1.01	78.0	1	
4800		282	68.0	71.7	3.7	72.2	0.010693	5.8	49	21	0.66	80.0	3	
4500		282	64.5	66.6	2.1	67.3	0.027321	6.8	42	30	1.01	75.0	300	
4450		299	62.0	65.4	3.4	65.8	0.009986	5.0	60	32	0.64	75.0	50	
4000		299	56.0	58.0	2.0	58.8	0.026983	6.9	43	30	1.01	62.0	450	
3500		299	42.7	46.4	3.7	46.7	0.006828	4.5	67	30	0.53	51.6	500	
3380		299	42.7	45.0	2.3	45.4	0.019839	5.5	55	42	0.84	51.8	120	
3000		325	34.4	38.8	4.4	39.5	0.012899	6.4	51	21	0.72	44.3	380	
2500		325	28.4	33.3	4.9	33.8	0.009899	5.7	57	22	0.63	37.7	500	
2000		325	21.3	25.2	3.9	26.2	0.026172	7.8	42	22	1	26.2	500	
1850		325	18.4	23.5	5.1	23.7	0.007861	3.9	83	52	0.55	24.6	150	
lower creek														Combined
1500		647	16.4	21.4	5.0	21.5	0.005597	3.0	217	161	0.45	20.8	350	in Junction
1000		647	12.3	17.6	5.3	17.8	0.01021	3.8	171	138	0.6	16.4	500	at 1850
500		647	10.7	13.5	2.8	13.8	0.006486	3.8	170	96	0.51	13.1	500	
0		647	7.4	10.8	3.4	11.0	0.006416	3.3	228	162	0.49	8.2	500	

Note:
Tailwater was set to 1-foot above downstream Railroad tracks which act as a barier to flow, 10.8 feet
Mainline Edge of Pavement elevation is 84.04 nearest the creek.
Mainline Edge of Travelway is about elevation 84.2 nearest the creek.
Mainline Freeboard at Station 4977 is about 1.1 feet between Edge of Travelway and Creek Water Level

At Proposed frontage road crossing (Frontage Station 393+00)
Centerline of roadway is 86.9, Edge of Travelway is 86.6, grading is matched around 84.8 at frontage station 392+00
Spill of 22 cfs will occur upstream of the proposed Frontage roadway, near station 392+50, which will overland flow to crossing at frontage station 383+50
WSEL at Frontage Station 393+00 is 86.3, which results in 0.3 feet of freeboard from the Frontage Edge of Travelway.

Marin Sonoma Narrows Improvement Project

Table 3A
Existing Route 101 Culvert Hydrology - 25 Year Storm

Node [1] #	Sheet Number on Plans	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C [6]	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Cross Culvert Station 317															
I-317-02	D-7	16.4	12.2	14.0	14.03	19.09		0.60	11.50	19.09	11.50	10.0	10.0	2.51	**29.1**
I-317-01	D-7	16.0	7.7	11.7	11.66	1.85		0.40	0.74	1.85	12.24	10.0	10.1	2.50	**30.9**
Cross Culvert Station 311															
I-311-02	D-7	21.6	20.3	21.4	21.41	6.05		0.56	3.38	6.05	3.38	11.0	11.0	2.42	**8.3**
I-311-01	D-7	24.4	17.2	19.3	19.31	1.05		0.40	0.42	1.05	3.80	10.0	11.2	2.41	**9.2**
Cross Culvert Station 305															
I-305-02	D-7	37.0	30.4	35.0	35.01	535.03		0.65	346.50	535.03	346.50	19.0	19.0	1.93	**673.9**
I-305-01	D-7	36.5	27.4	33.7	33.69	1.27		0.40	0.51	1.27	347.01	10.0	19.1	1.93	**673.8**
Cross Culvert Station 296															
I-296-02	D-6	48.0	45.2	45.6	45.62	0.49		0.70	0.34	0.49	0.34	10.0	10.0	2.51	**0.9**
I-296-01	D-6	44.0	41.5	42.1	42.14	0.49		0.40	0.20	0.49	0.54	10.0	10.3	2.48	**1.4**
Cross Culvert Station 293															
I-293-02	D-6	45.6	42.8	45.6	45.64	379.30		0.56	212.15	379.30	212.15	33.0	33.0	1.47	**314.7**
I-293-01A	D-6	45.0	43.1	45.0	44.98	0.21		0.40	0.08	0.21	0.08	10.0	10.0	2.51	**0.2**
I-293-01	D-6	46.0	41.9	45.9	45.87	(N/A)		(N/A)	0.00	(N/A)	212.24	0.0	33.1	1.47	**314.7**
Cross Culvert Station 291															
I-291-02	D-6	45.0	42.9	43.3	43.27	0.42		0.70	0.29	0.42	0.29	10.0	10.0	2.51	**0.7**
I-291-01	D-6	42.4	40.0	40.5	40.46	0.56		0.40	0.22	0.56	0.52	10.0	10.3	2.48	**1.3**
Cross Culvert Station 283															
I-283-02	D-5	25.3	24.1	25.3	25.28	1.95		0.76	1.49	1.95	1.49	10.0	10.0	2.51	**3.8**
I-283-01	D-5	24.9	22.0	22.9	22.92	1.20		0.40	0.48	1.20	1.97	10.0	10.3	2.49	**4.9**
Cross Culvert Station 279															
I-279-02	D-5	24.4	19.6	19.6	19.55	(N/A)		(N/A)	0.00	(N/A)	0.00	0.0	0.0	3.45	**0.0**
I-279-01	D-5	18.3	16.5	16.5	16.49	(N/A)		(N/A)	0.00	(N/A)	0.00	0.0	0.0	3.45	**0.0**
Cross Culvert Station 275															
I-275-01	D-5	10.3	6.3	8.8	8.84	97.55		0.54	52.65	97.55	52.65	17.0	17.0	2.01	**106.4**
Cross Culvert Station 267															
I-267-02	D-4	13.4	11.1	13.4	13.43	42.39		0.55	23.28	42.39	23.28	20.0	20.0	1.89	**44.4**
I-267-01A	D-4	13.4	10.9	13.4	13.35	0.55		0.40	0.22	0.55	0.22	10.0	10.0	2.51	**0.6**
I-267-01	D-4	14.5	9.6	14.5	14.46	(N/A)		(N/A)	0.00	(N/A)	23.50	0.0	20.0	1.89	**44.8**
Cross Culvert Station 263															
I-263-02	D-4	15.3	13.8	15.3	15.25	0.46		0.70	0.32	0.46	0.32	10.0	10.0	2.51	**0.8**
I-263-01	D-4	15.4	13.7	15.4	15.35	40.89		0.55	22.28	40.89	22.60	19.0	19.0	1.93	**44.0**
Cross Culvert Station 256															
I-256-02	D-3	10.0	5.1	5.7	5.69	1.58		0.70	1.11	1.58	1.11	10.0	10.0	2.51	**2.8**
I-256-01	D-3	8.8	4.8	5.5	5.52	0.99		0.40	0.40	0.99	1.50	10.0	10.2	2.49	**3.8**
Cross Culvert Station 254															
I-254-02	D-3	9.3	7.1	9.3	9.27	29.37		0.55	16.27	29.37	16.27	15.0	15.0	2.08	**34.1**
I-254-01	D-3	8.4	6.1	8.4	8.39	0.48		0.40	0.19	0.48	16.46	10.0	15.1	2.08	**34.5**
Cross Culvert Station 250															
I-250-02	D-2	7.2	5.9	7.2	7.17	19.74		0.54	10.70	19.74	10.70	15.0	15.0	2.08	**22.4**
I-250-01	D-2	9.3	5.8	8.3	8.34	0.34		0.40	0.14	0.34	10.83	10.0	15.2	2.07	**22.6**
Cross Culvert Station 246															
I-246-02	D-2	8.9	7.7	8.9	8.86	60.90		0.54	33.09	60.90	33.09	23.0	23.0	1.78	**59.3**
I-246-01	D-2	8.4	6.9	8.4	8.35	0.30		0.40	0.12	0.30	33.21	10.0	23.1	1.78	**59.5**
Cross Culvert Station 244															
I-244-02	D-2	9.3	6.4	7.9	7.94	16.67		0.69	11.49	16.67	11.49	19.0	19.0	1.93	**22.4**
I-244-01	D-2	8.5	5.8	7.9	7.88	1.11		0.40	0.44	1.11	11.94	5.0	19.1	1.93	**23.2**

Notes
(1) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(2) Cumlative Area = Inlet CA + Lateral Inlet CA
(3) Discharge is from the Rational Method, Q = CIA

Marin Sonoma Narrows Improvement Project

Table 3B
Existing Route 101 Culvert Hydrology - 25 Year Storm

Node [1] #	Sheet Number on Plans	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C [6]	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Cross Culvert Station 412															
I-412-02	D-14	109.6	108.0	109.6	109.57	4.63		0.60	2.79	4.63	2.79	10.0	10.0	2.51	**7.1**
I-412-01	D-14	109.2	106.6	107.9	107.88	0.27		0.40	0.11	0.27	2.90	5.0	10.1	2.50	**7.3**
Cross Culvert Station 409															
I-409-02	D-14	106.2	103.4	106.2	106.22	10.94		0.59	6.43	10.94	6.43	10.0	10.0	2.51	**16.3**
I-409-01	D14	105.0	103.2	105.0	104.98	0.32		0.40	0.13	0.32	6.56	5.0	10.1	2.50	**16.5**
Cross Culvert Station 405															
I-405-02	D-14	96.0	94.8	96.0	96.00	6.13		0.60	3.65	6.13	3.65	10.0	10.0	2.51	**9.2**
I-405-01	D-14	99.6	93.6	95.9	95.94	0.45		0.40	0.18	0.45	3.83	5.0	10.2	2.49	**9.6**
Cross Culvert Station 402															
I-402-02	D-14	94.1	93.4	94.1	94.12	5.51		0.59	3.24	5.51	3.24	10.0	10.0	2.51	**8.2**
I-402-01	D-14	96.5	92.5	94.5	94.54	0.28		0.40	0.11	0.28	3.35	5.0	10.2	2.49	**8.4**
Cross Culvert Station 391															
I-391-01	D-13	82.6	73.6	77.8	77.84	359.30		0.54	194.59	359.30	194.59	31.0	31.0	1.50	**294.1**
Cross Culvert Station 387															
I-387-02	D-13	74.2	71.8	74.2	74.23	25.42		0.57	14.37	25.42	14.37	10.0	10.0	2.51	**36.3**
I-387-01	D-13	75.4	66.6	75.4	75.44	1.24		0.40	0.50	1.24	14.86	5.0	10.0	2.51	**37.5**
Cross Culvert Station 378															
I-378-02	D-12	64.0	60.8	62.4	62.37	37.66		0.55	20.65	37.66	20.65	13.0	13.0	2.25	**46.9**
I-378-01	D-12	63.0	60.4	62.0	62.00	0.68		0.40	0.27	0.68	20.92	5.0	13.1	2.24	**47.3**
Cross Culvert Station 373															
I-373-02	D-12	63.9	58.0	63.9	63.85	8.20		0.64	5.26	8.20	5.26	12.0	12.0	2.34	**12.4**
I-373-01	D-12	59.9	57.1	58.4	58.40	0.37		0.40	0.15	0.37	5.40	5.0	12.1	2.33	**12.7**
Cross Culvert Station 366															
I-366-01	D-11	47.7	39.0	45.4	45.43	76.90		0.57	43.98	76.90	43.98	13.0	13.0	2.25	**99.8**
Cross Culvert Station 361															
I-361-02	D-11	57.1	56.6	57.1	57.09	2.10		0.58	1.22	2.10	1.22	10.0	10.0	2.51	**3.1**
I-361-01	D-11	60.0	56.6	57.2	57.22	(N/A)		(N/A)	0.00	(N/A)	1.22	0.0	10.0	2.51	**3.1**
Cross Culvert Station 356															
I-356-02	D-11	44.1	43.4	44.1	44.07	30.47		0.55	16.85	30.47	16.85	12.0	12.0	2.34	**39.7**
I-356-01	D-11	45.5	36.9	43.1	43.06	0.49		0.40	0.20	0.49	17.04	5.0	12.1	2.33	**40.0**
Cross Culvert Station 350															
I-350-02	D-9	57.1	55.4	57.1	57.06	16.17		0.60	9.64	16.17	9.64	10.0	10.0	2.51	**24.4**
I-350-01	D-9	48.8	46.2	48.8	48.77	6.20		0.59	3.65	6.20	13.29	10.0	10.2	2.49	**33.4**
Cross Culvert Station 331															
I-331-03	D-9	43.2	42.3	43.2	43.15	4.19		0.54	2.26	4.19	2.26	10.0	10.0	2.51	**5.7**
I-331-02	D-9	44.8	41.7	42.6	42.58	(N/A)		(N/A)	0.00	(N/A)	2.26	0.0	10.0	2.51	**5.7**
I-331-01	D-9	43.2	40.1	41.1	41.11	0.57		0.40	0.23	0.57	2.49	10.0	10.2	2.49	**6.3**
Cross Culvert Station 328															
I-328-02	D-8	31.8	28.5	29.2	29.20	1.37		0.95	1.30	1.37	1.30	10.0	10.0	2.51	**3.3**
I-328-01	D-8	30.3	28.4	29.1	29.10	(N/A)		(N/A)	0.00	(N/A)	1.30	0.0	10.0	2.51	**3.3**
Cross Culvert Station 323															
I-323-03	D-8	19.0	16.8	19.0	18.97	16.52		0.55	9.05	16.52	9.05	13.0	13.0	2.25	**20.6**
I-323-02	D-8	19.6	16.6	19.6	19.55	(N/A)		(N/A)	0.00	(N/A)	9.05	0.0	13.0	2.25	**20.5**
I-323-01	D-8	18.8	13.1	18.8	18.81	0.54		0.40	0.22	0.54	9.27	10.0	13.1	2.24	**21.0**

Notes
(1) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(2) Cumlative Area = Inlet CA + Lateral Inlet CA
(3) Discharge is from the Rational Method, Q = CIA

Marin Sonoma Narrows Improvement Project

Table 3C
Existing Route 101 Culvert Hydraulics - 25 Year Storm

Pipe #	Upstream Node	Downstream Node	Drainage Plan Sheet Number	Total Discharge [3] (cfs) [1]	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		Freeboard [2] (feet)	Upstream Cover (feet)	Velocity (ft/s)
										Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Cross Culvert Station 317																		
P-317-02	I-317-02	I-317-01	D-7	29.1	56.6	24	71	0.063	0.013	12.18	7.74	16.43	16.04	14.03	11.66	**2.4**	2.3	18.1
P-317-01	I-317-01	O-317	D-7	30.9	20.9	24	57	0.009	0.013	7.74	7.25	16.04	9.71	11.66	10.60	**4.4**	6.3	9.8
Cross Culvert Station 311																		
P-311-02	I-311-02	I-311-01	D-7	8.3	11.5	18	75	0.041	0.024	20.30	17.22	21.57	24.42	21.41	19.31	**0.2**	-0.2	7.1
P-311-01	I-311-01	O-311	D-7	9.2	6.2	18	54	0.012	0.024	17.22	16.57	24.42	17.50	19.31	17.74	**5.1**	5.7	5.2
Cross Culvert Station 305																		
P-305-02	I-305-02	I-305-01	D-7	673.9	1440.3	12x4 RCB	74	0.040	0.013	30.40	27.43	37.00	36.53	35.01	33.69	**2.0**	2.6	14.0
P-305-01	I-305-01	O-305 -H	D-7	673.8	489.0	12x4 RCB	67	0.005	0.013	27.43	27.12	36.53	31.36	33.69	33.10	**2.8**	5.1	14.0
Cross Culvert Station 296																		
P-296-02	I-296-02	I-296-01	D-6	0.9	4.2	12	79	0.047	0.024	45.23	41.48	48.01	44.03	45.62	42.14	**2.4**	1.8	4.2
P-296-01	I-296-01	O-296	D-6	1.4	12.3	18	60	0.014	0.013	41.48	40.66	44.03	44.45	42.14	42.16	**1.9**	1.1	4.6
Cross Culvert Station 293																		
P-293-02	I-293-02	I-293-01	D-6	314.7	233.5	6x3 RCB	66	0.013	0.013	42.77	41.92	45.64	45.99	47.41	45.87	**ABOVE RIM**	-0.1	17.5
P-293-01A	I-293-01A	I-293-01	D-6	0.2	3.9	6x3 RCB	99	0.012	0.013	43.08	41.92	44.98	45.99	45.87	45.87	**ABOVE RIM**	0.9	0.3
P-293-01	I-293-01	O-293 -H	D-6	314.7	231.7	6x3 RCB	67	0.013	0.013	41.92	41.07	45.99	45.03	45.87	44.30	**0.1**	1.1	17.5
Cross Culvert Station 291																		
P-291-02	I-291-02	I-291-01	D-6	0.7	3.9	12	71	0.041	0.024	42.91	40.03	44.97	42.43	43.27	40.46	**1.7**	1.1	3.8
P-291-01	I-291-01	O-291	D-6	1.3	23.6	18	69	0.050	0.013	40.03	36.55	42.43	37.62	40.46	36.79	**2.0**	0.9	7.2
Cross Culvert Station 283																		
P-283-02	I-283-02	I-283-01	D-5	3.8	3.3	12	72	0.029	0.024	24.14	22.02	25.28	24.92	25.62	22.92	**ABOVE RIM**	0.1	4.8
P-283-01	I-283-01	O-283	D-5	4.9	7.9	15	68	0.015	0.013	22.02	21.00	24.92	22.88	22.92	22.25	**2.0**	1.7	6.8
Cross Culvert Station 279																		
P-279-02	I-279-02	I-279-01	D-5	0.0	4.3	15	200	0.015	0.024	19.55	16.49	24.40	18.29	19.55	16.49	**4.9**	3.6	0.0
P-279-01	I-279-01	O-279	D-5	0.0	4.8	15	200	0.019	0.024	16.49	12.75	18.29	14.63	16.49	14.00	**1.8**	0.6	0.0
Cross Culvert Station 275																		
P-275-01	I-275-01	O-275	D-5	106.4	97.4	4x2 RCB	131	0.019	0.013	6.34	3.79	10.28	8.76	8.84	5.79	**1.4**	1.9	13.3
Cross Culvert Station 267																		
P-268-01A	I-267-01A	I-267-01	D-4	0.6	6.5	12	37	0.033	0.013	10.85	9.63	13.35	14.46	14.47	14.46	**ABOVE RIM**	1.5	0.7
P-267-02	I-267-02	I-267-01	D-4	44.4	8.6	18	63	0.023	0.024	11.06	9.63	13.43	14.46	52.80	14.46	**ABOVE RIM**	0.9	25.1
P-267-01	I-267-01	O-267	D-4	44.8	8.6	18	71	0.023	0.024	9.63	8.02	14.46	8.90	53.48	9.52	**ABOVE RIM**	3.3	25.3
Cross Culvert Station 263																		
P-263-02	I-263-02	I-263-01	D-4	0.8	1.3	18	179	0.001	0.024	13.79	13.69	15.25	15.35	15.39	15.35	**ABOVE RIM**	0.0	0.5
P-263-01	I-263-01	O-263	D-4	44.0	16.3	18	138	0.024	0.013	13.69	10.38	15.35	11.43	36.05	11.88	**ABOVE RIM**	0.2	24.9
Cross Culvert Station 256																		
P-256-02	I-256-02	I-256-01	D-3	2.8	7.4	18	55	0.005	0.013	5.05	4.78	9.99	8.78	5.69	5.52	**4.3**	3.4	3.9
P-256-01	I-256-01	O-256	D-3	3.8	15.2	18	69	0.021	0.013	4.78	3.34	8.78	6.46	5.52	4.84	**3.3**	2.5	7.1
Cross Culvert Station 254																		
P-254-02	I-254-02	I-254-01	D-3	34.1	29.2	24	59	0.017	0.013	7.07	6.09	9.27	8.39	9.73	8.39	**ABOVE RIM**	0.2	10.9
P-254-01	I-254-01	O-254	D-3	34.5	16.8	24	60	0.006	0.013	6.09	5.76	8.39	7.33	9.15	7.76	**ABOVE RIM**	0.3	11.0
Cross Culvert Station 250																		
P-250-02	I-250-02	I-250-01	D-2	22.4	22.0	30	59	0.002	0.010	5.92	5.82	7.17	9.29	8.44	8.34	**ABOVE RIM**	-1.3	4.6
P-250-01	I-250-01	O-250	D-2	22.6	20.8	30	66	0.002	0.010	5.82	5.72	9.29	7.66	8.34	8.22	**0.9**	1.0	4.6
Cross Culvert Station 246																		
P-246-02	I-246-02	I-246-01	D-2	59.3	16.4	36x18 Arch	55	0.015	0.024	7.65	6.85	8.86	8.35	18.90	8.35	**ABOVE RIM**	-0.3	15.5
P-246-01	I-246-01	O-246	D-2	59.5	7.6	36x18 Arch	61	0.003	0.024	6.85	6.66	8.35	8.70	19.92	8.16	**ABOVE RIM**	0.0	15.5
Cross Culvert Station 244																		
P-224-02	I-244-02	I-244-01	D-2	22.4	30.6	2x2 RCB	54	0.011	0.013	6.37	5.76	9.28	8.48	7.94	7.88	**1.3**	0.9	8.4
P-224-01	I-244-01	O-244	D-2	23.2	19.9	2x2 RCB	71	0.005	0.013	5.76	5.42	8.48	8.49	7.88	7.42	**0.6**	0.7	5.8

Notes
(1) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(2) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(3) Discharge is from the Rational Method, Q = CIA
(5) Outfalls with -H suffix indicated tailwater is set by Hec-Ras output for the creeks passing through site

Marin Sonoma Narrows Improvement Project

Table 3D
Existing Route 101 Culvert Hydraulics - 25 Year Storm

Pipe #	Upstream Node	Downstream Node	Drainage Plan Sheet Number	Total Discharge [3] (cfs) [1]	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		Freeboard [2] (feet)	Upstream Cover (feet)	Velocity (ft/s)
										Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Cross Culvert Station 412																		
P-412-02	I-412-02	I-412-01	D-14	7.1	5.0	12	69	0.020	0.013	107.99	106.62	109.57	109.22	110.59	107.88	**ABOVE RIM**	0.6	9.0
P-412-01	I-412-01	O-412	D-14	7.3	7.6	18	64	0.018	0.024	106.62	105.49	109.22	107.00	107.88	106.99	**1.3**	1.1	4.9
Cross Culvert Station 409																		
P-409-02	I-409-02	I-409-01	D-14	16.3	3.7	18	63	0.004	0.024	103.44	103.18	106.22	104.98	110.13	104.98	**ABOVE RIM**	1.3	9.2
P-409-01	I-409-01	O-409	D14	16.5	8.4	18	62	0.022	0.024	103.18	101.83	104.98	104.09	108.56	103.33	**ABOVE RIM**	0.3	9.4
Cross Culvert Station 405																		
P-405-02	I-405-02	I-405-01	D-14	9.2	8.2	18	57	0.021	0.024	94.77	93.59	96.00	99.59	97.43	95.94	**ABOVE RIM**	-0.3	5.2
P-405-01	I-405-01	O-405	D-14	9.6	7.0	18	64	0.015	0.024	93.59	92.61	99.59	96.55	95.94	94.11	**3.7**	4.5	5.4
Cross Culvert Station 402																		
P-402-02	I-402-02	I-402-01	D-14	8.2	7.2	18	57	0.016	0.024	93.40	92.48	94.12	96.48	95.72	94.54	**ABOVE RIM**	-0.8	4.6
P-402-01	I-402-01	O-402	D-14	8.4	6.7	18	68	0.014	0.024	92.48	91.55	96.48	92.99	94.54	93.05	**1.9**	2.5	4.8
Cross Culvert Station 391																		
P-391-01	I-391-01	O-391	D-13	294.1	585.3	6x5 RCB	163	0.019	0.013	73.63	70.49	82.58	77.53	77.84	75.49	**4.7**	4.0	19.5
Cross Culvert Station 387																		
P-387-02	I-387-02	I-387-01	D-13	36.3	12.2	12	74	0.069	0.010	71.76	66.64	74.23	75.44	120.96	75.44	**ABOVE RIM**	1.5	46.3
P-387-01	I-387-01	O-387	D-13	37.5	11.4	18	77	0.040	0.024	66.64	63.53	75.44	69.17	98.56	65.03	**ABOVE RIM**	7.3	21.3
Cross Culvert Station 378																		
P-378-02	I-378-02	I-378-01	D-12	46.9	59.1	4x2 RCB	53	0.007	0.013	60.75	60.37	64.00	63.04	62.37	62.00	**1.6**	1.3	8.5
P-378-01	I-378-01	O-378	D-12	47.3	149.2	4x2 RCB	63	0.046	0.013	60.37	57.49	63.04	61.12	62.00	59.49	**1.0**	0.7	16.1
Cross Culvert Station 373																		
P-373-02	I-373-02	I-373-01	D-12	12.4	3.8	12	83	0.011	0.013	58.00	57.06	63.85	59.86	68.42	58.40	**ABOVE RIM**	4.9	15.8
P-373-01	I-373-01	O-373	D-12	12.7	17.0	18	62	0.026	0.013	57.06	55.43	59.86	57.30	58.40	56.93	**1.5**	1.3	10.6
Cross Culvert Station 366																		
P-366-01	I-366-01	O-366	D-11	99.8	713.9	8x7 RCB	109	0.005	0.013	39.02	38.43	47.72	46.20	45.43	45.43	**2.3**	1.7	8.7
Cross Culvert Station 361																		
P-361-02	I-361-02	I-361-01	D-11	3.1	8.1	18	2	0.020	0.024	56.59	56.55	57.09	60.00	57.26	57.20	**ABOVE RIM**	-1.0	4.3
P-361-01	I-361-01	O-361	D-11	3.1	46.4	18	14	0.666	0.024	56.55	47.23	60.00	48.09	57.22	48.73	**2.8**	2.0	14.9
Cross Culvert Station 356																		
P-356-02	I-356-02	I-356-01	D-11	39.7	41.3	24	57	0.114	0.024	43.40	36.92	44.07	45.52	49.04	43.06	**ABOVE RIM**	-1.3	12.6
P-356-01	I-356-01	O-356	D-11	40.0	32.4	24	112	0.070	0.024	36.92	29.10	45.52	30.23	43.06	31.10	**2.5**	6.6	12.8
Cross Culvert Station 350																		
P-350-02	I-350-02	I-350-01	D-9	24.4	64.1	24	194	0.048	0.010	55.39	46.17	57.06	48.77	57.13	48.77	**ABOVE RIM**	-0.3	19.0
P-350-01	I-350-01	O-350	D-9	33.4	24.2	24	163	0.039	0.024	46.17	39.82	48.77	41.55	53.93	41.82	**ABOVE RIM**	0.6	10.6
Cross Culvert Station 331																		
P-331-03	I-331-03	I-331-02	D-9	5.7	13.0	12	5	0.134	0.013	42.33	41.66	43.15	44.76	43.28	42.33	**ABOVE RIM**	-0.2	16.1
P-331-02	I-331-02	I-331-01	D-9	5.7	8.5	18	68	0.022	0.024	41.66	40.14	44.76	43.24	42.58	41.11	**2.2**	1.6	5.2
P-331-01	I-331-01	O-331_	D-9	6.3	20.5	18	78	0.130	0.024	40.14	30.00	43.24	33.40	41.11	31.50	**2.1**	1.6	10.2
Cross Culvert Station 328																		
P-328-02	I-328-02	I-328-01	D-8	3.3	8.1	18	5	0.020	0.024	28.51	28.41	31.81	30.27	29.20	29.08	**2.6**	1.8	4.3
P-328-01	I-328-01	O-328_	D-8	3.3	14.1	18	217	0.062	0.024	28.41	15.00	30.27	17.83	29.10	16.50	**1.2**	0.4	6.5
Cross Culvert Station 323																		
P-323-03	I-323-03	I-323-02	D-8	20.6	11.9	18	5	0.044	0.024	16.77	16.55	18.97	19.55	20.20	19.55	**ABOVE RIM**	0.7	11.6
P-323-02	I-323-02	I-323-01	D-8	20.5	12.5	18	71	0.048	0.024	16.55	13.11	19.55	18.81	28.06	18.81	**ABOVE RIM**	1.5	11.6
P-323-01	I-323-01	O-323	D-8	21.0	11.5	18	109	0.041	0.024	13.11	8.68	18.81	9.73	25.38	10.60	**ABOVE RIM**	4.2	11.9

Notes
(1) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(2) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(3) Discharge is from the Rational Method, Q = CIA
(5) Outfalls with -H suffix indicated tailwater is set by Hec-Ras output for the creeks passing through site

Marin Sonoma Narrows Improvement Project

Table 3E
Existing Route 101 Culvert Slip-lined Hydraulics - 25 Year Storm

Pipe #	Upstream Node	Downstream Node	Drainage Plan Sheet Number	Total Discharge [3] (cfs) [1]	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard [2] (feet)**	Upstream Cover (feet)	Velocity (ft/s)
										Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
90g																		
P-412-02	I-412-02	I-412-01	D-14	7.1	13.3	17.3	69	0.020	0.013	107.99	106.62	109.57	109.22	109.03	107.88	**0.5**	0.1	8.3
P-412-01	I-412-01	O-412	D-14	7.3	7.6	18	64	0.018	0.024	106.62	105.49	109.22	107.00	107.88	106.99	**1.3**	1.1	4.9
90f																		
Cross Culvert Station 409																		
P-409-02	I-409-02	I-409-01	D-14	16.3	6.1	17.3	63	0.004	0.013	103.44	103.18	106.22	104.98	106.85	104.98	**ABOVE RIM**	1.3	10.0
P-409-01	I-409-01	O-409	D14	16.5	8.4	18	62	0.022	0.024	103.18	101.83	104.98	104.09	108.56	103.33	**ABOVE RIM**	0.3	9.4
90e																		
Cross Culvert Station 405																		
P-405-02	I-405-02	I-405-01	D-14	9.2	13.6	17.3	57	0.021	0.013	94.77	93.59	96.00	99.59	95.95	94.79	**0.0**	-0.2	9.0
P-405-01	I-405-01	O-405	D-14	9.6	13.0	18	64	0.015	0.013	93.59	92.61	99.59	96.55	94.79	94.11	**4.8**	4.5	8.1
90d																		
Cross Culvert Station 402																		
P-402-02	I-402-02	I-402-01	D-14	8.2	12.0	17.3	57	0.016	0.013	93.40	92.48	94.12	96.48	94.97	94.54	**ABOVE RIM**	-0.7	5.0
P-402-01	I-402-01	O-402	D-14	8.4	6.7	18	68	0.014	0.024	92.48	91.55	96.48	92.99	94.54	93.05	**1.9**	2.5	4.8
90c																		
Cross Culvert Station 356																		
P-356-02	I-356-02	I-356-01	D-11	39.7	68.9	23.1	57	0.114	0.013	43.40	36.92	44.07	45.52	45.29	43.09	**ABOVE RIM**	-1.3	24.5
P-356-01	I-356-01	O-356	D-11	40.1	32.4	24	112	0.070	0.024	36.92	29.10	45.52	30.23	43.09	31.10	**2.4**	6.6	12.8
90b																		
Cross Culvert Station 350																		
P-350-01	I-350-01	O-350	D-9	33.4	40.3	23.1	163	0.039	0.013	46.17	39.82	48.77	41.55	48.03	41.74	**0.7**	0.7	15.5
90a																		
Cross Culvert Stration 267																		18.1
P-268-01A	I-267-01A	I-267-01	D-4	0.6	6.5	12	37	0.033	0.013	10.85	9.63	13.35	14.46	14.47	14.46	**ABOVE RIM**	1.5	0.7
P-267-02	I-267-02	I-267-01	D-4	44.4	10.4	15.4	63	0.023	0.013	11.06	9.63	13.43	14.46	40.31	14.46	**ABOVE RIM**	1.1	34.3
P-267-01	I-267-01	O-267	D-4	44.8	8.6	18	71	0.023	0.024	9.63	8.02	14.46	8.90	53.50	9.52	**ABOVE RIM**	3.3	25.3

Notes
(1) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(2) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(3) Discharge is from the Rational Method, Q = CIA

Marin Sonoma Narrows Improvement Project

TABLE 3F

Route 101 Overtopping, 100-Year Peak Flow Rate

Station	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
245+00	105	92.8	10.8	11.11	11.05	11.13	0.00	1.02	90.61	941.43	0.58
245+00	0	92.8	10.8	11.05	11.05	11.10	0.01	1.81	51.41	511.98	1.00
276+00	105	293.4	11.6	12.29	12.20	12.40	0.00	2.65	110.80	282.30	0.74
276+00	0	293.4	11.6	12.20	12.20	12.38	0.01	3.35	87.71	259.10	1.01
316+00	105	27.8	18.2	18.50	18.44	18.53	0.00	1.29	21.50	142.73	0.59
316+00	0	27.8	18.2	18.44	18.44	18.50	0.01	1.97	14.10	115.57	1.00
379+00	105	54.7	64.9	65.13	65.08	65.15	0.00	1.11	49.33	380.89	0.54
379+00	0	54.7	64.9	65.08	65.08	65.13	0.01	1.73	31.61	338.26	1.00

Marin Sonoma Narrows Improvement Project

TABLE 4A

Flow Capacity of Proposed Culverts

	Culvert Station	Align	Drainage Plan System	Hillside Drainage Area (acres)	Runoff Coef. "C"	Roadway Drainage Area (acres)	Runoff Coef. "C"	Time of Conc. (minutes)	100 Year Rainfall Intensity (in/hour)	70% of 100-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)	Diameter (inches)	Orifice "C"	Pipe Area (sq. feet)	Hydraulic Radius	Pipe Roughness "N"	Culvert Length (feet)	Constructed Slope (ft/foot)	Inlet Flow Line (feet)	Tailwater Elevation	Edge of Pavement Elev (feet)	Available Depth (feet)	70%-100-Yr Depth Inlet Control (feet)	70%-100-Yr IC Surcharge ? (feet)	Full Flow Headloss (feet)	100-Year Depth Inlet Control (feet)	100-Year HGL Inlet Control (feet)	100-Year Full Flow Velocity (fps)	100-Year EGL Inlet Control (feet)	100-Year Inlet Control Freeboard (feet)	Meet Freeboard Requirement 70%-100-Yr	Meet Freeboard Requirement 100-Yr
County Right-of-Way	226+78	FR1	1c	0.62	0.70	0.15	0.90	10.0	3.12	1.2	1.8	18	.60	1.8	0.4	0.013	63	0.005	15.73		17.6	1.9	.77	No	.782	.8	16.5	1.0	16.5	1.1	Yes	See Note 5
	236+28	FR1	3c	2.30	0.70	0.13	0.90	10.0	3.12	3.8	5.4	18	.60	1.8	0.4	0.013	53	0.009	15.24		18.8	3.5	.95	No	1.995	1.2	16.2	3.1	16.4	2.4	Yes	Yes
	241+18	FR1	4c	3.30	0.70	0.18	0.90	10.2	3.10	5.4	7.7	18	.60	1.8	0.4	0.013	63	0.010	10.75		14.4	3.6	1.15	No	3.368	1.6	12.0	4.3	12.3	2.0	Yes	Yes
	244+00	FR1	5b	8.60	0.70	0.24	0.90	19.0	2.33	10.1	14.5	24	.60	3.1	0.5	0.013	51	0.005	8.27	11.05 '	12.7	4.4	1.45	No	1.111	1.9	9.9	4.6	10.2	2.5	Yes	See Note 5
	245+66	FR1	6d	58.60	0.70	0.15	0.90	23.7	2.10	60.5	86.4	RCB 4X2 -Double	.60	16.0	1.1	0.013	62	0.006	9.17	11.05 '	13.5	4.3	1.62	No	.103	2.3	11.0	5.4	11.4	2.0	Yes	Yes
	250+43	FR1	7c	19.90	0.70	0.09	0.90	14.5	2.63	25.8	36.8	30	.60	4.9	0.6	0.013	75	0.005	17.35		24.2	6.9	2.44	No	1.261	3.7	20.2	7.5	21.0	3.2	Yes	Yes
	253+66	FR1	8c	31.70	0.70	0.20	0.90	20.3	2.26	35.3	50.5																					
								Flow to individual culvert		17.7	25.2	30 - Double	.60	4.9	0.6	0.013	99	0.062	19.09		30.8	11.7	1.81	No	1.140	2.4	21.1	5.1	21.5	9.3	Yes	Yes
	263+70	FR1	11c	36.40	0.70	0.20	0.90	19.3	2.31	41.4	59.2																					
								Flow to individual culvert		20.7	29.6	30 - Double	.60	4.9	0.6	0.013	53	0.005	21.95		27.3	5.3	2.02	No	.716	2.8	24.2	6.0	24.8	2.5	Yes	Yes
	267+50	FR1	12b	8.90	0.70	0.27	0.90	15.4	2.56	11.6	16.6	24	.60	3.1	0.5	0.013	77	0.005	11.48		22.6	11.2	1.59	No	1.917	2.2	13.2	5.3	13.7	8.9	Yes	Yes
	270+34	FR1	79b	32.20	0.70	0.20	0.90	19.9	2.28	36.2	51.7	RCB 4x2	.60	8.0	1.0	0.013	87	0.005	17.24		31.0	13.8	1.88	No	.412	2.8	19.4	6.5	20.0	11.0	Yes	Yes
	275+00	FR1	14d	75.20	0.70	0.28	0.90	17.9	2.39	88.4	126.3	RCB 5X2 - Double	.60	20.0	1.3	0.013	56	0.006	9.35	12.2 '	14.0	4.7	1.84	No	.077	2.7	11.5	6.3	12.1	2.0	Yes	See Note 5
	281+50	BK	15b	18.80	0.70	0.26	0.90	16.6	2.48	23.2	33.2	RCB 4x2	.60	8.0	1.0	0.013	112	0.005	12.84		26.6	13.7	1.36	No	.340	1.7	14.3	4.1	14.6	12.0	Yes	Yes
	293+48	BK	16d	378.70	0.70	0.12	0.90	33.2	1.80	333.9	477.0	RCB 7X4 -Double	.60	56.0	2.2	0.013	31	0.010	46.31	47.4 '	51.9	5.6	3.53	No	.010	4.6	49.8	8.5	50.9	1.0	Yes	See Note 5
	303+00	BK	17b	6.00	0.70	0.08	0.90	18.9	2.33	7.0	9.9	18	.60	1.8	0.4	0.013	34	0.009	39.85		43.5	3.7	1.42	No	2.361	2.1	41.5	5.6	42.0	1.6	Yes	See Note 5
	304+30	BK	18b	3.80	0.70	0.12	0.90	18.9	2.33	4.5	6.4	18	.60	1.8	0.4	0.013	34	0.010	36.68		40.7	4.0	1.03	No	1.529	1.3	37.8	3.6	38.0	2.7	Yes	Yes
	305+39	BK	19d	526.80	0.70	0.30	0.90	35.8	1.74	448.6	640.8	RCB 8X4 - Double	.60	64.0	2.3	0.013	25	0.055	33.56	38.3 '	40.9	7.3	4.12	.1	.008	6.3	38.3	10.0	39.9	1.0	No	See Note 5
	310+10	BK	21b	4.80	0.70	0.19	0.90	10.6	3.04	7.5	10.7	18	.60	1.8	0.4	0.013	35	0.020	25.57		30.9	5.3	1.53	.0	2.624	2.3	27.3	6.1	27.9	2.9	No	Yes
	318+10	BK	23b	14.60	0.70	0.15	0.90	10.3	3.08	22.3	31.9	30	.60	4.9	0.6	0.013	29	0.024	19.93		24.9	5.0	2.14	No	.422	3.1	22.3	6.5	23.0	1.9	Yes	See Note 5
	323+60	BK	25b	14.70	0.70	0.11	0.90	11.3	2.96	21.5	30.7	RCB 4x2	.60	8.0	1.0	0.013	61	0.010	17.37		30.0	12.7	1.31	No	.171	1.6	18.8	3.8	19.0	11.0	Yes	Yes
	326+50	BK	25d	7.10	0.70	0.00	0.90	11.3	2.96	10.3	14.7	24	.60	3.1	0.5	0.013	284	0.100	36.92		46.7	9.8	1.46	No	6.267	1.9	38.5	4.7	38.9	7.8	Yes	Yes
	326+50	BK	25f	9.00	0.70	0.07	0.90	11.3	2.96	13.2	18.8	24	.60	3.1	0.5	0.013	20	0.050	35.12		40.3	5.2	1.76	No	.565	2.5	37.1	6.0	37.7	2.7	Yes	Yes
	332+50	BK	87b	1.30	0.70	0.00	0.90	10.0	3.12	2.0	2.8	18	.60	1.8	0.4	0.013	8	0.050	73.30		75.9	2.6	.80	No	.159	.9	74.1	1.6	74.2	1.8	Yes	See Note 5
	334+07	BK	32b	3.20	0.70	0.09	0.90	10.0	3.12	5.1	7.2	18	.60	1.8	0.4	0.013	76	0.005	71.60		76.4	4.8	1.11	No	3.846	1.5	72.8	4.1	73.1	3.3	Yes	Yes
	347+00	RLF	37b	12.80	0.70	0.12	0.90	10.0	3.12	19.8	28.3	RCB 4x2	.60	8.0	1.0	0.013	119	0.100	73.06		84.3	11.2	1.26	No	.308	1.5	74.4	3.5	74.6	9.7	Yes	Yes
	351+74	RLF	43c	29.70	0.70	0.34	0.90	12.5	2.82	41.6	59.5	RCB 5x2	.60	10.0	1.1	0.013	100	0.005	65.71		87.3	21.6	1.75	No	.302	2.5	67.7	5.9	68.2	19.1	Yes	Yes
	356+00	RLF	44b	0.40	0.70	0.04	0.90	10.0	3.12	.7	1.0	18	.60	1.8	0.4	0.024	145	0.192	70.87		82.8	12.0	.76	No	1.844	.8	71.6	.6	71.6	11.2	Yes	Yes
	358+50	RLF	46b	2.03	0.70	0.10	0.90	10.1	3.10	3.3	4.7	18	.60	1.8	0.4	0.013	64	0.020	66.85		76.9	10.0	.90	No	2.095	1.1	67.8	2.7	67.9	9.0	Yes	Yes
	361+50	RLF	47b	1.90	0.70	0.08	0.90	10.1	3.10	3.0	4.4	18	.60	1.8	0.4	0.013	77	0.010	51.03		60.8	9.8	.88	No	2.339	1.0	51.9	2.5	52.0	8.7	Yes	Yes
	365+72	RLF	48b	77.60	0.70	1.06	0.90	13.3	2.74	106.1	151.6	RCB 8X7	.60	56.0	2.5	0.013	56	0.018	40.00		49.3	9.3	3.65	No	.005	3.8	43.7	2.7	43.8	5.5	Yes	Yes
	373+35	RLF	49c	1.30	0.70	0.23	0.90	11.7	2.91	2.3	3.2	18	.60	1.8	0.4	0.013	45	0.030	61.05		64.4	3.4	.82	No	1.020	.9	61.9	1.8	61.9	2.5	Yes	Yes
	378+42	RLF	50d	16.80	0.70	0.40	0.90	12.6	2.81	23.9	34.1	RCB 4X2	.60	8.0	1.0	0.013	48	0.013	62.00	65.08 '	65.5	3.5	1.38	No	.150	1.8	63.5	4.3	63.8	1.8	Yes	See Note 5
	380+90	RLF	85f	8.80	0.70	0.20	0.90	12.6	2.81	12.5	17.8	36	.60	7.1	0.8	0.013	7	0.005	63.00		67.6	4.6	1.13	No	.022	1.3	64.2	2.5	64.3	3.3	Yes	Yes
	383+60	RLF	85j	1.60	0.70	0.16	0.90	12.6	2.81	2.5	3.6	18	.60	1.8	0.4	0.013	8	0.005	64.38		71.4	7.0	.84	No	.199	.9	65.2	2.0	65.3	6.1	Yes	Yes
	385+85	RLF	85n	15.10	0.70	0.20	0.90	12.6	2.81	21.2	30.2	30	.60	4.9	0.6	0.013	8	0.005	65.43		74.6	9.2	2.05	No	.110	2.9	67.7	6.2	68.3	6.3	Yes	Yes
	388+50	RLF	51b	25.00	0.70	0.29	0.90	10.2	3.09	38.4	54.9	36	.60	7.1	0.8	0.013	80	0.022	73.69		78.4	4.8	2.78	No	.757	4.1	76.9	7.8	77.8	0.6	Yes	See Note 5
	391+75	RLF	52f	356.37	0.70	0.65	0.90	31.3	1.85	323.7	462.4	RCB 10X5	.60	50.0	2.5	0.013	111	0.006	74.25		83.1	8.8	4.31	No	.035	6.2	79.1	9.2	80.4	2.7	Yes	Yes
	393+55	RLF	52d	355.44	0.70	0.65	0.90	31.3	1.85	322.8	461.2	RCB 7X4 - Double	.60	56.0	2.2	0.013	69	0.069	79.00		85.7	6.7	3.43	No	.021	4.9	82.9	8.2	83.9	1.7	Yes	See Note 5
	398+68	RLF	53c	3.90	0.70	0.17	0.90	10.0	3.12	6.3	9.0	18	.60	1.8	0.4	0.013	32	0.007	89.52		93.0	3.5	1.30	No	2.011	1.9	91.0	5.1	91.4	1.6	Yes	See Note 5
	402+50	RLF	54c	6.90	0.70	0.28	0.90	10.0	3.12	11.1	15.9	24	.60	3.1	0.5	0.013	54	0.005	93.67		98.5	4.8	1.54	No	1.287	2.1	95.4	5.1	95.8	2.7	Yes	Yes
	404+60	RLF	55c	5.50	0.70	0.31	0.90	10.0	3.12	9.0	12.9	24	.60	3.1	0.5	0.013	66	0.018	96.94		101.3	5.4	1.36	No	1.278	1.7	97.4	4.1	97.7	3.7	Yes	Yes
	409+33	RLF	56b	7.40	0.70	0.22	0.90	10.0	3.12	11.8	16.8	24	.60	3.1	0.5	0.013	55	0.005	103.73		108.3	4.5	1.60	No	1.388	2.2	105.5	5.3	106.0	2.3	Yes	Yes
	412+00	RLF	57b	4.80	0.70	0.15	0.90	10.0	3.12	7.6	10.9	18	.60	1.8	0.4	0.013	55	0.005	108.28		112.1	3.8	1.56	.1	4.191	2.4	110.1	6.2	110.7	1.4	No	See Note 5
	305+22	FR2	20d	536.60	0.70	4.79	0.90	35.8	1.74	461.8	659.7	RCB 8X4 - Double	.60	64.0	2.3	0.013	128	0.016	26.00		34.4	8.4	4.25	.2	.040	6.58	30.9	10.3	32.6	1.8	No	See Note 5
	320+50	FR2	24c	19.05	0.70	12.04	0.90	10.3	3.08	52.1	74.5	RCB 5x2	.60	10.0	1.1	0.013	48	0.029	6.74		11.1	4.3	2.17	.2	.182	3.39	9.3	7.4	10.1	0.9	No	See Note 5
	328+57	FR2	27c	0.00	0.70	12.96	0.90	10.0	3.12	25.5	36.4	30	.60	4.9	0.6	0.013	215.0	0.029	14.00		28.8	14.8	2.41	No	3.574	3.63	16.8	7.4	17.6	11.2	Yes	Yes

	Culvert Station	Align	Major Drainage Area Station	Drainage Area (acres)	Runoff Coefficient "C"			Time of Concentration (minutes)	25 Year Rainfall Intensity (in/hour)	25 Year Peak Flow Rate (cfs)	Diameter (inches)	Orifice "C"	Pipe Area (sq. feet)	Hydraulic Radius	Pipe Roughness "N"	Culvert Length (feet)	Constructed Slope (ft/foot)	Flow Line (feet)		Edge of Pavement Elev (feet)	Available Depth (feet)				25-Year Depth Inlet Control (feet)			25-Year Inlet Control Freeboard (feet)	25-Yr Meet Freeboard Requirement
Caltrans Right-of-Way	280+76	N2R	15d	19.30	0.70			16.6	1.99	26.9	RCB 4x2	.60	8.0	1.0	0.013	122	0.005	12.18		20.0	7.8				1.49			6.33	Yes
	328+96	RL1	29b	0.72	0.70			10.0	2.51	1.3	18	.60	1.8	0.4	0.013	95	0.004	20.40		35.6	15.2				.77			14.43	Yes
	330+36	RL1	30c	9.57	0.70			10.0	2.51	16.8	30	.60	4.9	0.6	0.013	91	0.062	30.79		43.9	13.2				1.76			11.39	Yes
	334+38	RL4	32d	3.20	0.70			10.0	2.51	5.6	18	.60	1.8	0.4	0.013	66	0.019	69.55		74.0	4.5				1.19			3.26	Yes
	335+86	RL2	40c	4.13	0.70			10.0	2.51	7.3	18	.60	1.8	0.4	0.013	91	0.054	64.16		77.1	13.0				1.48			11.48	Yes
	336+00	RL2	39b	0.52	0.70			10.0	2.51	.9	18	.60	1.8	0.4	0.013	20	0.077	55.10		61.5	6.4				.76			5.64	Yes
	336+20	RL3	36b	0.31	0.70			10.0	2.51	.5	18	.60	1.8	0.4	0.013	130	0.015	67.05		72.5	5.5				.75			4.70	Yes
	337+82	RL2	41b	0.11	0.70			10.0	2.51	.2	18	.60	1.8	0.4	0.013	192	0.060	66.15		71.7	5.5				.75			4.75	Yes
	338+51	RL3	37d	13.53	0.70			10.0	2.51	23.8	RCB 4x2	.60	8.0	1.0	0.013	60	0.022	61.15		68.2	7.0				1.38			5.66	Yes
	339+77	RL2	41f	0.21	0.70			10.0	2.51	.4	18	.60	1.8	0.4	0.013	43	0.010	50.50		63.4	12.9				.75			12.11	Yes
	339+77	RL2	41d	0.54	0.70			10.0	2.51	.9	18	.60	1.8	0.4	0.013	85	0.024	50.07		58.7	8.6				.76			7.85	Yes
	340+67	RL2	41h	0.75	0.70			10.0	2.51	1.3	18	.60	1.8	0.4	0.013	23	0.106	46.07		57.1	11.0				.77			10.23	Yes
	348+50	N2R	44d	5.34	0.70			10.1	2.49	9.3	18	.60	1.8	0.4	0.013	82	0.005	43.81		46.6	2.7				1.95			0.79	Yes
	373+60	N2R	86b	Overflow	0.70					14.5	18	.60	1.8	0.4	0.013		0.005	62.25		67.4	5.2				3.64			1.53	Yes
	376+50	N2R	86d	Overflow	0.70					14.5	18	.60	1.8	0.4	0.013		0.015	68.29		71.8	3.5				3.64			-0.14	No
	378+40	N2R	86f	Overflow	0.70					14.5	18	.60	1.8	0.4	0.013		0.017	71.84		75.4	3.6				3.64			-0.08	No
	378+90	N2R	86h	Overflow	0.70					14.5	18	.60	1.8	0.4	0.013		0.019	72.09		75.6	3.5				3.64			-0.13	No

Notes:
1. Tailwater controlled by Route 101 overtopping elevation at low point
2. Tailwater controlled by ditch downstream
3. 100-Year flow for County facilities, 100 Year Runoff Coefficient 0.7 per Marin County
4. 25-Year Flow used for Caltrans facilities
5. Positive freeboard met thought two foot freeboard requirement impracticle due to cover over crown of culvert
6. See Figure 3 for location of proposed culverts
7. Orifice Coefficient C = 0.6 is used for all pipes for inlet control calculation.

Marin Sonoma Narrows Improvement Project

TABLE 4A
Rock Slope Protection Calculations HEC-14 Method

						HEC-14 Calculations					Construction Documents		
Culvert Station	Align	Drainage Plan System	100-Year Peak Flow Rate (cfs)	Diameter (inches)	Diameter (feet)	$D_{adjusted}$ [1]	D_{50} [2] (feet)	D_{50} [2] (inches)	Apron Length (feet)	Apron Depth [3] (feet)	D_{50} (inches)	Apron Length (feet)	Apron Depth (feet)
228+78	FR1	1c	1.8	18	1.5	N / A	0.04	0.5	6	0.1	7	6.5	1.5
236+28	FR1	3c	5.4	18	1.5	1.14	0.35	4.2	6	1.2	7	6.5	1.5
241+18	FR1	4c	7.7	18	1.5	1.21	0.48	5.7	6	1.6	7	6.5	1.6
244+00	FR1	5b	14.5	24	2	N / A	0.35	4.2	8	1.2	7	8.0	1.5
250+43	FR1	7c	36.8	30	2.5	2.50	0.71	8.6	13	1.7	11	13.0	1.8
263+70	FR1	11c	59.2										
			29.6	30 - Double	2.5	N /A	0.53	6.4	13	1.3	11	13.0	1.8
303+00	BK	17b	9.9	18	1.5	1.30	0.57	6.9	8	1.4	11	8.0	1.8
304+30	BK	18b	6.4	18	1.5	1.16	0.42	5.0	6	1.5	7	6.5	1.5
310+10	BK	21b	10.7	18	1.5	1.31	0.62	7.5	8	1.5	11	8.0	1.8
318+10	BK	23b	31.9	30	2.5	1.87	1.16	13.9	15	2.6	14	26.0	2.6
332+50	BK	87b	2.8	18	1.5	0.96	0.22	2.7	6	0.8	7	10.0	1.5
358+50	RLF	46b	4.7	18	1.5	1.04	0.35	4.2	6	1.2	7	10.0	1.5
361+50	RLF	47b	4.4	18	1.5	1.09	0.29	3.5	6	1.0	7	10.0	1.5
373+35	RLF	49c	3.2	18	1.5	0.96	0.26	3.1	6	0.9	7	6.5	1.5
398+68	RLF	53c	9.0	18	1.5	1.40	0.43	5.1	6	1.4	7	6.5	1.5
328+57	FR2	27c	36.4	30	2.5	1.89	1.02	12.2	15	2.2	14	13.0	2.5
328+96	RL1	29b	1.3	18	1.5	N /A	0.03	0.3	6	0.1	7	10.0	1.5
330+36	RL1	30c	16.8	30	2.5	1.59	0.72	8.6	13	1.7	11	13.0	1.8
334+38	RL4	32d	5.6	18	1.5	1.08	0.42	5.0	6	1.4	7	10.0	1.5
335+86	RL2	40c	7.3	18	1.5	1.03	0.65	7.8	8	1.6	11	10.0	1.8
336+20	RL3	36b	0.5	18	1.5	0.85	0.03	0.4	6	0.1	7	10.0	1.5

N/A - Not Applicable

Notes:
1. HEC-14 Equation 10.5 - Diameter adjustment for supercritical flow only (Diameter adjustment is used for calculations D_{50} only and does not represent a physical change in diameter.)
2. HEC-14 Equation 10.4 - D_{50} sizing for circular culverts
3. Apron Depth are based on calculated D_{50}

Marin Sonoma Narrows Improvements

TABLE 5A
Drainage Ditches, Southern Project - 100 YR STORM

Alignment	Drainage Area Station Outfall	Drainage Plan System	Side Opening	Brow Ditch	100-Year Rainfall Intensity (in/hour)	Hillside 100-Year Flow (cfs)	Road Drainage Area (acres)	Road 100-Year Flow (cfs)	Total 100-year Flow (cfs)	Swale Slope (ft/foot)	Side-slope (H:V)	Bottom Width (feet)	100-Year Ditch Depth (feet)	Wetter Perimeter Top Width (feet)	Manning's Roughness Full Flow ("N")	100-year Flow Area (sq feet)	100-year Wetted Perimeter (feet)	100-year Flow (cfs)	100-Year Velocity (fps)	100-Year Velocity Head (feet)	100-Year Required Depth (feet)	Constructed Ditch Depth (feet)	Meet 100-Year Conveyance Requirement	Meet Freeboard Requirment
FR1	226+00	70a	No	No	3.12	4.8	0.14	.4	5.2	0.005	2	4	.90	7.62	0.080	5.3	8.0	5.2	1.0	0.02	0.92	1.15	Yes	Yes
FR1	228+78	70b	No	No	3.12	1.4	0.15	.4	1.8	0.008	2	2	.60	4.4	0.080	1.9	4.7	1.8	.9	0.01	0.62	1.15	Yes	Yes
FR1	236+28	70b	No	No	3.12	5.0	0.13	.4	5.4	0.005	2	2	1.18	6.7	0.080	5.2	7.3	5.4	1.0	0.02	1.20	1.65	Yes	Yes
FR1	241+18	70c	No	No	3.10	7.2	0.18	.5	7.7	0.008	2	2	1.25	7.0	0.080	5.6	7.6	7.7	1.4	0.03	1.28	1.65	Yes	Yes
FR1	244+00	88a	Yes	No	2.33	13.2	0.15	.3	13.5	0.005	2	1	1.01	5.0	0.016	3.0	5.5	13.5	4.4	0.31	1.31	1.59	Yes	Yes
FR1	244+00	70d	Yes	No	3.12	1.0	0.09	.3	1.3	0.005	2	2	.57	4.3	0.080	1.8	4.6	1.3	.7	0.01	0.58	1.61	Yes	Yes
FR1	245+56	70e	No	No	2.66	8.7	0.15	.4	9.1	0.014	2	2.5	1.11	6.9	0.080	5.2	7.5	9.1	1.7	0.05	1.16	1.20	Yes	Yes
FR1	250+43	70f	No	No	3.12	.9	0.09	.3	1.1	0.022	2	2	.36	3.4	0.080	1.0	3.6	1.1	1.2	0.02	0.38	1.15	Yes	Yes
FR1	253+66	70f	No	No	3.12	.4	0.04	.1	0.5	0.058	2	2	.18	2.7	0.080	.4	2.8	.6	1.3	0.03	0.21	3.14	Yes	Yes
FR1	253+66	70g	No	No	2.58	17.9	0.16	.4	18.2	0.005	2	4.75	1.63	11.3	0.080	13.1	12.1	18.2	1.4	0.03	1.66	4.91	Yes	Yes
See Note 2	4.09	9a	No	Yes	2.58	7.4	0.00	.0	7.4	0.080	2	0	.59	2.3	0.016	.7	2.6	7.4	10.8	1.80	2.39	1.00	Yes	No
See Note 2	0.22	70h	No	No	3.12	.5	0.07	.2	.7	0.010	2	2	.34	3.3	0.080	.9	3.5	.7	.8	0.01	0.35	1.22	Yes	Yes
FR1	263+70	70i	No	No	2.66	4.5	0.20	.5	5.0	0.005	2	2	1.13	6.5	0.080	4.8	7.1	5.0	1.0	0.02	1.15	2.02	Yes	Yes
See Note 2	0.17	9e	No	Yes	3.12	.4	0.00	.0	.4	0.080	2	0	.19	.8	0.016	.1	.9	.4	5.1	0.40	0.60	1.00	Yes	Yes
See Note 2	0.58	70h	No	No	3.12	1.3	0.13	.4	1.6	0.015	2	2	.49	3.9	0.080	1.4	4.2	1.6	1.1	0.02	0.51	1.22	Yes	Yes
FR1	267+50	70j	Yes	No	3.05	6.2	0.16	.4	6.6	0.005	2	2.5	1.22	7.4	0.080	6.1	8.0	6.6	1.1	0.02	1.24	1.30	Yes	Yes
FR1	267+50	70k	Yes	No	2.56	10.8	0.11	.3	11.0	0.017	2	4	.97	7.9	0.080	5.8	8.4	11.0	1.9	0.06	1.03	4.25	Yes	Yes
See Note 2	2.46	13a	No	Yes	2.65	4.6	0.00	.0	4.6	0.080	2	0	.49	2.0	0.016	.5	2.2	4.6	9.6	1.42	1.91	1.00	Yes	No
See Note 2	0.09	70l	No	No	3.12	.2	0.05	.1	.3	0.013	2	2	.21	2.8	0.080	.5	2.9	.3	.7	0.01	0.22	2.26	Yes	Yes
FR1	270+34	13b	Yes	No	3.12	.4	0.00	.0	0.4	0.046	2	0	.22	.9	0.016	.1	1.0	.4	4.3	0.29	0.51	1.00	Yes	Yes
FR1	275+00	13b	No	Yes	3.12	3.9	0.00	.0	3.9	0.046	2	0	.51	2.1	0.016	.5	2.3	3.9	7.5	0.87	1.38	1.00	Yes	No
FR1	275+00	70m	No	No	3.12	.7	0.16	.4	1.1	0.021	2	2	.36	3.4	0.080	1.0	3.6	1.1	1.1	0.02	0.38	1.17	Yes	Yes
FR1	275+00	88b	No	No	2.39	122.2	0.12	.3	122.4	0.010	1	2	2.51	7.0	0.016	11.4	9.1	122.4	10.8	1.81	4.32	3.29	Yes	No
See Note 2	72.3	88c	No	No	2.39	121.0	0.12	.3	121.2	0.010	2	3	1.84	10.3	0.016	12.3	11.2	121.2	9.9	1.52	3.35	2.52	Yes	No
BK	281+50	70n	Yes	No	2.48	32.6	0.26	.6	33.2	0.030	2	3	1.64	9.6	0.080	10.3	10.3	33.2	3.2	0.16	1.80	4.56	Yes	Yes
BK	293+48	70o	No	No	2.16	14.7	0.12	.2	14.9	0.005	2	4.25	1.54	10.4	0.080	11.2	11.1	14.9	1.3	0.03	1.56	4.55	Yes	Yes
BK	303+00	70p	Yes	No	2.33	9.8	0.08	.2	9.9	0.030	2	3	.89	6.6	0.080	4.3	7.0	9.9	2.3	0.08	0.98	1.50	Yes	Yes
BK	305+39	21e	No	No	3.12	.7	0.00	.0	0.7	0.050	2	0	.26	1.0	0.016	.1	1.2	.7	4.9	0.38	0.64	7.02	Yes	Yes
BK	310+10	21e	Yes	No	3.12	1.7	0.00	.0	1.7	0.016	2	0	.46	1.8	0.016	.4	2.1	1.7	4.1	0.26	0.72	1.78	Yes	Yes
BK	310+10	21f	Yes	No	3.12	3.1	0.00	.0	3.1	0.006	2	0	.68	2.7	0.016	.9	3.1	3.1	3.3	0.17	0.85	1.23	Yes	Yes

Notes

1. See Figure 3 for location
2. Ditch outfalls to another ditch. See Figure 3 for correspoding ditch limits.

Marin Sonoma Narrows Improvements

TABLE 5B
Drainage Ditches, Northern Project- 100 YR STORM

Alignment	Drainage Area Station Outfall	Drainage Plan System	Side Opening	Brow Ditch	100-Year Rainfall Intensity (in/hour)	Hillside 100-Year Flow (cfs)	Road Drainage Area (acres)	Road 100-Year Flow (cfs)	Total 100-year Flow (cfs)	Swale Slope (ft/foot)	Side-slope (H:V)	Bottom Width (feet)	100-Year Ditch Depth (feet)	Wetter Perimeter Top Width (feet)	Manning's Roughness Full Flow ("N")	100-year Flow Area (sq feet)	100-year Wetted Perimeter (feet)	100-year Flow (cfs)	100-year Velocity (fps)	100-Year Velocity Head (feet)	100-Year Required Depth (feet)	Constructed Ditch Depth (feet)	Meet 100-Year Conveyance Requirement	Meet Freeboard Requirment
BK	318+10	23e	Yes	No	3.11	10.0	0.07	.20	10.2	.015	2	0	0.90	3.6	0.016	1.6	4.0	10.2	6.2	0.60	1.51	1.80	Yes	Yes
BK	318+10	23f	Yes	No	3.08	21.6	0.08	.2	21.8	.005	2	0	1.48	5.9	0.016	4.4	6.6	21.8	5.0	0.39	1.86	2.42	Yes	Yes
BK	323+60	25p	Yes	No	2.96	11.8	0.04	.1	11.9	.029	2	0	0.85	3.4	0.016	1.4	3.8	11.9	8.3	1.07	1.92	2.80	Yes	Yes
BK	326+50	25a	Yes	Yes	2.96	14.7	0.00	.0	14.7	.015	1	0	1.43	2.9	0.016	2.0	4.0	14.7	7.2	0.81	2.24	1.50	Yes	No
BK	326+50	25q	Yes	No	3.12	4.2	0.07	.2	4.4	.040	1	0	0.75	1.5	0.016	.6	2.1	4.4	7.7	0.92	1.67	1.20	Yes	No
BK	332+50	61a	Yes	Yes	3.12	2.8	0.00	.0	2.8	.070	2	0	0.42	1.7	0.016	.4	1.9	2.8	8.1	1.01	1.43	1.50	Yes	Yes
BK	334+07	35a	Yes	No	3.12	7.0	0.09	.3	7.2	.120	1	0	0.74	1.5	0.016	.5	2.1	7.3	13.2	2.71	3.45	1.05	Yes	No
See Note 2	0.04	35b	No	Yes	3.12	.1	0.00	.0	.1	.110	1	0	0.14	.3	0.016	.0	.4	.1	4.2	0.28	0.42	1.50	Yes	Yes
RLF	347+00	37h	Yes	Yes	3.12	27.6	0.00	.0	27.6	.100	2	0	0.92	3.7	0.016	1.7	4.1	27.6	16.3	4.12	5.04	1.75	Yes	No
RLF	347+00	37g	Yes	No	3.12	.4	0.00	.0	.4	.100	1	0	0.27	.5	0.016	.1	.8	.4	6.1	0.58	0.85	1.00	Yes	Yes
RLF	351+74	43e	No	No	3.12	10.5	0.18	.5	11.0	.005	2	0	1.14	4.6	0.016	2.6	5.1	11.0	4.2	0.28	1.42	4.23	Yes	Yes
RLF	351+74	43f	No	No	3.05	13.9	0.16	.4	14.3	.010	2	0	1.11	4.4	0.016	2.5	5.0	14.3	5.8	0.53	1.64	4.23	Yes	Yes
RLF	356+00	44f	Yes	No	3.12	.9	0.04	.1	1.0	.054	2	0	0.30	1.2	0.016	.2	1.3	1.0	5.6	0.49	0.79	6.27	Yes	Yes
RLF	358+50	46h	Yes	No	3.11	2.8	0.00	.0	2.8	.036	2	0	0.47	1.9	0.016	.5	2.1	2.8	6.3	0.61	1.09	2.13	Yes	Yes
RLF	358+50	46j	Yes	Yes	3.11	1.5	0.00	.0	1.5	.027	2	0	0.40	1.6	0.016	.3	1.8	1.5	4.8	0.36	0.76	1.00	Yes	Yes
RLF	358+50	46i	No	No	3.12	.1	0.10	.3	.3	.027	1	0	0.31	.6	0.016	.1	.9	.3	3.5	0.19	0.51	1.00	Yes	Yes
RLF	361+50	47g	Yes	Yes	3.10	3.9	0.00	.0	3.9	.043	2	0	0.52	2.1	0.016	.5	2.3	3.9	7.3	0.82	1.34	1.00	Yes	No
RLF	361+50	47f	No	No	3.12	.2	0.00	.0	.2	.043	1	0	0.24	.5	0.016	.1	.7	.2	3.7	0.22	0.46	1.00	Yes	Yes
RLF	365+72	48d	No	No	3.09	54.1	0.31	.9	55.0	.020	1	0	2.22	4.4	0.016	4.9	6.3	55.0	11.2	1.95	4.16	3.57	Yes	No
RLF	365+72	48e	No	No	3.12	11.8	0.52	1.5	16.5	.022	1	0	1.39	2.8	0.016	1.9	3.9	16.5	8.6	1.15	2.53	3.82	Yes	Yes
RLF	373+35	49f	No	No	2.91	2.6	0.23	.6	3.2	.015	1	1	0.45	1.9	0.016	.7	2.3	3.2	5.0	0.38	0.83	1.15	Yes	Yes
RLF	378+42	50i	No	No	2.92	13.3	0.22	.6	13.8	.005	1	1	1.27	3.5	0.016	2.9	4.6	13.8	4.8	0.36	1.63	1.90	Yes	Yes
RLF	378+42	50j	No	No	2.81	20.3	0.18	.5	20.7	.005	1	0	1.99	4.0	0.016	4.0	5.6	20.7	5.2	0.42	2.42	2.90	Yes	Yes
RLF	380+90	85p	Yes	No	3.08	19.0	0.20	.6	19.5	.014	1	0	1.61	3.2	0.016	2.6	4.5	19.5	7.6	0.89	2.49	2.75	Yes	Yes
RLF	383+60	85q	Yes	No	3.12	3.5	0.16	.4	3.9	.014	1	0	0.88	1.8	0.016	.8	2.5	3.9	5.1	0.40	1.28	2.90	Yes	Yes
RLF	385+85	85r	Yes	No	2.81	29.7	0.20	.5	30.2	.014	1	0	1.89	3.8	0.016	3.6	5.4	30.2	8.4	1.10	3.00	3.50	Yes	Yes
RLF	388+50	51g	No	No	3.09	3.7	0.29	.8	4.5	.022	1	1	0.48	2.0	0.016	.7	2.4	4.5	6.2	0.60	1.09	1.09	Yes	Yes
RLF	393+55	52k	No	No	3.12	8.5	0.65	1.8	10.4	.024	1	2	0.53	3.1	0.016	1.4	3.5	10.4	7.6	0.91	1.44	1.50	Yes	Yes
RLF	402+50	54f	No	No	3.12	7.7	0.11	.3	8.0	.005	1	0	1.39	2.8	0.016	1.9	3.9	8.0	4.1	0.26	1.65	2.97	Yes	Yes
RLF	402+50	54g	No	No	3.12	7.4	0.17	.5	7.9	.005	1	0	1.39	2.8	0.016	1.9	3.9	7.9	4.1	0.26	1.65	2.69	Yes	Yes
RLF	404+50	55f	Yes	No	3.12	12.0	0.31	.9	12.9	.005	1	0	1.67	3.3	0.016	2.8	4.7	12.9	4.6	0.33	2.00	2.28	Yes	Yes
See Note 2	0.3	56h	No	Yes	3.12	.7	0.00	.0	.7	.120	2	0	0.22	.9	0.016	.1	1.0	.7	6.8	0.73	0.95	1.00	Yes	Yes
RLF	409+33	62g	Yes	No	3.12	.4	0.22	.6	1.1	.014	1	0	0.54	1.1	0.016	.3	1.5	1.1	3.6	0.21	0.74	1.75	Yes	Yes
RLF	412+00	62g	Yes	Yes	3.12	1.7	0.22	.6	2.4	.080	2	0	0.38	1.5	0.016	.3	1.7	2.4	8.1	1.02	1.40	1.00	Yes	No
RLF	412+00	57i	Yes	No	3.12	8.7	0.15	.4	9.2	.005	1	0.5	1.23	3.0	0.016	2.1	4.0	9.2	4.3	0.29	1.52	1.65	Yes	Yes
See Note 2	2.09	58a	No	Yes	3.12	4.6	0.00	.0	4.6	.080	1	0	0.67	1.3	0.016	.5	1.9	4.6	10.1	1.59	2.26	1.00	Yes	No
See Note 2	0.1	88e	No	No	3.15	.2	0.12	.3	.6	.008	1	0	0.47	.9	0.016	.2	1.3	.6	2.5	0.10	0.57	1.75	Yes	Yes
RLF	420+00	58e	No	No	3.10	5.2	0.41	1.1	6.4	.030	2	3	0.70	5.8	0.080	3.1	6.2	6.4	2.0	0.06	0.77	1.55	Yes	Yes
See Note 2	0.66	58e	No	Yes	3.10	1.4	0.00	.0	1.4	.090	1	0	0.43	.9	0.016	.2	1.2	1.4	7.9	0.97	1.40	1.00	Yes	No
See Note 2	0.63	70q	No	No	3.12	1.4	0.39	1.1	2.5	.030	2	2	0.51	4.0	0.080	1.5	4.3	2.5	1.6	0.04	0.55	1.59	Yes	Yes
RL2	336+50				3.45		0.04	.13	.13	.050	1	0	0.19	.4	0.016	.0	.5	.1	3.5	0.19	0.38	1.00	Yes	Yes
RL2	339+10				3.45		0.12	.39	.39	.050	1	0	0.29	.6	0.016	.1	.8	.4	4.6	0.33	0.62	1.00	Yes	Yes
RL2	339+90				3.45		0.84	2.75	2.75	.050	2	11	0.18	11.7	0.080	2.1	11.8	2.8	1.3	0.03	0.21	1.50	Yes	Yes
NR2	318+50				3.45		1.11	2.42	2.42	.005	2	3	0.68	5.7	0.080	3.0	6.0	2.4	.8	0.01	0.69	1.58	Yes	Yes
NR2/RL4	324+00				3.45		2.32	5.33	5.33	.015	2	0	0.71	2.8	0.016	1.0	3.2	5.3	5.3	0.44	1.15	1.08	Yes	No
N2R	332+16				3.45		1.28	2.26	2.26	.030	2	4	0.34	5.4	0.080	1.6	5.5	2.26	1.4	0.03	0.37	2.00	Yes	Yes
N2R	242+75				3.45		0.55	1.29	1.29	.008	2	4	0.36	5.4	0.080	1.7	5.6	1.3	.8	0.01	0.37	2.00	Yes	Yes

Notes:

1. See Figure 3 for location
2. Ditch outfalls to another ditch. See Figure 3 for correspoding ditch limits.
3. Energy grade line "spills" west over right-of-way not east towards frontage road

Marin Sonoma Narrows Improvement Project

TABLE 5C

Ditch Transition to Side Opening Inlet, 100-Year Peak Flow Rate

Station	Ditch	Culvert	Ditch Station	100-year Peak Flow (cfs)	Minimum Channel Elevation (feet)	Water Level (feet)	Energy Grade Level (feet)	Opening / Ditch Depth (feet)	Energy Grade Depth (feet)	Inlet Depth (feet)	Available Depth (feet)	Critical Water Level (feet)	Energy Grade Slope (ft/foot)	Channel Velocity (fps)	Flow Area (sq. feet)	Top Width (feet)
244+00	88a	5a	110	13.5	10.75	11.76	12.06	1.6	1.3		0.3	11.75	0.0049	4.4	3.1	5.1
244+00	88a	5a	105	13.5	10.72	11.73	12.03	1.6	1.3		0.3	11.73	0.0051	4.4	3.0	5.0
244+00	88a	5a	100	13.5	10.70	11.43	11.79	1.0		0.7	0.3	11.43	0.0062	4.8	2.8	3.9
244+00	70d	5a	110	1.3	10.75	11.40	11.41	1.6	0.7		1.0	0.00	0.0031	0.6	2.2	4.6
244+00	70d	5a	105	1.3	10.72	11.39	11.40	1.6	0.7		0.9	0.00	0.0029	0.6	2.2	4.7
244+00	70d	5a	100	1.3	10.70	11.39	11.39	1.0		0.7	0.3	10.85	0.0001	0.5	2.6	3.9
267+50	70j	12a	110	6.6	18.70	19.37	19.47	1.3	0.8		0.5	19.22	0.0533	2.6	2.6	5.2
267+50	70j	12a	105	6.6	18.68	19.20	19.40	1.3	0.7		0.6	19.20	0.0054	3.6	1.8	4.6
267+50	70j	12a	100	6.6	18.65	19.11	19.34	1.0		0.5	0.5	19.11	0.0065	3.9	1.7	3.8
267+50	70k	12a	110	11	18.82	19.56	19.68	4.3	0.9		3.4	0.00	0.0460	2.7	4.1	7.0
267+50	70k	12a	105	11	18.74	19.56	19.65	4.3	0.9		3.3	0.00	0.0013	2.4	4.6	7.3
267+50	70k	12a	100	11	18.65	19.29	19.61	1.0		0.6	0.4	19.29	0.0063	4.6	2.4	3.8
270+34	13b	79a	110	0.4	31.25	31.55	31.63	1.0	0.4		0.6	31.55	0.0081	2.2	0.2	1.2
270+34	13b	79a	105	0.4	31.02	31.32	31.40	1.0	0.4		0.6	31.32	0.0081	2.2	0.2	1.2
270+34	13b	79a	100	0.4	30.79	30.86	30.90	1.0		0.1	0.9	30.86	0.0096	1.5	0.3	3.7
281+50	70n	15a	110	33.2	22.30	23.94	24.10	4.6	1.8		2.8	0.00	0.0306	3.2	10.3	9.5
281+50	70n	15a	105	33.2	22.15	23.95	24.07	4.6	1.9		2.6	0.00	0.0008	2.8	11.9	10.2
281+50	70n	15a	100	33.2	22.00	23.34	24.01	1.5		1.3	0.2	23.34	0.0068	6.6	5.1	3.8
303+00	70p	17a	110	9.9	42.64	43.25	43.48	1.5	0.8		0.7	43.25	0.1283	3.9	2.6	5.4
303+00	70p	17a	105	9.9	42.49	43.10	43.33	1.5	0.8		0.7	43.10	0.0051	3.9	2.6	5.4
303+00	70p	17a	100	9.9	42.34	42.94	43.24	1.0		0.6	0.4	42.94	0.0063	4.4	2.3	3.8
310+10	21e	21a	110	1.7	27.96	28.49	28.63	1.8	0.7		1.1	28.49	0.0069	3.0	0.6	2.1
310+10	21e	21a	105	1.7	27.88	28.41	28.55	1.8	0.7		1.1	28.41	0.0069	3.0	0.6	2.1
310+10	21e	21a	100	1.7	27.80	27.99	28.08	1.0		0.2	0.8	27.99	0.0074	2.5	0.7	3.7
310+10	21f	21a	110	3.1	27.86	28.54	28.71	1.2	0.9		0.4	28.54	0.0061	3.3	0.9	2.7
310+10	21f	21a	105	3.1	27.83	28.51	28.68	1.2	0.9		0.4	28.51	0.0064	3.4	0.9	2.7
310+10	21f	21a	100	3.1	27.80	28.08	28.22	1.0		0.3	0.7	28.08	0.0068	3.0	1.0	3.8
318+10	23e	23a	110	10.2	22.08	23.18	23.46	1.8	1.4		0.4	23.17	0.1325	4.2	2.4	4.4
318+10	23e	23a	105	10.2	22.01	23.10	23.39	1.8	1.4		0.4	23.10	0.0055	4.3	2.4	4.4
318+10	23e	23a	100	10.2	21.93	22.90	23.02	1.0		1.0	0.0	22.54	0.0016	2.8	3.7	3.8
318+10	23f	23a	110	21.8	21.98	23.64	23.88	2.4	1.9		0.5	23.46	0.0666	3.9	5.5	6.7
318+10	23f	23a	105	21.8	21.95	23.43	23.81	2.4	1.9		0.6	23.43	0.0049	5.0	4.4	5.9
318+10	23f	23a	100	21.8	21.93	22.94	23.45	1.5		1.0	0.5	22.94	0.0065	5.7	3.8	3.8
323+60	25p	25a	110	11.9	25.62	26.78	27.08	2.8	1.5		1.3	26.78	0.0054	4.4	2.7	4.7
323+60	25p	25a	105	11.9	25.47	26.63	26.93	2.8	1.5		1.3	26.63	0.0053	4.4	2.7	4.7
323+60	25p	25a	100	11.9	25.33	26.01	26.35	1.0		0.7	0.3	26.01	0.0064	4.7	2.5	3.8

TABLE 5D
Ditch Transition to Side Opening Inlet, 100-Year Peak Flow Rate

Station	Ditch	Culvert	Ditch Station	100-year Peak Flow (cfs)	Minimum Channel Elevation (feet)	Water Level (feet)	Energy Grade Level (feet)	Opening / Ditch Depth (feet)	Energy Grade Depth (feet)	Inlet Depth (feet)	(feet)	Critical Water Level (feet)	Energy Grade Slope (ft/foot)	Channel Velocity (fps)	Flow Area (sq. feet)	Top Width (feet)
326+50	25a	25c	110	14.7	46.82	48.49	48.92	1.5	2.1		-0.6	48.49	0.0065	5.3	2.8	3.3
326+50	25a	25c	105	14.7	46.74	48.41	48.84	1.5	2.1		-0.6	48.41	0.0065	5.3	2.8	3.3
326+50	25a	25c	100	14.7	46.67	47.45	47.84	1.0		0.8	0.2	47.45	0.0064	5.0	2.9	3.8
326+50	25q	25e	110	4.4	39.52	40.55	40.82	1.2	1.3		-0.1	40.55	0.0076	4.1	1.1	2.1
326+50	25q	25e	105	4.4	39.32	40.35	40.62	1.2	1.3		-0.1	40.35	0.0076	4.1	1.1	2.1
326+50	25q	25e	100	4.4	39.12	39.47	39.65	1.0		0.4	0.6	39.47	0.0066	3.4	1.3	3.8
332+50	61a	87a	110	2.8	74.67	75.53	75.75	1.5	1.1		0.4	75.53	0.0081	3.8	0.7	1.7
332+50	61a	87a	105	2.8	74.32	75.18	75.40	1.5	1.1		0.4	75.18	0.0081	3.8	0.7	1.7
332+50	61a	87a	100	2.8	73.97	74.87	74.88	1.0		0.9	0.1	74.23	0.0002	0.8	3.4	3.8
334+07	35a	32a	110	7.2	75.80	77.06	77.38	1.1	1.6		-0.5	77.06	0.0071	4.6	1.6	2.5
334+07	35a	32a	105	7.2	75.20	76.46	76.78	1.1	1.6		-0.5	76.46	0.0071	4.6	1.6	2.5
334+07	35a	32a	100	7.2	74.60	75.09	75.33	1.0		0.5	0.5	75.09	0.0064	4.0	1.8	3.8
347+00	37h	37a	110	27.6	82.67	84.30	84.72	1.8	2.1		-0.3	84.30	0.0048	5.2	5.3	6.5
347+00	37h	37a	105	27.6	82.17	83.80	84.22	1.8	2.1		-0.3	83.80	0.0047	5.2	5.3	6.5
347+00	37h	37a	100	27.6	81.67	82.86	83.45	1.5		1.2	0.3	82.86	0.0067	6.2	4.5	3.8
347+00	37g	37a	110	0.4	82.67	83.07	83.17	1.0	0.5		0.5	83.07	0.0104	2.6	0.2	0.8
347+00	37g	37a	105	0.4	82.17	82.57	82.67	1.0	0.5		0.5	82.57	0.0104	2.6	0.2	0.8
347+00	37g	37a	100	0.4	81.67	81.74	81.78	1.0		0.1	0.9	81.74	0.0097	1.5	0.3	3.7
356+00	44f	44a	110	0.9	74.41	74.83	74.93	6.3	0.5		5.7	74.83	0.0072	2.6	0.4	1.7
356+00	44f	44a	105	0.9	74.14	74.56	74.66	6.3	0.5		5.8	74.56	0.0072	2.6	0.4	1.7
356+00	44f	44a	100	0.9	73.87	73.99	74.05	1.0		0.1	0.9	73.99	0.0097	2.1	0.4	3.7
358+50	46h	46a	110	2.8	75.86	76.51	76.68	2.1	0.8		1.3	76.51	0.0064	3.3	0.9	2.6
358+50	46h	46a	105	2.8	75.68	76.33	76.50	2.1	0.8		1.3	76.33	0.0064	3.3	0.9	2.6
358+50	46h	46a	100	2.8	75.50	75.76	75.89	1.0		0.3	0.7	75.76	0.0070	2.9	1.0	3.8
358+50	46j	46a	110	1.5	75.77	76.28	76.41	1.0	0.6		0.4	76.28	0.0070	2.9	0.5	2.0
358+50	46j	46a	105	1.5	75.64	76.15	76.28	1.0	0.6		0.4	76.15	0.0070	2.9	0.5	2.0
358+50	46j	46a	100	1.5	75.50	75.67	75.76	1.0		0.2	0.8	75.67	0.0075	2.3	0.6	3.7
361+50	47g	47a	110	3.9	60.04	60.79	60.98	1.0	0.9		0.1	60.79	0.0062	3.5	1.1	3.0
361+50	47g	47a	105	3.9	59.82	60.57	60.76	1.0	0.9		0.1	60.57	0.0062	3.5	1.1	3.0
361+50	47g	47a	100	3.9	59.61	59.93	60.09	1.0		0.3	0.7	59.93	0.0066	3.2	1.2	3.8
383+60	85q	85k	110	3.9	68.55	69.54	69.79	2.9	1.2		1.7	69.54	0.0076	4.0	1.0	2.0
383+60	85q	85k	105	3.9	68.48	69.47	69.72	2.9	1.2		1.7	69.47	0.0076	4.0	1.0	2.0
383+60	85q	85k	100	3.9	68.41	68.73	68.89	1.0		0.3	0.7	68.73	0.0066	3.2	1.2	3.8
385+85	85r	85o	110	30.2	71.31	73.52	74.12	3.5	2.8		0.7	73.52	0.0061	6.2	4.8	4.0
385+85	85r	85o	105	30.2	71.24	73.44	74.05	3.5	2.8		0.7	73.44	0.0063	6.3	4.8	4.0
385+85	85r	85o	100	30.2	71.17	72.43	73.06	1.5		1.3	0.2	72.43	0.0067	6.4	4.8	3.8
409+33	62g	56a	110	16.7	106.64	108.40	108.85	1.8	2.2		-0.5	108.40	0.0063	5.4	3.1	3.5
409+33	62g	56a	105	16.7	106.57	108.33	108.78	1.8	2.2		-0.5	108.33	0.0064	5.4	3.1	3.5
409+33	62g	56a	100	16.7	106.50	107.35	107.77	1.0		0.8	0.2	107.35	0.0064	5.2	3.2	3.8
412+00	62g	57a	110	2.4	109.90	110.52	110.71	1.0	0.8		0.2	110.51	0.0067	3.5	0.7	1.7
412+00	62g	57a	105	2.4	109.86	110.47	110.67	1.0	0.8		0.2	110.47	0.0071	3.6	0.7	1.7
412+00	62g	57a	100	2.4	109.82	110.10	110.18	1.0		0.3	0.7	110.05	0.0040	2.3	1.1	3.8
412+00	57i	57a	110	9.2	109.87	111.10	111.39	1.7	1.5		0.1	111.03	0.0050	4.3	2.1	3.0
412+00	57i	57a	105	9.2	109.85	111.02	111.36	1.7	1.5		0.1	111.02	0.0064	4.7	1.9	2.8
412+00	57i	57a	100	9.2	109.82	110.39	110.68	1.0		0.6	0.4	110.39	0.0063	4.3	2.2	3.8

Marin Sonoma Narrow Project Improvements

Table 6
Hydrograph Modification Program Facilities

BAHM Model	Existing Condition (acres)	Proposed Condition (acres)	1 Biostrip South of Interchange	2 Biostrip Interchange & East Frontage Road	3 Biostrip North of Interchange	4 Detention Basin	Runoff to hydrograph modification faciliites (acres)	Runoff away from hydrograph modification BMP's (acres)
Total Area	92.13	92.13	3.89	7.91	5.34	15.41	32.55	59.58
Impervious Area	16.25	27.37	2.63	5.26	3.96	0.53	12.38	14.99
Pervious Area	75.88	64.76	1.26	2.65	1.38	14.88	20.17	44.59

Overall Project	Existing Condition (acres)	Proposed Condition (acres)	Difference	Biostrip (acres)	Detention Basin (acres)
Total Area	92.13	92.13	0.0	17.14	15.41
Total Impervious Area	16.25	27.37	11.12	11.85	0.53
Total Pervious Area	75.88	64.76	-11.12	5.29	14.88

Marin Somona Narrow Project Improvements

Table 7
Discharge Duration for 37 Year Period, Project Wide

Hours	Pre-Project Baseline Flow (cfs)	Developed Hydrograph Modification Facility Flow (cfs)	Flow Reduction Compared to Pre-Project Flow (cfs)
4 HR	28.4	25.9	2.5
5 HR	26.2	24.5	1.7
6 HR	25.3	22.3	3.1
7 HR	24.2	20.9	3.3
8 HR	23.4	20.6	2.8
9 HR	22.5	20.0	2.5
10 HR	20.9	19.2	1.7
11 HR	20.6	18.9	1.7
12 HR	20.0	18.9	1.1
18 HR	18.1	16.1	1.9
24 HR	16.4	15.6	0.8
30 HR	15.0	13.6	1.4
36 HR	14.5	13.1	1.4
42 HR	13.6	12.0	1.7
48 HR	12.5	11.4	1.1
72 HR	11.1	9.7	1.4
100 HR	9.7	8.6	1.1
200 HR	7.2	6.4	0.8
300 HR	5.8	5.3	0.6
400 HR	4.7	4.2	0.6
500 HR	4.2	3.6	0.6
600 HR	3.6	3.3	0.3
700 HR	3.3	3.1	0.3
800 HR	2.8	2.8	0.0
900 HR	2.8	2.5	0.3
1000 HR	2.5	2.5	0.0
1500 HR	1.7	1.7	0.0
2000 HR	1.4	1.4	0.0
2500 HR	1.1	1.1	0.0
3000 HR	1.1	1.1	0.0
3500 HR	1.1	1.1	0.0

Return Period (Years)	Pre-Project Baseline (cfs)	Developed Hydrograph Modification Falicity (cfs)	Flow Reduction Compared to Pre-Project Flow (cfs)
2	11.1	9.6	1.5
5	20.9	19.0	1.8
10	28.7	26.0	2.7
25	50.1	43.7	6.4

Marin Sonoma Narrows Improvement Project

Table 8
County Culvert Hydrology (Tailwater condition) - 100 Year Storm

Node [1] #	Drainage Plan System	Sheet Number on Plans	Ground Elevation (ft)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [3] (cfs)**
Cross Culvert Station 378																
I-378-1-3-1	85k	D-13	72.2	64.4	68.86	68.86	1.76		0.70	1.23	1.76	1.23	10.0	10.0	3.12	**4**
I-378-1-2-1	85g	D-12	67.8	63.0	66.75	66.75	9.00		0.70	6.30	9.00	6.30	10.3	10.3	3.09	**20**
I-378-1-5	85o	D-13	74.9	65.5	70.89	70.89	15.30		0.70	10.71	15.30	10.71	12.6	12.6	2.85	**31**
I-378-1-4	85m	D-13	74.2	65.4	70.82	70.17	(N/A)		(N/A)	0.00	15.30	10.71	0.0	12.6	2.84	**31**
I-378-1-3	85i	D-12	72.0	64.3	68.85	68.79	(N/A)	1.76	(N/A)	0.00	17.06	12.47	0.0	13.2	2.78	**33**
I-378-1-2	85e	D-12	67.8	63.0	66.74	66.65	(N/A)	9.00	(N/A)	0.00	26.06	18.24	0.0	13.9	2.71	**50**
I-378-1-1	85c	D-12	67.8	62.9	66.50	65.92	(N/A)		(N/A)	0.00	26.06	18.24	0.0	14.0	2.70	**50**
I-378-2	50a	D-12	65.5	62.0	65.46	65.46	17.20		0.70	12.04	17.20	12.04	12.6	12.6	2.82	**35**
I-378-1	85a	D-12	65.8	61.1	65.46	65.10	(N/A)	26.06	(N/A)	0.00	43.26	30.28	0.0	14.6	2.63	**80**
Cross Culvert Station 350		**Tailwater Set at Crown of Pipe.**														
I-350-1L-1	39g	D-9	52.0	47.0	52.00	52.00	0.55		0.90	0.50	0.55	0.50	5.0	5.0	4.29	**2.1**
I-350-1-2	39a	D-9	53.0	48.0	52.73	52.73	(N/A)		(N/A)	0.00	(N/A)	0.00	0.0	0.0	4.29	**0.5**
I-350-1-1	39c	D-9	53.0	47.2	52.72	52.72	(N/A)		(N/A)	0.00	(N/A)	0.00	0.0	10.0	3.12	**0.5**
I-350-5	43b	D-9	87.3	65.7	67.37	67.37	30.04		0.70	21.10	30.04	21.10	12.5	12.5	2.86	**61**
I-350-4	43d	D-9	80.0	64.9	67.07	66.53	(N/A)		(N/A)	0.00	30.04	21.10	0.0	12.7	2.83	**60**
I-350-3	43f	D-9	80.0	56.4	58.57	58.02	(N/A)		(N/A)	0.00	30.04	21.10	0.0	12.9	2.82	**60**
I-350-2	39e	D-9	52.5	49.2	52.57	52.50	0.74		0.70	0.52	30.04	21.61	5.0	12.9	2.81	**61**
I-350-1	39i	D-9	53.0	46.2	52.72	52.28	0.22	0.55	0.90	0.20	30.59	22.31	5.0	19.9	2.36	**53**
Cross Culvert Station 305																
I-305		D-7	40.9	33.6	38.33	38.33	527.10		0.70	368.97	527.10	368.97	35.8	35.8	1.79	**664**
Cross Culvert Station 293																
I-293		D-6	51.9	46.3	49.67	49.67	378.82		0.70	265.20	378.82	265.20	33.2	33.2	1.83	**489**
Cross Culvert Station 275																
I-275		D-5	14.0	9.4	12.25	12.25	75.48		0.70	52.89	75.48	52.89	17.9	17.9	2.46	**131**
Cross Culvert Station 245																
I-245		D-2	13.5	9.2	11.16	11.16	58.75		0.70	41.16	58.75	41.16	23.7	23.7	2.18	**90**
Cross Culvert Station 244																
I-244		D-2	11.9	8.3	11.28	11.28	8.81		0.71	6.21	8.81	6.21	19.0	19.0	2.40	**15**

Notes
(1) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(2) Cumlative Area = Inlet CA + Lateral Inlet CA
(3) Discharge is from the Rational Method, Q = CIA

Marin Sonoma Narrows Improvement Project

Table 9
County Culvert Hydraulics (Tailwater condition) - 100 Year Storm

Pipe #	Drainage Plan System	Drainage Plan Sheet Number	Upstream Node	Downstream Node	Total Discharge (cfs) [1]	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	Freeboard [2] (feet)	Pipe Loss (feet)	DS Junction Loss (feet)	Upstream Cover (feet)	Velocity (ft/s)	Energy Grade (feet)	EGL Freeboard (feet)
Cross Culvert Station 378																							
P-378-1-3-1	85j	D-13	I-378-1-3-1	I-378-1-3	3.9	6.8	18	12	0.004	0.013	64.38	64.33	72.16	72.03	69.67	69.66	**2.5**	**0.01**	**0.07**	6.3	2.2	69.74	2.4
P-378-1-2-1	85f	D-12	I-378-1-2-1	I-378-1-2	19.6	33.4	36	12	0.003	0.013	63.00	62.97	67.81	67.79	67.61	67.60	**0.2**	**0.01**	**0.10**	1.8	2.8	67.73	0.1
P-378-1-5	85n	D-13	I-378-1-5	I-378-1-4	30.7	23.7	30	12	0.003	0.013	65.47	65.43	74.92	74.18	71.77	71.70	**3.2**	**0.07**	**0.71**	7.0	6.3	72.38	2.5
P-378-1-4	85l	D-13	I-378-1-4	I-378-1-3	30.7	28.6	30	226	0.005	0.013	65.43	64.33	74.18	72.03	70.99	69.72	**3.2**	**1.27**	**0.13**	6.3	6.3	71.60	2.6
P-378-1-3	85h	D-12	I-378-1-3	I-378-1-2	33.5	28.6	30	271	0.005	0.013	64.33	63.01	72.03	67.79	69.59	67.79	**2.4**	**1.80**	**0.29**	5.2	6.8	70.31	1.7
P-378-1-2	85d	D-12	I-378-1-2	I-378-1-1	49.8	39.2	36	26	0.003	0.013	62.97	62.88	67.79	67.79	67.50	67.35	**0.3**	**0.15**	**0.35**	1.8	7.1	68.27	-0.5
P-378-1-1	85b	D-12	I-378-1-1	I-378-1	49.7	57.4	4x2 RCB	247	0.007	0.013	62.88	61.21	67.79	65.83	67.00	65.75	**0.8**	**1.25**	**0.47**	2.9	6.2	67.60	0.2
P-378-2	50d	D-12	I-378-2	I-378-1	34.5	97.1	4x2 RCB	32	0.019	0.013	62.00	61.38	65.54	65.83	65.49	65.41	**0.1**	**0.08**	**0.13**	1.5	4.3	65.78	-0.2
P-378-1	50e	D-12	I-378-1	OF-378	80.3	106.6	4x2 RCB	15	0.023	0.013	61.10	60.75	65.83	65.08	65.28	65.08	**0.5**	**0.20**	-	2.7	10.0	66.85	-1.0
Cross Culvert Station 350																							
Caltrans, 25-year Design																							
P-350-1L-1	39h	D-9	I-350-1L-1	I-350-1	2.1	8.4	18	132	0.006	0.013	47.01	46.17	52.00	53.00	52.87	52.82	**ABOVE RIM**	**0.05**	**0.54**	3.5	1.2	52.89	-0.9
In Detention Basin																							
P-350-1-2	39b	D-9	I-350-1-2	I-350-1-1	0.5	7.0	18	180	0.004	0.013	47.95	47.16	52.95	52.95	52.68	52.68	**0.3**	**0.00**	**0.00**	3.5	0.3	52.68	0.3
P-350-1-1	39d	D-9	I-350-1-1	I-350-1	0.5	7.0	18	178	0.004	0.013	47.16	46.37	52.95	53.00	52.68	52.67	**0.3**	**0.01**	**0.39**	4.3	0.3	52.68	0.3
P-350-5	43c	D-9	I-350-5	I-350-4	60.7	62.4	5x2 RCB	105	0.005	0.013	65.71	65.22	87.30	80.00	67.37	66.81	**19.9**	**0.56**	**0.28**	19.6	7.7	68.28	19.0
Caltrans, 25-year Design																							
P-350-4	43e	D-9	I-350-4	I-350-3	60.2	222.8	5x2 RCB	143	0.060	0.013	64.88	56.37	80.00	80.00	66.53	58.09	**13.5**	**8.44**	**0.07**	13.1	18.1	71.64	8.4
P-350-3	43g	D-9	I-350-3	I-350-2	59.9	277.1	5x2 RCB	78	0.092	0.013	56.37	49.19	80.00	52.50	58.02	52.50	**22.0**	**5.52**	**-0.83**	21.6	20.9	64.78	15.2
P-350-2	39f	D-9	I-350-2	I-350-1	61.3	179.5	5x2 RCB	73	0.039	0.013	49.19	46.37	52.50	53.00	53.33	53.00	**ABOVE RIM**	**0.33**	**0.72**	1.3	6.1	53.91	-1.4
Caltrans, Lined																							
P-350-1	92b	D-9	I-350-1	OF-350	53.6	41.9	24	188	0.034	0.013	46.17	39.72	53.00	.00	52.28	41.72	**0.7**	**10.56**	-	4.8	17.1	56.80	-3.8
Cross Culvert Station 305																							
P-305		D-7	I-305	OF-305	663.7	2074.5	Double 8x4	25	0.055	0.013	33.56	32.19	40.90	40.90	38.44	38.30	**2.5**	**0.14**	-	3.3	10.4	40.11	0.8
Cross Culvert Station 293																							
P-293		D-6	I-293	OF-293	489.0	751.7	Double 7X4	31	0.010	0.013	46.31	46.00	51.90	51.00	49.67	48.86	**2.2**	**0.81**	-	1.6	14.5	52.93	-1.0
Cross Culvert Station 275																							
P-275		D-5	I-275	OF-275	130.9	144.4	Double 5x2	56	0.006	0.013	9.35	9.00	14.00	12.20	12.49	12.20	**1.5**	**0.29**	-	2.7	6.5	13.15	0.8
Cross Culvert Station 245																							
P-245		D-2	I-245	OF-245	90.5	106.4	Double 4x2	62	0.006	0.013	9.17	8.81	13.50	11.05	11.31	11.05	**2.2**	**0.26**	-	2.3	5.7	11.81	1.7
Cross Culvert Station 244																							
P-244		D-2	I-244	OF-244	15.0	16.2	24	51	0.005	0.013	8.27	8.01	11.87	11.05	11.28	11.05	**0.6**	**0.23**	-	1.6	4.8	11.64	0.2

Notes
(1) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(2) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(3) Discharge is from the Rational Method, Q = CIA

APPENDIX A

Drainage Criteria
Based on Technical Memorandum dated May 8, 2009

INTRODUCTION

The following Technical Memorandum documents the design criteria and parameters used for the layout and sizing of drainage improvements for the proposed Marin-Sonoma Narrows (MSN) Project improvements. The MSN Project is located between the City of Novato and the Marin-Sonoma County Limits (located near San Antonio Creek and Road). Figure 1 shows the project location map. As a part of this phase of the project, the Redwood Landfill Interchange will be modified to a tight diamond interchange, frontage roads will be extended east and west of the highway and a Class I bike path will be constructed on the west side of the highway within State right of way. Other than a slight realignment of a portion of southbound Route 101 to facilitate the interchange improvements, no mainline work along Route 101 is proposed and mainline/HOV improvements identified in the PA&ED will be deferred to the future as part of a separate project. Frontage roads will be relinquished to the County following construction.

DESIGN CRITERIA AND PARAMETERS

Project improvements will be located and sized using both Caltrans and local (Marin County) criteria. Design of County facilities will be based on County requirements. Caltrans facilities will be sized using Caltrans requirements. Where practical, Caltrans design criteria and parameters are used for both facilities.

Caltrans Design Criteria include:

Design flow rates to project facilities are computed using the Rational Method. Depth of flow and flow velocity through project facilities are computed using Manning's Equation.

Peak Flow Rate – Rational Method

The following parameters are used for computing the peak flow rate:

Drainage Area - Drainage areas are delineated using contours developed by planimetric flown in the winter 2008/2009. Drainage areas are based on natural drainage paths. No field verification has occurred for this phase of the study. Local grading for roadways and trails may direct flows away from natural drainage paths. Possible deviations from the natural drainage path should be reviewed as a part of Final Design.

Runoff Coefficient - Runoff Coefficients were calculated using Figure 819.2A of the Caltrans Highway Design Manual, page 810-18 of the September 2006 version with the following inputs –

Soil types and Infiltration properties are taken from the USDA soil service soil classification website.

Relief is from the site topographic map.

Site visits and aerial photos are used to classify Vegetal Cover and Surface Storage. In general, vegetal cover is excellent and surface storage is normal.

County of Marin Department of Public Works Hydrology Manual Simplified Instruction recommend a Runoff Coefficient of at least 0.7. This is used for all county drainage facilities

Rainfall Intensity - Rainfall intensities are from the Caltrans WINIDF v1.0 computer program.

The WINIDF program identified the following four (4) nearby rainfall measuring stations;

Novato FS#1 - 4.4 miles from the MSN site - elevation 35

Petaluma FS No. 2 – 6.2 miles from the MSN site - elevation 16

Novato 8 WNW - 8.2 miles from the MSN site - elevation 350

Nacasio Dam - 8.9 miles from the MSN - elevation 315.

The Novato Fire Station #1 gage corresponds best to site conditions and is recommended for use on the project. The Petaluma gage provides rainfall intensities about 12% less intense than the Novato gage, corresponding to a mean annual precipitation about 18 percent lower than for the Novato rain gage. The Novato 8 WNW and Nacasio gages provide rainfall totals about 10 percent higher than the Novato Fire Station #1 gage. These rain gages are at higher elevations and have more intense rainfall intensities. The IDF for the Novato FS#1 rain gage has a rainfall intensity of 1.5 inches per hour for a 30-minute duration rainfall event.

Time of Concentration

The time of concentration (Tc) is computed as the sum of overland flow time, shallow flow time and concentrated flow. If the initial Tc calculated is less than 10 minutes, a 10-minute Time of Concentration factor is used. See Table 1C for the Times of Concentration. Equations used are presented in Section 816.6 of the Highway Design Manual. Sheet flow travel time is used for the initial flow path and is calculated using the equation presented in Section 816.6 (1) and is based on the Kinematic Wave equation. A coefficient of 0.15 is used representing short prairie grass. The 2-year, 24-hour precipitation amount of 3.5 inches per 24 hours is used in the analyses. The length of overland flow is calculated such that $n * L / S^{1/2}$ is equal to 100 with a maximum length of overland flow of 300 feet. After this distance, the time of concentration is calculated based on shallow concentrated flow. As a simplification, the slope for overland flow is computed using the initial 300 feet of the flow path and the slope for shallow flow uses the same point as the upper point for calculating the slope of the shallow concentrated flow. Refining the transition point location would result in a minor change to the slope and will not significantly change the total time of concentration. The shallow concentrated flow equation is used to a point where there are defined channels on the topographic maps. A k factor of 0.213 is used representing short pasture grasses. A flow velocity of 5 feet per second is used to calculated travel time as concentrated flows. The flow velocity is based on an average of the flow velocities computed in the HEC-RAS analyses for the upper reaches of the modeled Creeks. The total time of concentration is the combined overland flow, shallow concentrated flow and concentrated flow travel times.

Any travel time within project facilities is added to the inlet time of concentration to calculate flow at downstream locations.

Flow Depth and Velocity – Manning's Equation

Water Levels in Creeks

Water levels in Creeks are computed using the US Army Corps of Engineers HEC-RAS River Analysis System Computer Model. A Manning's Roughness factor of 0.045 is used for channels that are downstream of Route 101.

The downstream water level is set at the higher of the following:

- Elevation 8, (MHHW of Petaluma River near San Pablo Bay, Army Corps of Engineers - SF Bay Tidal Stage vs. Frequency Study, dated October 1984, NGVD 1929)
- One foot above the grade of the railroad tracks located east of the Project B1 area.

Water Levels in Earth-lined Ditches

Water levels in Ditches longitudinal to the frontage road and bike path are computed using Manning's Equation. Table A lists Roughness Coefficients in vegetated swales that vary depending on the depth of flow, flow velocity and the hydraulic radius. For the project a Roughness Coefficient of 0.080 is used. The size of the ditch is held constant from upstream most collection point to the discharge point. The roughness coefficient used for the ditches includes an allowance for thick vegetation and grasses within the ditches and allows for shallow flow depths.

Water Levels in Concrete-lined Ditches

Water levels in concrete-lined Ditches are computed using Manning's Equation with a Roughness Coefficient of 0.016. The size of the ditch is held constant from upstream most collection point to the discharge point.

Highway drainage improvements are sized to convey the 25-year storm event.

Culverts

Extensions of existing crossing culverts are designed to match size and alignment of the existing onsite facilities.

Closed conduits in the states Right-of-Way are designed using the following Cal-Trans Standards:

- Max HGL in an inlet 0.75-feet below grate elevation HDM 838.3
- Inlets in series are spaced apart 20-feet minimum HDM 837.3
- Max concentrated sheet flow across pavement 0.10 cfs HDM 831.4
- Energy Gradient should not rise above the lip of intake HDM 838.3
- Min pipe diameter under roadbed 18-inches HDM 838.4

- Min pipe design slope, half full velocity of 3.0-feet/second HDM 838.4
- Max pipe access spacing HDM 838.5
- Manning's Coefficient HDM Table 851.2

Treatment Best Management Practices (T-BMPs) were designed using the following criteria:

T-BMPs are designed to treat the added and re-worked impervious areas. Re-worked areas are defined as an existing impervious surface that, when it is removed, causes pervious material to be exposed prior to ultimate reconstruction as an impervious surface.

Biofiltration Strips

Biofiltration strips are designed with an engineered fill with turf plantings to treat by filtration with some infiltration occurring. These strips are designed with a maximum slope of 25% (1V:4H).

All T-BMPs will be sized to treat the Water Quality Flow (WQF) and pass the peak drainage event (25-year for state facilities, and 100-year for County facilities as calculated using the Rational Method described previously.

(The following section is modified from May 8, 2009 Technical Memorandum based on discussions with Caltrans)

Hydromodification Best Management Practices (H-BMPs)

H-BMPs are designed using the following criteria:

Hydrograph Modification will be evaluated using the Bay Area Hydrograph Model (BAHM) modified with local rainfall using the Petaluma Airport Rain Gage. The goal of modeling is to maintain current flow duration for given flow rates between 10 percent of a 2-year storm event and the 10-year storm event based on a 30-year rainfall period.

(The following section is modified from May 8, 2009 Technical Memorandum based on discussion with the County)

Local (Marin County) Criteria include:

Proposed frontage roads and bike lanes are designed with drainage facilities sized to convey the 100-year storm event following County standards. It is assumed that the frontage roads will be relinquished at the end of construction to the County. The same is assumed for the proposed Class I bike path in State Right-of-Way. Relinquishment may be deferred to future Route 101 HOV/Mainline improvement projects.

Marin Sonoma Narrow Improvement Project

Table A
Manning's Roughness in a Vegetated Swale

Calculate Velocity * Radius
where:
Velocity is in feet per second
Hydraulic Radius (= Area / Perimeter) is in feet

	Condition	Manning's N
For Depth equal to or less than 5 inches		0.250
For Depth greater than 5 inches		
	if V * R < 0.15	0.200
	if 0.15 < V * R < .4	0.150
	if 0.4 < V * R < .75	0.100
used this	if 0.75 < V * R < 1	0.080
	if 1 < V * R < 2	0.060
	if 2 < V * R	0.050

Manning's Roughness for a grass-lined channel / bioswale.
The velocity and Hydraulic Radius vary with roughness. An iterative process is needed to solve for depth and hydraulic roughness.

Valid for grasses 6" high and less. If a grass is used that will grow taller than 6", a higher roughness should be used.

WINIDF 1.0 OUTPUT TABLE

10/10/2011

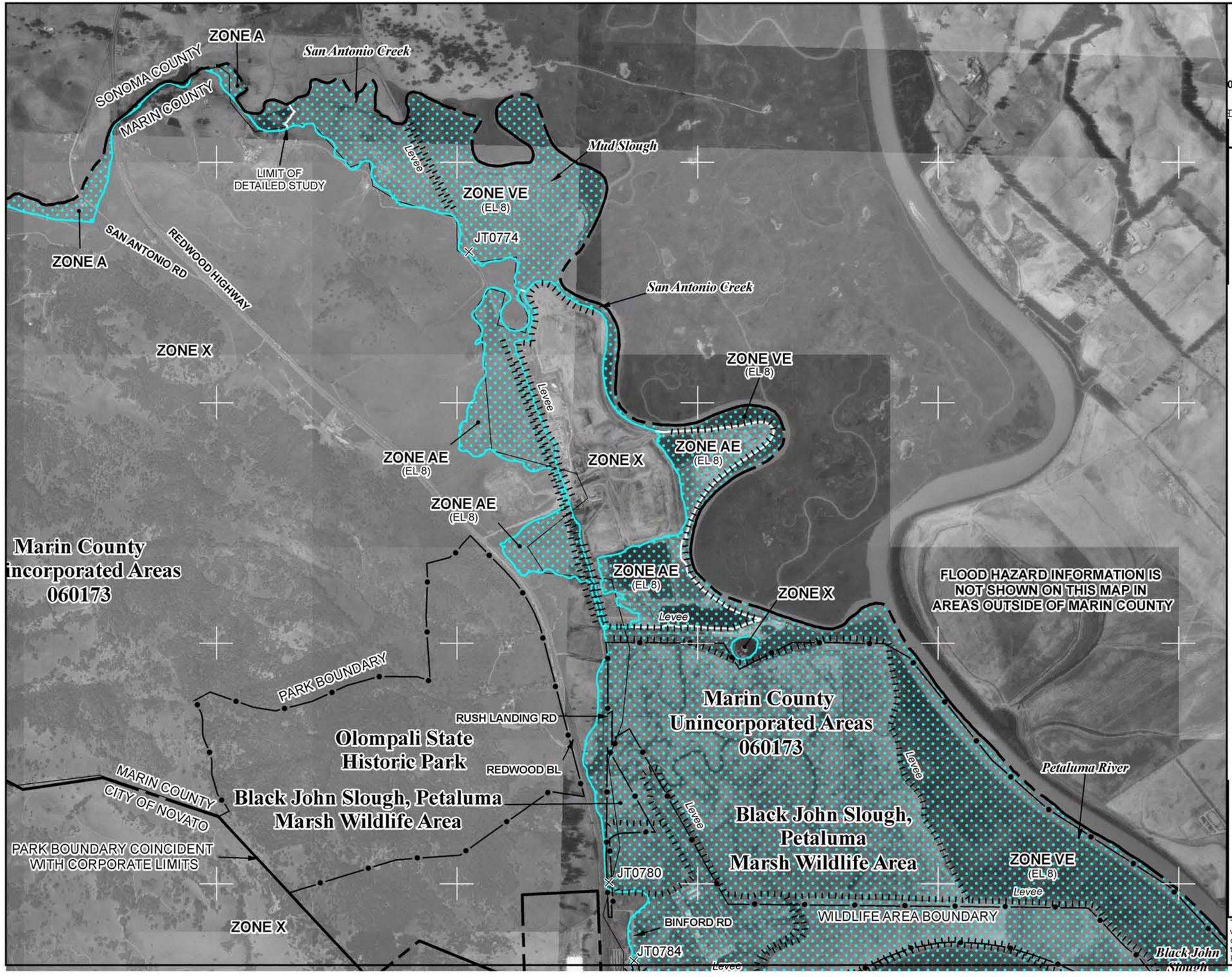
Input values: Lat.: 38.105 deg. Long.: 122.537 deg. Return Period: 2 yrs.

Selected Station(s)	Station ID	Elev.	Lat.	Long.	Dist.
		ft	deg.	deg.	miles
NOVATO FS #1	E206290001	35	38.105	122.537	0.00

Output table (Intensities in inches/hour):

Dur.\RP	2-yr	2-yr	10-yr	25-yr	50-yr	100-yr	10000-yr
5-min	1.713	1.725	2.885	3.450	3.889	4.297	6.900
10-min	1.246	1.254	2.098	2.508	2.827	3.124	5.016
15-min	1.034	1.041	1.741	2.081	2.346	2.592	4.163
30-min	0.751	0.757	1.265	1.513	1.706	1.884	3.026
60-min	0.546	0.550	0.920	1.100	1.240	1.370	2.200
120-min	0.397	0.400	0.669	0.800	0.901	0.996	1.599
4-hr	0.289	0.291	0.486	0.581	0.655	0.724	1.163
8-hr	0.210	0.211	0.353	0.423	0.476	0.526	0.845
16-hr	0.153	0.154	0.257	0.307	0.346	0.383	0.615
24-hr	0.127	0.127	0.213	0.255	0.287	0.318	0.510

a = 0.5463 b = -0.460 1.00 min



MAP SCALE 1" = 2000'

000 0 2000 4000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0175D

FIRM

FLOOD INSURANCE RATE MAP

MARIN COUNTY,
CALIFORNIA
AND INCORPORATED AREAS

PANEL 175 OF 531

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARIN COUNTY	060173	0175	D
NOVATO, CITY OF	060178	0175	D

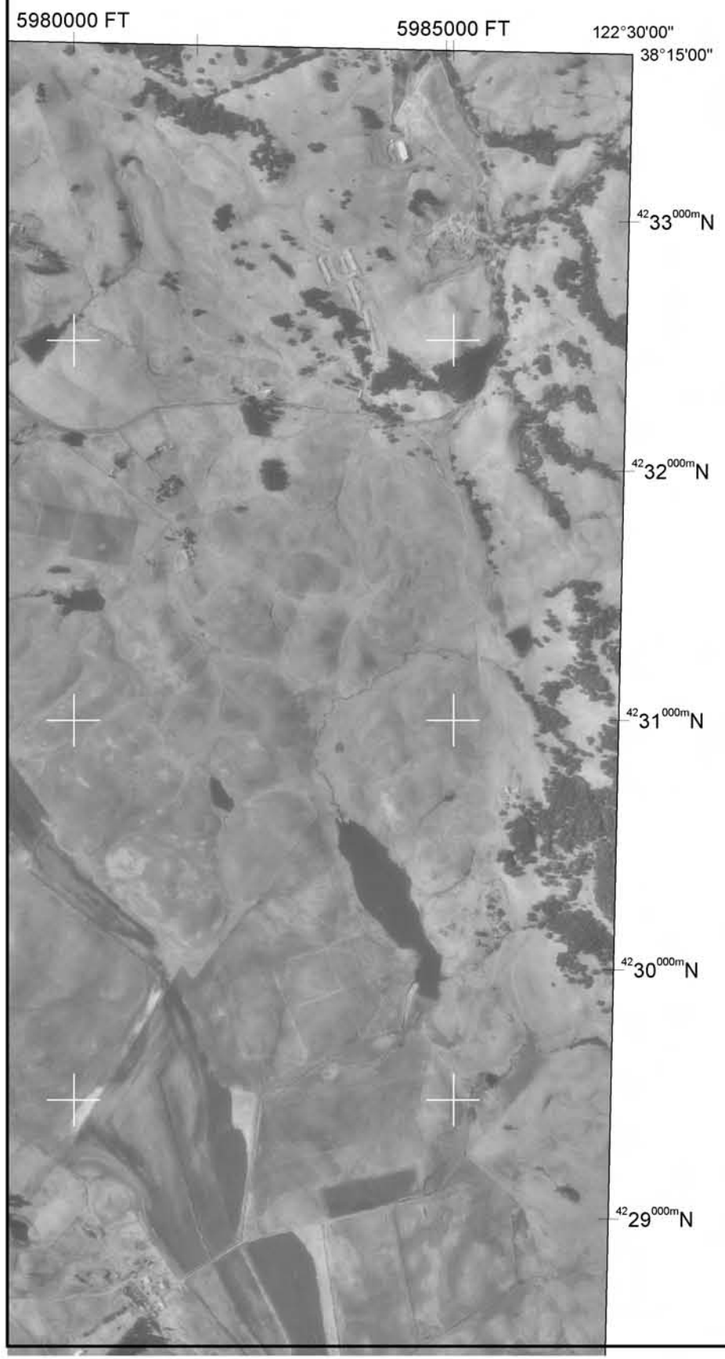
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06041C0175D

EFFECTIVE DATE
MAY 4, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

MAP SCALE 1" = 2000'

000 0 2000 4000 FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0175D

FIRM

FLOOD INSURANCE RATE MAP

MARIN COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 175 OF 531

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARIN COUNTY	060173	0175	D
NOVATO, CITY OF	060178	0175	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06041C0175D

EFFECTIVE DATE
MAY 4, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: 244-5b

Headwater Elevation (ft)	Total Discharge (cfs)	5b(1) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
11.05	0.00	0.00	0.00	1
11.06	2.00	2.00	0.00	1
11.10	4.00	4.00	0.00	1
11.15	6.00	6.00	0.00	1
11.24	8.00	8.00	0.00	1
11.34	10.00	10.00	0.00	1
11.47	12.00	12.00	0.00	1
11.62	14.00	14.00	0.00	1
11.64	14.30	14.30	0.00	1
11.99	18.00	18.00	0.00	1
12.21	20.00	20.00	0.00	1
12.70	23.86	23.86	0.00	Overtopping

Rating Curve Plot for Crossing: 244-5b

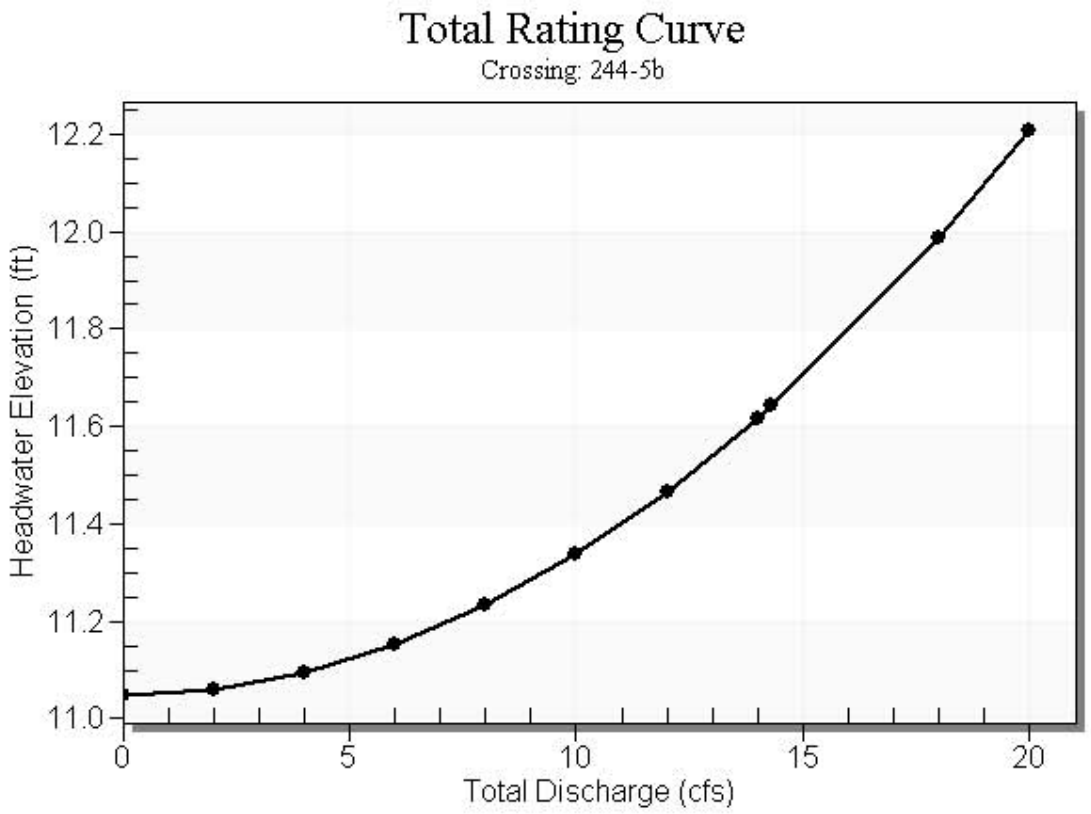


Table 2 - Culvert Summary Table: 5b(1)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	11.05	0.000	2.780	0-NF	0.000	0.000	0.000	2.780	0.000	0.000
2.00	2.00	11.06	0.661	2.792	4-FFf	0.469	0.481	2.000	2.780	0.637	0.000
4.00	4.00	11.10	0.958	2.826	4-FFf	0.676	0.695	2.000	2.780	1.273	0.000
6.00	6.00	11.15	1.212	2.884	4-FFf	0.846	0.862	2.000	2.780	1.910	0.000
8.00	8.00	11.24	1.429	2.965	4-FFf	0.999	1.006	2.000	2.780	2.546	0.000
10.00	10.00	11.34	1.622	3.070	4-FFf	1.144	1.128	2.000	2.780	3.183	0.000
12.00	12.00	11.47	1.806	3.197	4-FFf	1.293	1.241	2.000	2.780	3.820	0.000
14.00	14.00	11.62	1.991	3.348	4-FFf	1.452	1.344	2.000	2.780	4.456	0.000
14.30	14.30	11.64	2.020	3.373	4-FFf	1.478	1.360	2.000	2.780	4.552	0.000
18.00	18.00	11.99	2.398	3.719	4-FFf	2.000	1.523	2.000	2.780	5.730	0.000
20.00	20.00	12.21	2.630	3.939	4-FFf	2.000	1.605	2.000	2.780	6.366	0.000

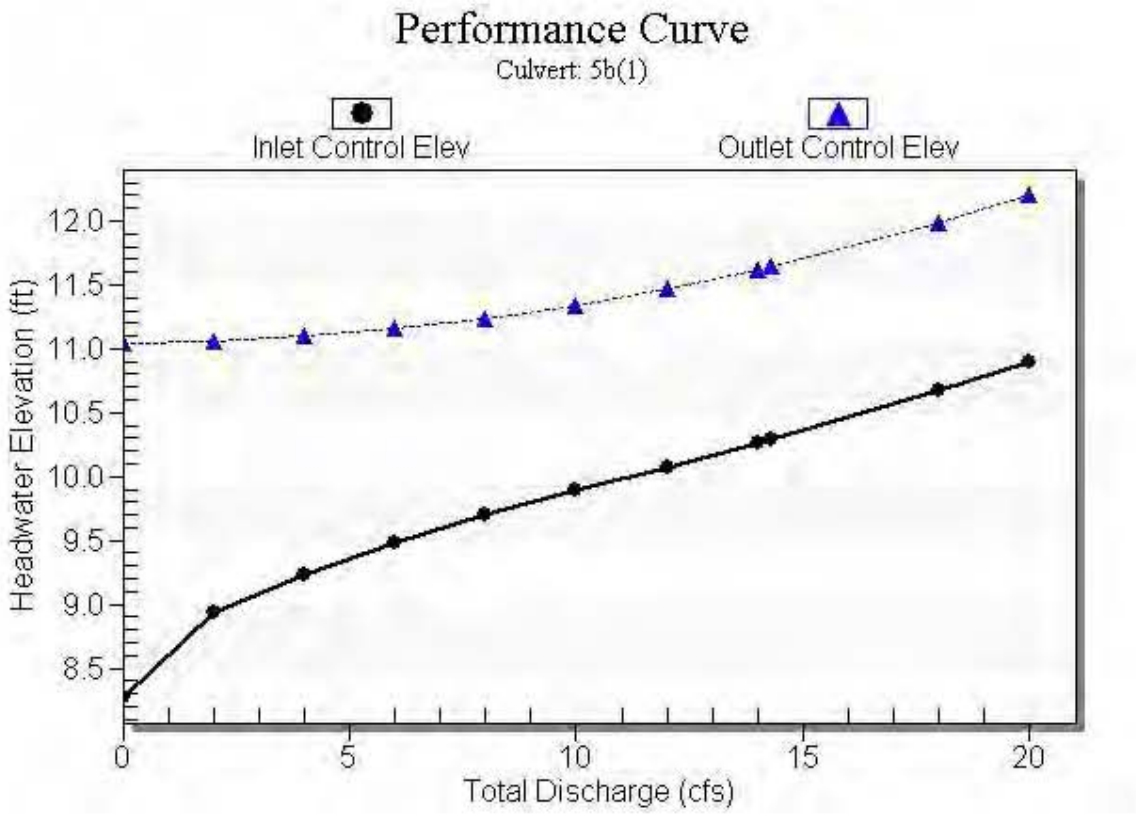
****

Inlet Elevation (invert): 8.27 ft, Outlet Elevation (invert): 8.01 ft

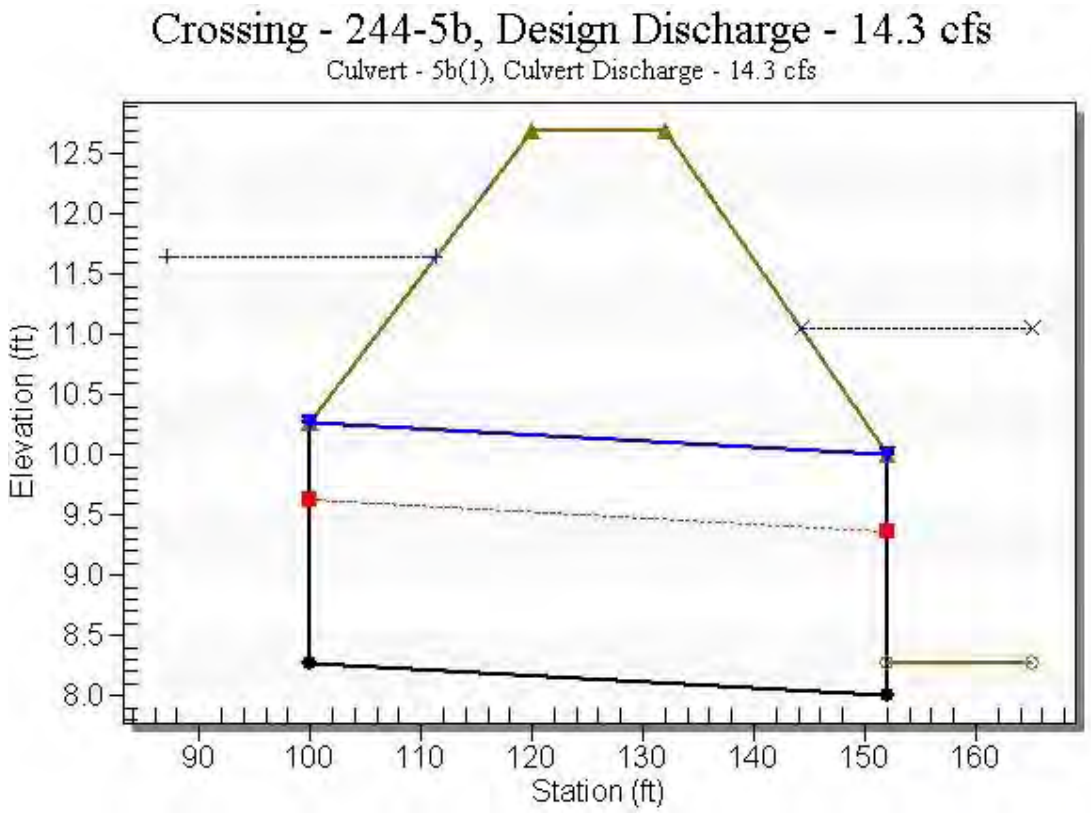
Culvert Length: 52.00 ft, Culvert Slope: 0.0050

****

Culvert Performance Curve Plot: 5b(1)



Water Surface Profile Plot for Culvert: 5b(1)



Site Data - 5b(1)

Site Data Option: Culvert Invert Data

Inlet Station: 100.00 ft

Inlet Elevation: 8.27 ft

Outlet Station: 152.00 ft

Outlet Elevation: 8.01 ft

Number of Barrels: 1

Culvert Data Summary - 5b(1)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Grooved End in Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: 244-5b)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	11.05	2.78
2.00	11.05	2.78
4.00	11.05	2.78
6.00	11.05	2.78
8.00	11.05	2.78
10.00	11.05	2.78
12.00	11.05	2.78
14.00	11.05	2.78
14.30	11.05	2.78
18.00	11.05	2.78
20.00	11.05	2.78

Tailwater Channel Data - 244-5b

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 11.05 ft

Roadway Data for Crossing: 244-5b

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 12.70 ft

Roadway Surface: Paved

Roadway Top Width: 12.00 ft

Table 1 - Summary of Culvert Flows at Crossing: 253-8c

Headwater Elevation (ft)	Total Discharge (cfs)	8c(1) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
19.09	0.00	0.00	0.00	1
19.82	6.00	6.00	0.00	1
20.14	12.00	12.00	0.00	1
20.40	18.00	18.00	0.00	1
20.66	24.00	24.00	0.00	1
20.88	30.00	30.00	0.00	1
21.08	36.00	36.00	0.00	1
21.28	42.00	42.00	0.00	1
21.48	48.00	48.00	0.00	1
21.56	50.50	50.50	0.00	1
21.90	60.00	60.00	0.00	1
30.80	179.15	179.15	0.00	Overtopping

Rating Curve Plot for Crossing: 253-8c

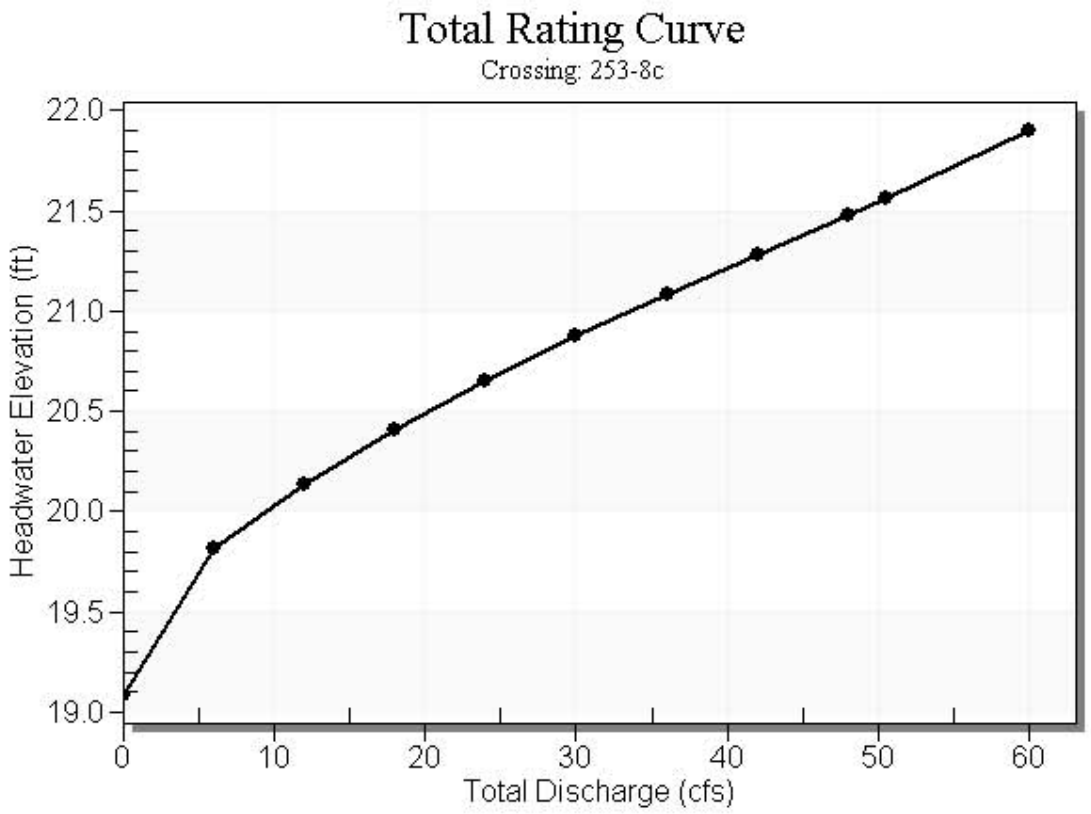


Table 2 - Culvert Summary Table: 8c(1)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	19.09	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
6.00	6.00	19.82	0.727	0.727	1-S1f	0.281	0.558	0.558	0.000	3.640	0.000
12.00	12.00	20.14	1.049	1.049	1-S1f	0.391	0.804	0.804	0.000	4.387	0.000
18.00	18.00	20.40	1.314	1.314	1-S1f	0.500	1.000	1.000	0.000	4.909	0.000
24.00	24.00	20.66	1.566	1.566	1-S1f	0.568	1.156	1.156	0.000	5.402	0.000
30.00	30.00	20.88	1.787	1.787	1-S1f	0.635	1.302	1.302	0.000	5.805	0.000
36.00	36.00	21.08	1.991	1.991	1-S1f	0.703	1.433	1.433	0.000	6.191	0.000
42.00	42.00	21.28	2.188	2.188	1-S1f	0.765	1.553	1.553	0.000	6.559	0.000
48.00	48.00	21.48	2.386	2.386	5-S1f	0.817	1.663	1.663	0.000	6.928	0.000
50.50	50.50	21.56	2.471	2.471	5-S1f	0.839	1.709	1.709	0.000	7.066	0.000
60.00	60.00	21.90	2.813	2.813	5-S1f	0.921	1.860	1.860	0.000	7.679	0.000

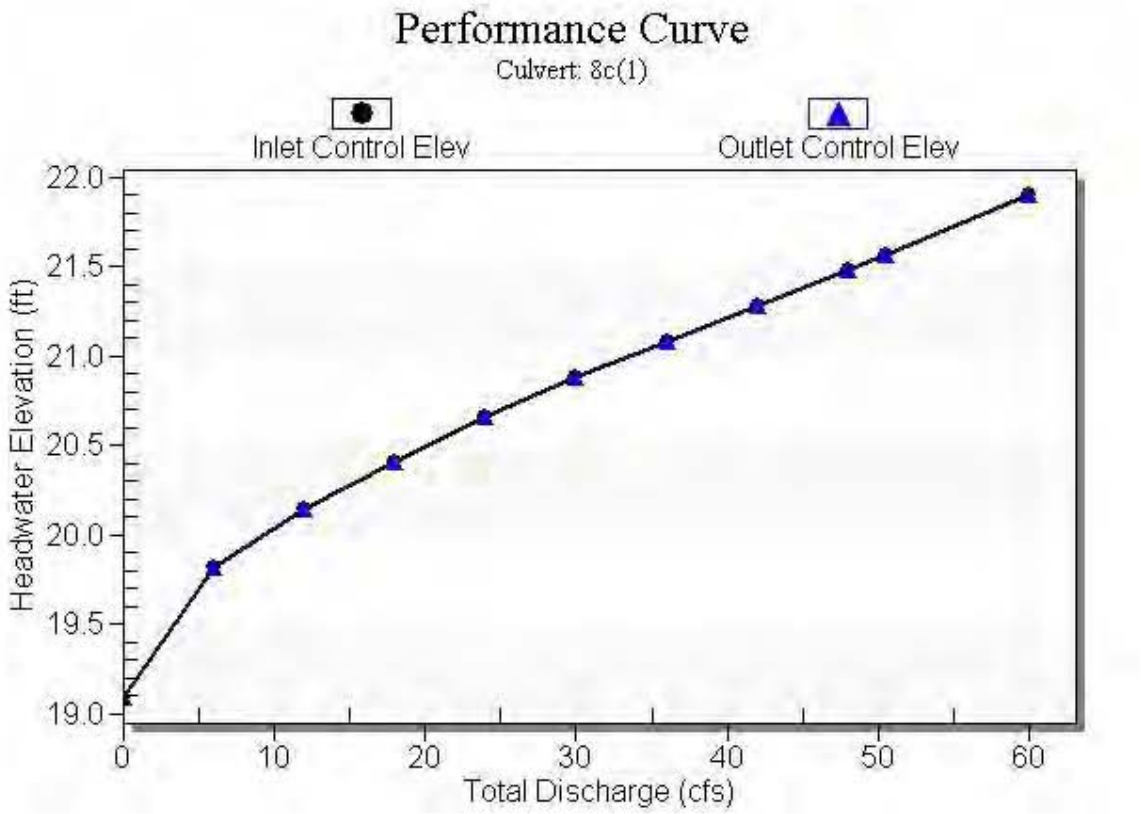
****

Inlet Elevation (invert): 19.09 ft, Outlet Elevation (invert): 12.91 ft

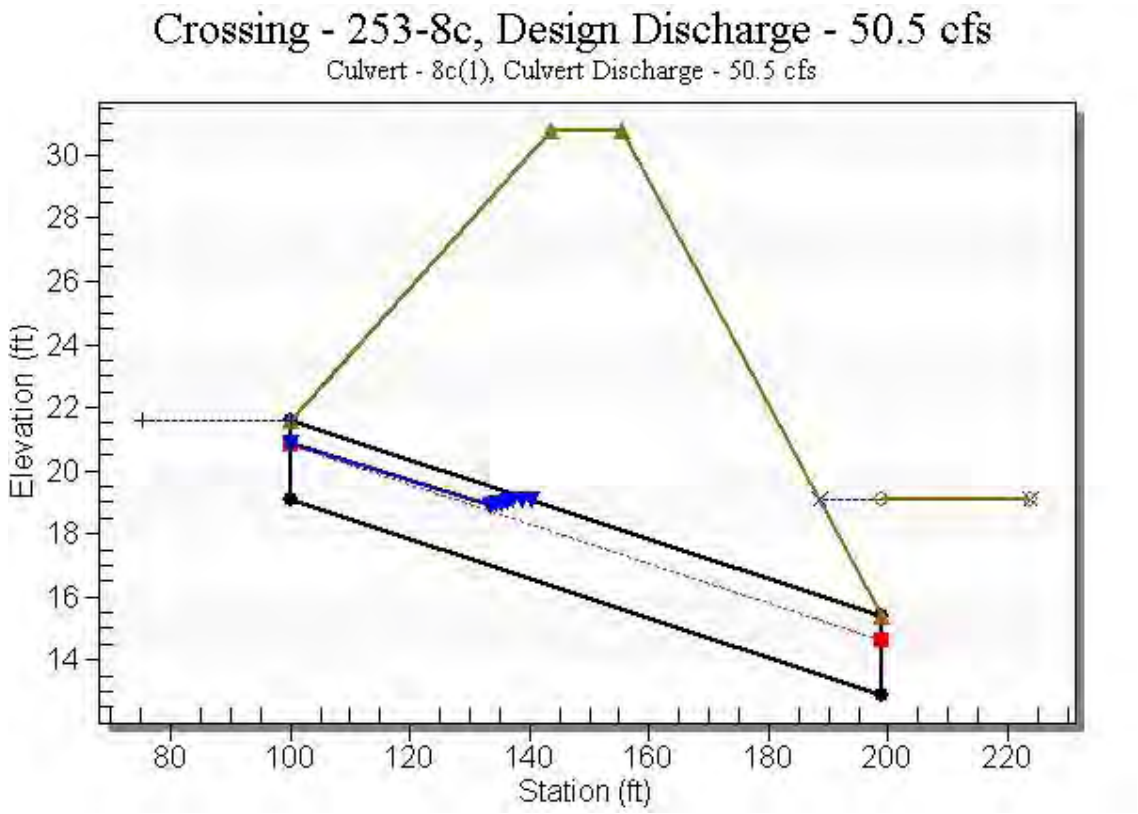
Culvert Length: 99.19 ft, Culvert Slope: 0.0624

****

Culvert Performance Curve Plot: 8c(1)



Water Surface Profile Plot for Culvert: 8c(1)



Site Data - 8c(1)

Site Data Option: Culvert Invert Data

Inlet Station: 100.00 ft

Inlet Elevation: 19.09 ft

Outlet Station: 199.00 ft

Outlet Elevation: 12.91 ft

Number of Barrels: 2

Culvert Data Summary - 8c(1)

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Grooved End in Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: 253-8c)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	19.09	0.00
6.00	19.09	0.00
12.00	19.09	0.00
18.00	19.09	0.00
24.00	19.09	0.00
30.00	19.09	0.00
36.00	19.09	0.00
42.00	19.09	0.00
48.00	19.09	0.00
50.50	19.09	0.00
60.00	19.09	0.00

Tailwater Channel Data - 253-8c

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 19.09 ft

Roadway Data for Crossing: 253-8c

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 30.80 ft

Roadway Surface: Paved

Roadway Top Width: 12.00 ft

Table 1 - Summary of Culvert Flows at Crossing: 318-23b

Headwater Elevation (ft)	Total Discharge (cfs)	23b(1) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
19.93	0.00	0.00	0.00	1
20.74	3.50	3.50	0.00	1
21.11	7.00	7.00	0.00	1
21.42	10.50	10.50	0.00	1
21.69	14.00	14.00	0.00	1
21.94	17.50	17.50	0.00	1
22.17	21.00	21.00	0.00	1
22.40	24.50	24.50	0.00	1
22.64	28.00	28.00	0.00	1
22.91	31.50	31.50	0.00	1
22.94	31.90	31.90	0.00	1
24.90	51.05	51.05	0.00	Overtopping

Rating Curve Plot for Crossing: 318-23b

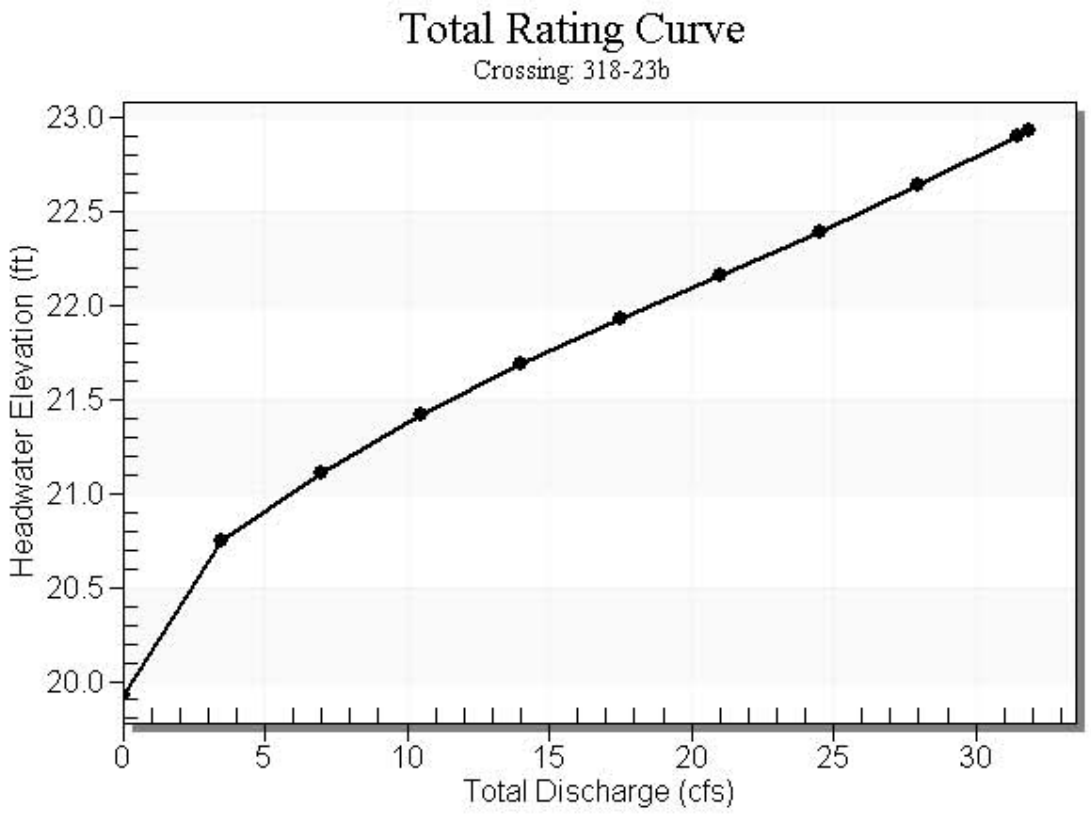


Table 2 - Culvert Summary Table: 23b(1)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	19.93	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
3.50	3.50	20.74	0.813	0.0*	1-S2n	0.375	0.602	0.392	0.000	6.891	0.000
7.00	7.00	21.11	1.177	0.0*	1-S2n	0.548	0.869	0.597	0.000	7.698	0.000
10.50	10.50	21.42	1.492	0.0*	1-S2n	0.674	1.078	0.754	0.000	8.421	0.000
14.00	14.00	21.69	1.763	0.000	1-S2n	0.787	1.259	0.890	0.000	8.911	0.000
17.50	17.50	21.94	2.005	0.000	1-S2n	0.884	1.411	1.018	0.000	9.329	0.000
21.00	21.00	22.17	2.235	0.000	1-S2n	0.980	1.553	1.131	0.000	9.725	0.000
24.50	24.50	22.40	2.467	0.000	1-S2n	1.066	1.682	1.242	0.000	10.066	0.000
28.00	28.00	22.64	2.712	0.000	5-S2n	1.149	1.799	1.348	0.000	10.375	0.000
31.50	31.50	22.91	2.977	0.000	5-S2n	1.232	1.905	1.447	0.000	10.703	0.000
31.90	31.90	22.94	3.009	0.000	5-S2n	1.241	1.917	1.457	0.000	10.747	0.000

* theoretical depth is impractical. Depth reported is corrected.

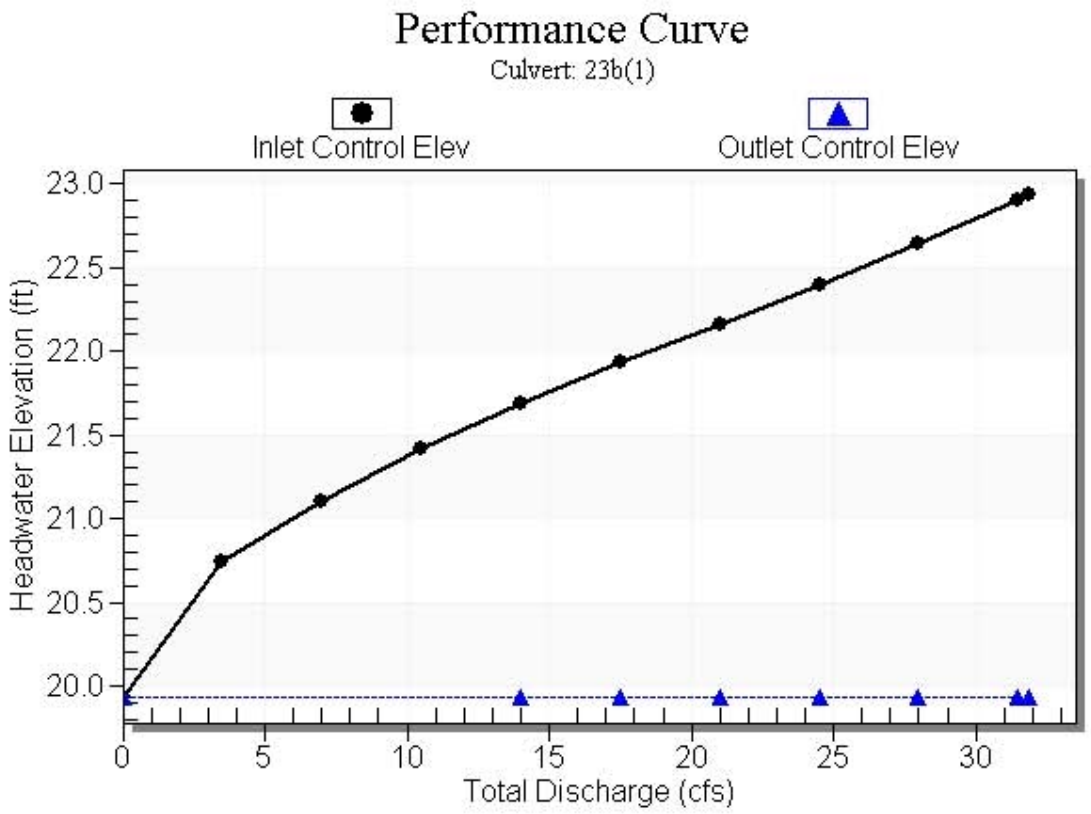
****

Inlet Elevation (invert): 19.93 ft, Outlet Elevation (invert): 19.24 ft

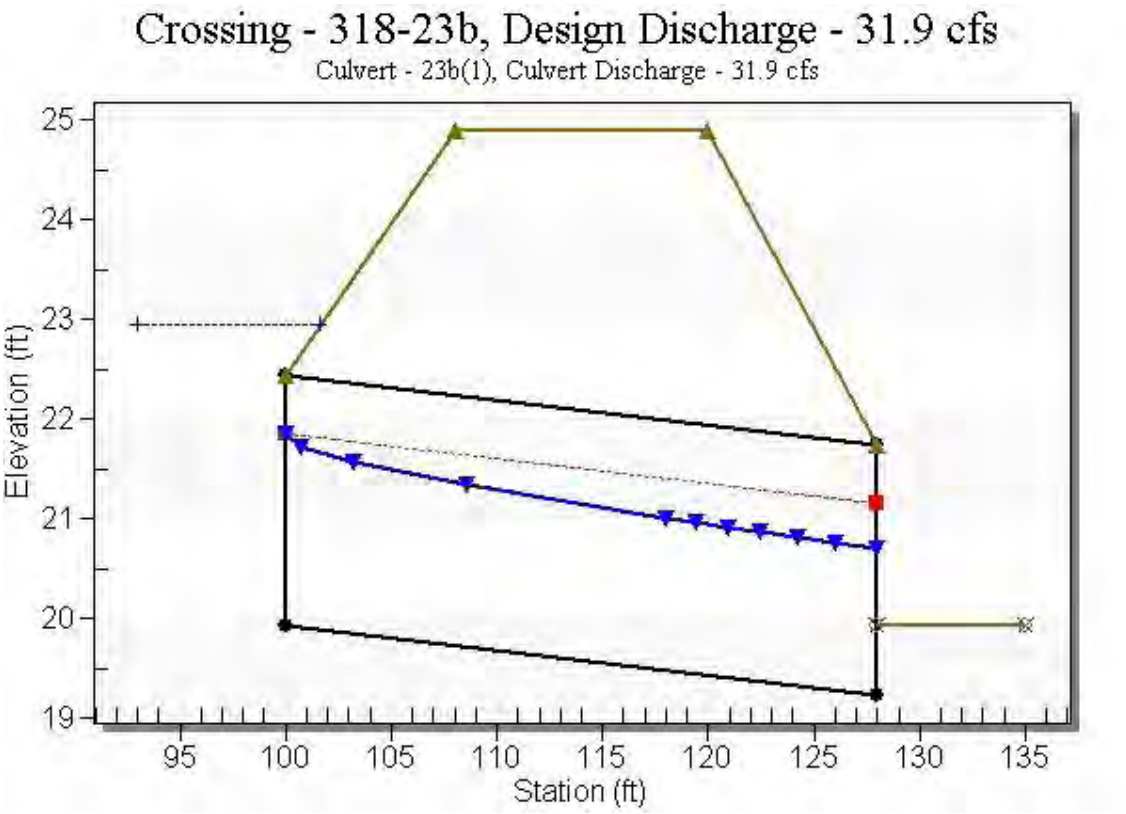
Culvert Length: 28.01 ft, Culvert Slope: 0.0246

****

Culvert Performance Curve Plot: 23b(1)



Water Surface Profile Plot for Culvert: 23b(1)



Site Data - 23b(1)

Site Data Option: Culvert Invert Data

Inlet Station: 100.00 ft

Inlet Elevation: 19.93 ft

Outlet Station: 128.00 ft

Outlet Elevation: 19.24 ft

Number of Barrels: 1

Culvert Data Summary - 23b(1)

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Grooved End in Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: 318-23b)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	19.93	0.00
3.50	19.93	0.00
7.00	19.93	0.00
10.50	19.93	0.00
14.00	19.93	0.00
17.50	19.93	0.00
21.00	19.93	0.00
24.50	19.93	0.00
28.00	19.93	0.00
31.50	19.93	0.00
31.90	19.93	0.00

Tailwater Channel Data - 318-23b

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 19.93 ft

Roadway Data for Crossing: 318-23b

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 24.90 ft

Roadway Surface: Paved

Roadway Top Width: 12.00 ft

Table 1 - Summary of Culvert Flows at Crossing: 46b

Headwater Elevation (ft)	Total Discharge (cfs)	46b(1) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
66.85	0.00	0.00	0.00	1
67.35	1.00	1.00	0.00	1
67.58	2.00	2.00	0.00	1
67.79	3.00	3.00	0.00	1
67.97	4.00	4.00	0.00	1
68.09	4.70	4.70	0.00	1
68.30	6.00	6.00	0.00	1
68.47	7.00	7.00	0.00	1
68.66	8.00	8.00	0.00	1
68.87	9.00	9.00	0.00	1
69.11	10.00	10.00	0.00	1
76.90	26.16	26.16	0.00	Overtopping

Rating Curve Plot for Crossing: 46b

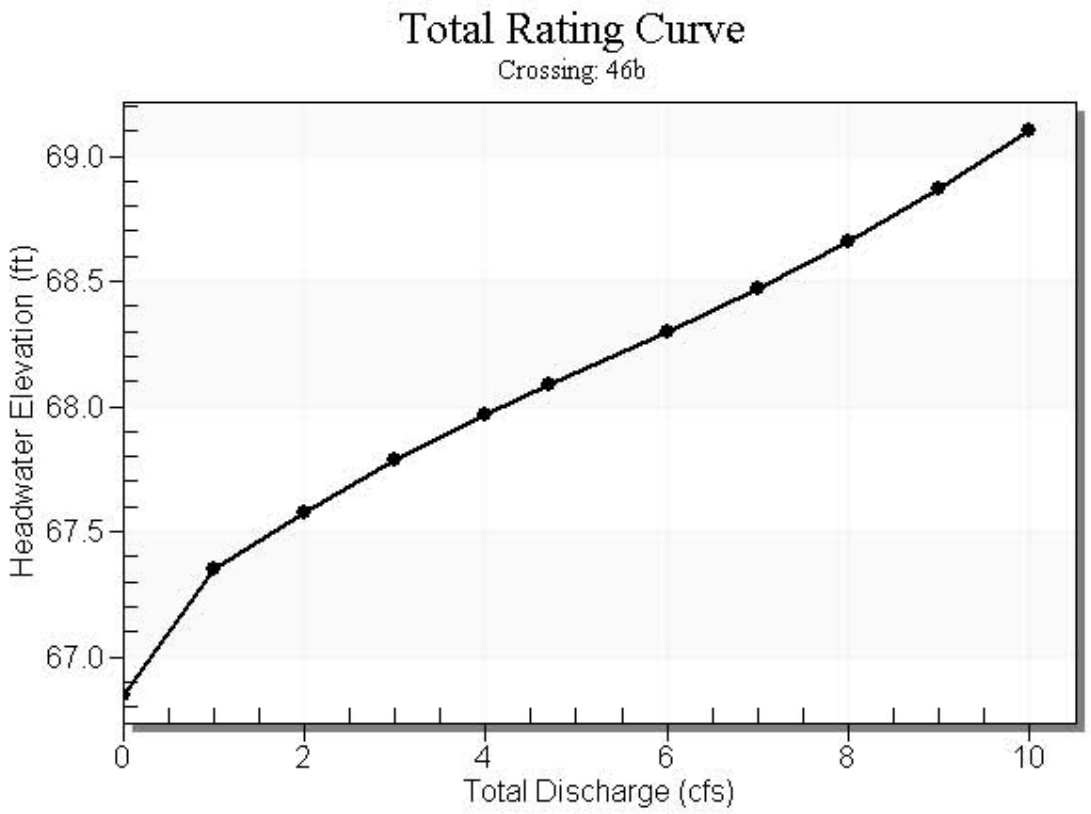


Table 2 - Culvert Summary Table: 46b(1)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	66.85	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
1.00	1.00	67.35	0.501	0.0*	1-S2n	0.256	0.366	0.256	0.000	4.884	0.000
2.00	2.00	67.58	0.726	0.0*	1-S2n	0.367	0.528	0.373	0.000	5.782	0.000
3.00	3.00	67.79	0.936	0.0*	1-S2n	0.459	0.655	0.459	0.000	6.558	0.000
4.00	4.00	67.97	1.119	0.0*	1-S2n	0.531	0.764	0.533	0.000	7.083	0.000
4.70	4.70	68.09	1.237	0.0*	1-S2n	0.581	0.830	0.583	0.000	7.398	0.000
6.00	6.00	68.30	1.451	0.0*	1-S2n	0.665	0.943	0.667	0.000	7.891	0.000
7.00	7.00	68.47	1.624	0.0*	5-S2n	0.728	1.022	0.731	0.000	8.180	0.000
8.00	8.00	68.66	1.812	0.0*	5-S2n	0.788	1.092	0.788	0.000	8.505	0.000
9.00	9.00	68.87	2.021	0.0*	5-S2n	0.848	1.157	0.849	0.000	8.730	0.000
10.00	10.00	69.11	2.256	0.0*	5-S2n	0.907	1.215	0.907	0.000	8.944	0.000

* theoretical depth is impractical. Depth reported is corrected.

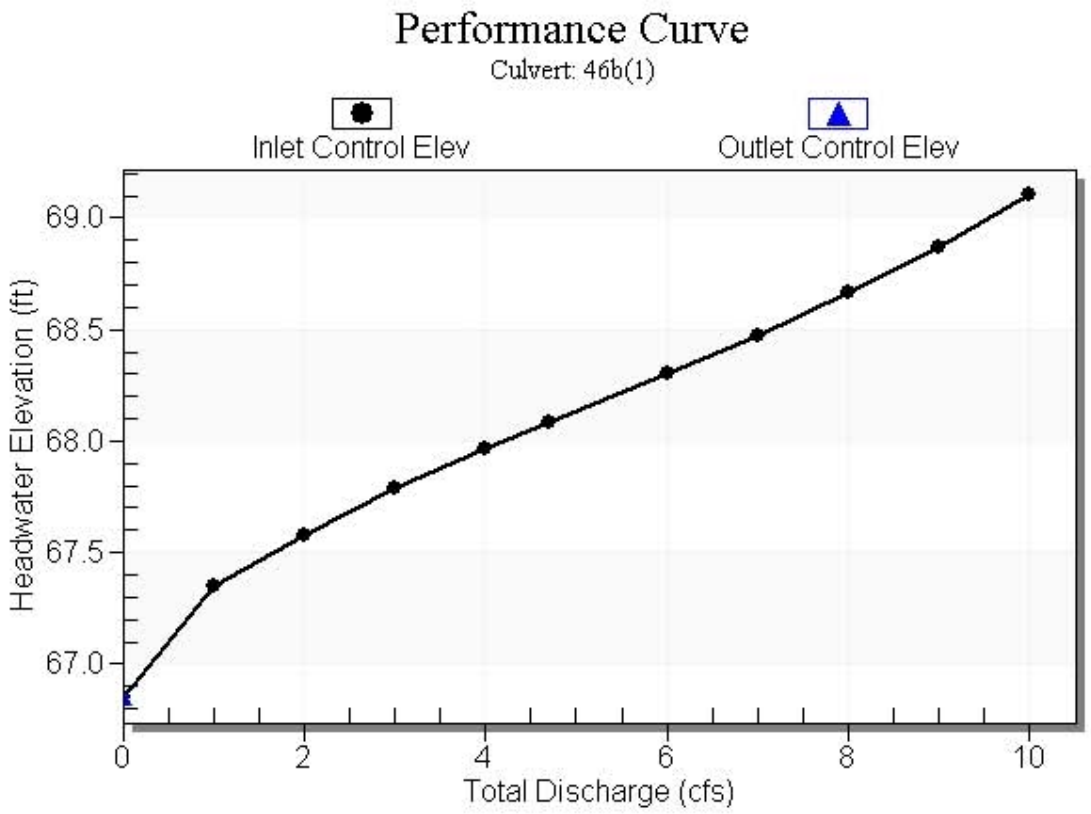
****

Inlet Elevation (invert): 66.85 ft, Outlet Elevation (invert): 65.60 ft

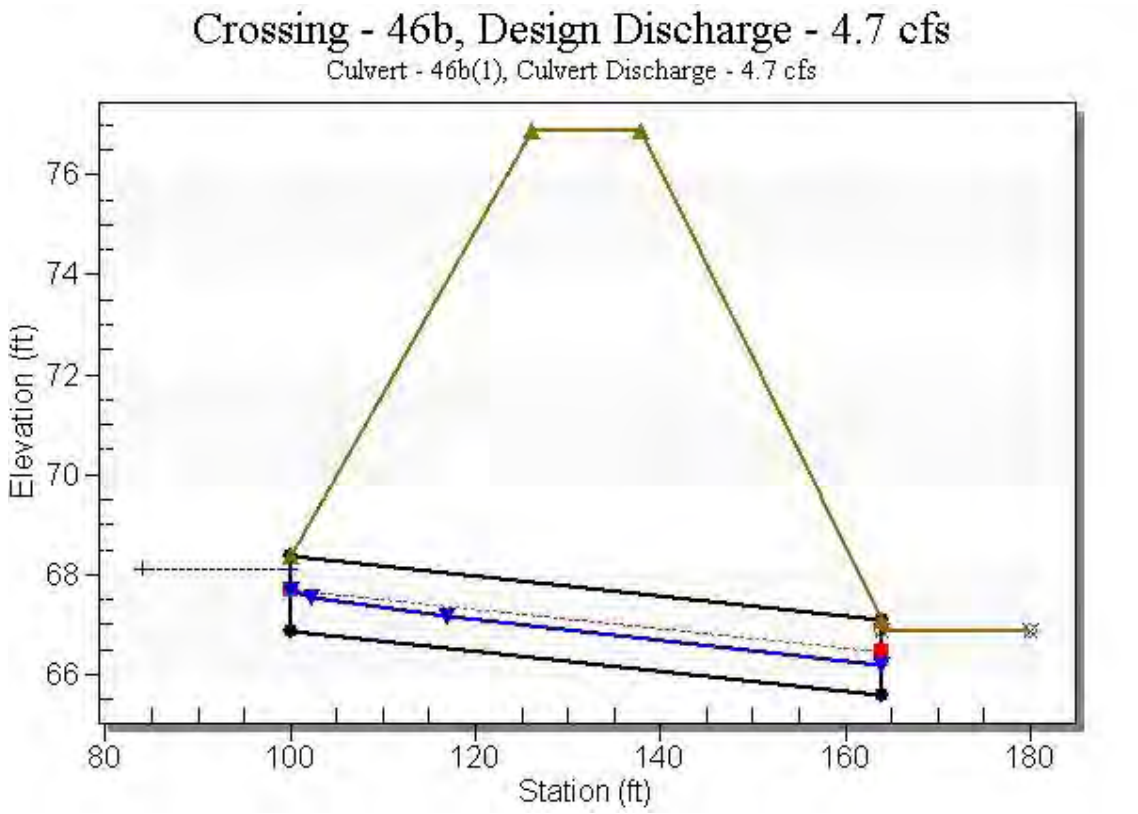
Culvert Length: 64.01 ft, Culvert Slope: 0.0195

****

Culvert Performance Curve Plot: 46b(1)



Water Surface Profile Plot for Culvert: 46b(1)



Site Data - 46b(1)

Site Data Option: Culvert Invert Data

Inlet Station: 100.00 ft

Inlet Elevation: 66.85 ft

Outlet Station: 164.00 ft

Outlet Elevation: 65.60 ft

Number of Barrels: 1

Culvert Data Summary - 46b(1)

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: 46b)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	66.85	0.00
1.00	66.85	0.00
2.00	66.85	0.00
3.00	66.85	0.00
4.00	66.85	0.00
4.70	66.85	0.00
6.00	66.85	0.00
7.00	66.85	0.00
8.00	66.85	0.00
9.00	66.85	0.00
10.00	66.85	0.00

Tailwater Channel Data - 46b

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 66.85 ft

Roadway Data for Crossing: 46b

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 76.90 ft

Roadway Surface: Paved

Roadway Top Width: 12.00 ft

9. Storm Water Information Handout

STORMWATER INFORMATION HANDOUT

For Construction on

STATE HIGHWAY
IN
MARIN COUNTY

IN AND NEAR NOVATO
FROM 1.0 MILE NORTH OF THE NORTH NOVATO OVERHEAD
TO 0.6 MILE SOUTH OF THE SONOMA COUNTY LINE

04-MRN-101 R23.2/27.1
CONTRACT No. 04-264074

Table of Contents

1. Notice of Intent
2. Vicinity Map
3. Layout Plans
4. Temporary Creek Diversion Details
5. Erosion Control Plans and Details
6. Contour Grading Plans
7. Drainage Plans with Discharge Locations and Sampling Locations
8. Drainage Area Maps and Hydrology Data
9. Rainfall Data
10. Wetlands and Waters of the U.S.
11. CRWQCB 401 Certification
12. Risk Assessment

1. Notice of Intent

State Water Resources Control Board

NOTICE OF INTENT

TO COMPLY WITH THE TERMS OF THE
GENERAL PERMIT TO DISCHARGE STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY (WQ ORDER No. 99-08-DWQ)

I. NOI STATUS (SEE INSTRUCTIONS)

MARK ONLY ONE ITEM 1. ☐ New Construction 2. ☐ Change of Information for WDID# _____

II. PROPERTY OWNER

Name	Contact Person		
Mailing Address	Title		
City	State	Zip	Phone

Owner Type (*check one*) 1.[ ] Private Individual 2.[ ]Business 3.[ ]Municipal 4.[ ]State 5.[ ]Federal 6.[ ]Other

III. DEVELOPER/CONTRACTOR INFORMATION

Developer/Contractor	Contact Person		
Mailing Address	Title		
City	State	Zip	Phone

IV. CONSTRUCTION PROJECT INFORMATION

Site/Project Name	Site Contact Person		
Physical Address/Location	Latitude _____ º	Longitude _____ º	County
City (or nearest City)	Zip	Site Phone Number	Emergency Phone Number

A. Total size of construction site area: _____ Acres B. Total area to be disturbed: _____ Acres (% of total _____)	C. Percent of site imperviousness (including rooftops): Before Construction: _____% After Construction: _____%	D. Tract Number(s): _____, _____ E. Mile Post Marker: _____

F. Is the construction site part of a larger common plan of development or sale? ☐ YES ☐ NO	G. Name of plan or development:
H. Construction commencement date: _____/_____/_____ I. % of site to be mass graded: _____	J. Projected construction dates: Complete grading: _____/_____/_____ Complete project: _____/_____/_____

K. Type of Construction (Check all that apply):

1. ☐ Residential 2. ☐ Commercial 3. ☐ Industrial 4. ☐ Reconstruction 5. ☐ Transportation
6. ☐ Utility Description: _____ 7. ☐ Other (Please List): _____

V. BILLING INFORMATION

SEND BILL TO:	Name	Contact Person	
☐ OWNER (as in II. above)			
☐ DEVELOPER (as in III. above)	Mailing Address	Phone/Fax	
☐ OTHER (enter information at right)	City	State	Zip

VI. REGULATORY STATUS

A. Has a local agency approved a required erosion/sediment control plan?..... ☐ YES ☐ NO

Does the erosion/sediment control plan address construction activities such as infrastructure and structures?..... ☐ YES ☐ NO

Name of local agency: _____ Phone: _____

B. Is this project or any part thereof, subject to conditions imposed under a CWA Section 404 permit of 401 Water Quality Certification?..... ☐ YES ☐ No

If yes, provide details: _____

VII. RECEIVING WATER INFORMATION

A. Does the storm water runoff from the construction site discharge to (Check all that apply):

1. ☐ **Indirectly to waters of the U.S.**

2. ☐ **Storm drain system - Enter owner's name:**_____

3. ☐ **Directly to waters of U.S. (e.g. , river, lake, creek, stream, bay, ocean, etc.)**

B. Name of receiving water: (river, lake, creek, stream, bay, ocean): _____

VIII. IMPLEMENTATION OF NPDES PERMIT REQUIREMENTS

A. STORM WATER POLLUTION PREVENTION PLAN (SWPPP) (check one)

☐ A SWPPP has been prepared for this facility and is available for review: Date Prepared: ____/____/____ Date Amended: ____/____/____

☐ A SWPPP will be prepared and ready for review by (enter date): ____/____/____

☐ A tentative schedule has been included in the SWPPP for activities such as grading, street construction, home construction, etc.

B. MONITORING PROGRAM

☐ A monitoring and maintenance schedule has been developed that includes inspection of the construction BMPs before anticipated storm events and after actual storm events and is available for review.

If checked above: A qualified person has been assigned responsibility for pre-storm and post-storm BMP inspections to identify effectiveness and necessary repairs or design changes..... ☐ YES ☐ NO

Name: _____ Phone: _____

C. PERMIT COMPLIANCE RESPONSIBILITY

A qualified person has been assigned responsibility to ensure full compliance with the Permit, and to implement all elements of the Storm Water Pollution Prevention Plan including:

1. Preparing an annual compliance evaluation..... ☐ YES ☐ NO

Name: _____ Phone: _____

2. Eliminating all unauthorized discharges..... ☐ YES ☐ NO

IX. VICINITY MAP AND FEE (must show site location in relation to nearest named streets, intersections, etc.)

Have you included a vicinity map with this submittal? ..... ☐ YES ☐ NO

Have you included payment of the annual fee with this submittal?..... ☐ YES ☐ NO

X. CERTIFICATIONS

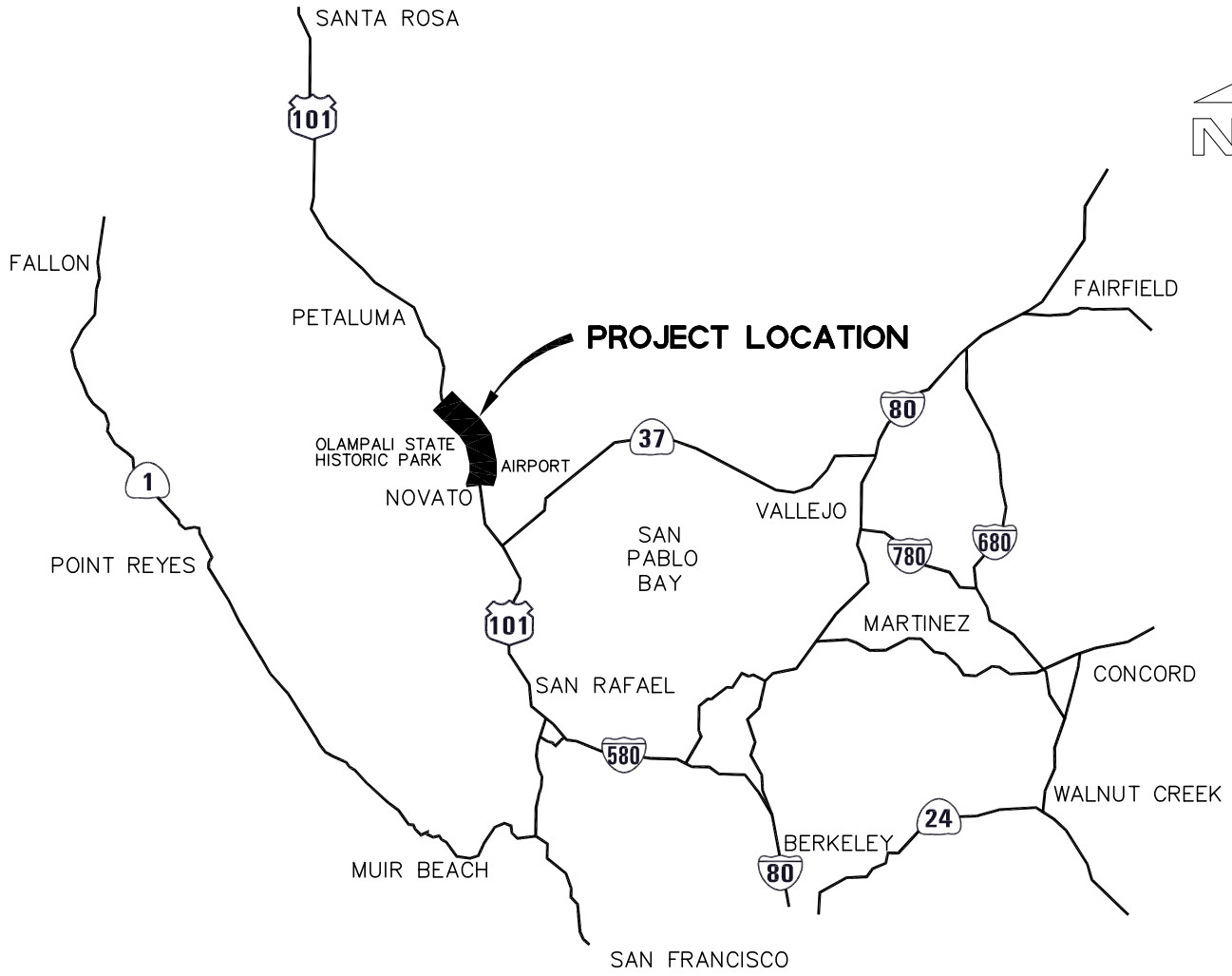
"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment. In addition, I certify that I have read the entire General Permit, including all attachments, and agree to comply with and be bound by all of the provisions, requirements, and prohibitions of the permit, including the development and implementation of a Storm Water Pollution Prevention Plan and a Monitoring Program Plan will be complied with."

Printed Name: _____

Signature: _____ **Date:** _____

Title: _____

2. Vicinity Map



MARIN/SONOMA NARROWS - SEGMENT B1 REDWOOD LANDFILL INTERCHANGE

IN MARIN COUNTY

FROM 3.2 MILES NORTH OF NORTH NOVATO OVERHEAD

TO 2.1 MILES SOUTH OF SONOMA COUNTY LINE

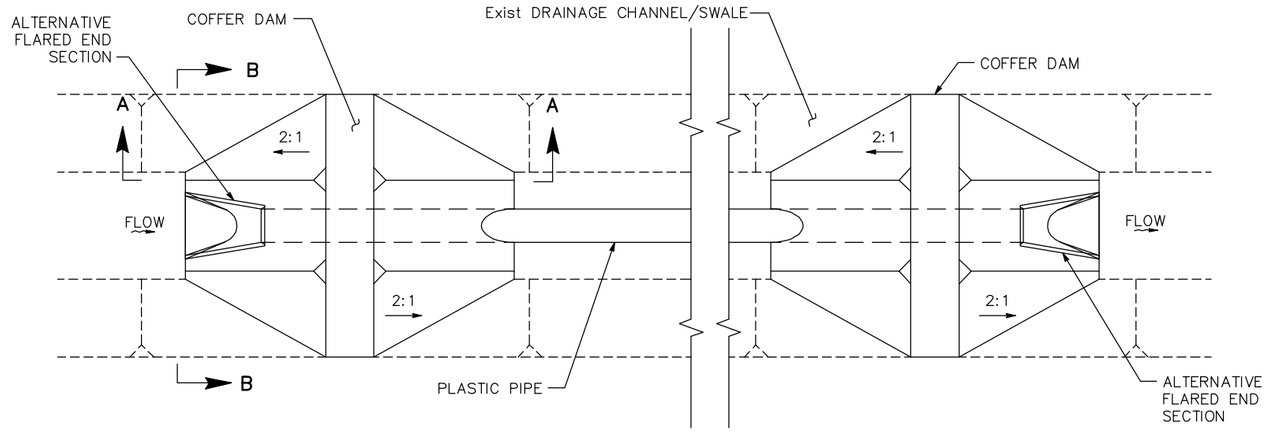
04–Mrn–101, PM R23.2/27.1

PROJECT VICINITY MAP

NOT TO SCALE

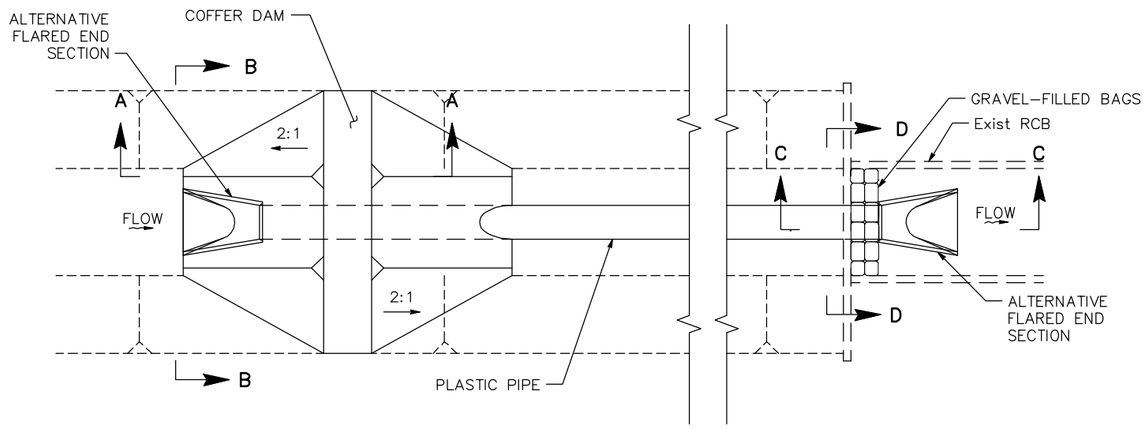
3. Layout Plans

4. Temporary Creek Diversion Details



PLAN

TYPE 1



PLAN

TYPE 2

NOTES:

1. PLASTIC SHEET SHALL BE COMMERCIAL QUALITY POLYETHYLENE WITH A Min THICKNESS OF 10 MILS.
2. ALL PLASTIC SHEETING SHALL BE FREE OF CRACKS OR OTHER DEFECTS ADVERSELY AFFECTING THE PROTECTIVE CHARACTERISTICS OF THE MATERIAL.
3. ALL JOINTS BETWEEN THE PLASTIC SHEET AND PIPE SHALL BE SEALED WITH COMMERCIAL QUALITY WATERPROOF TAPE.
4. CONTRACTOR TO SIZE COFFER DAM, PIPE DIAMETER, PIPE LENGTH, PIPE SLOPE, AND VERIFY FLOW RATE FOR THE PERIOD OF CONSTRUCTION.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

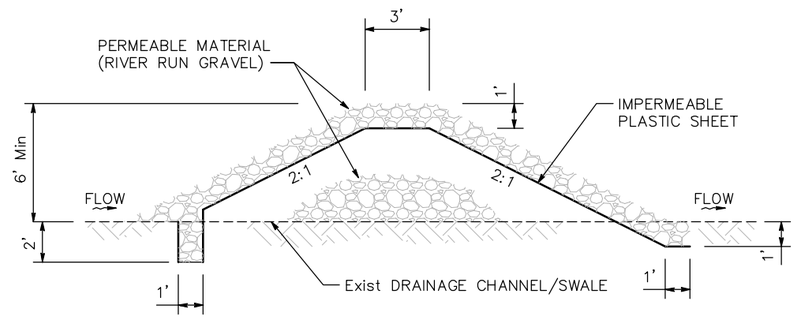
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

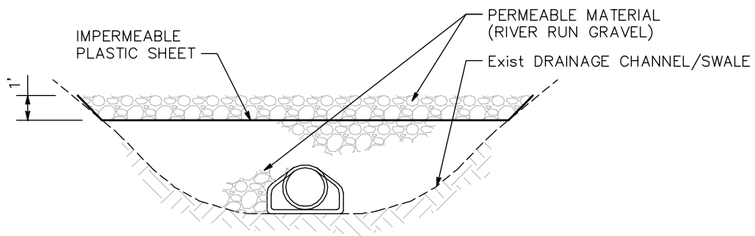
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



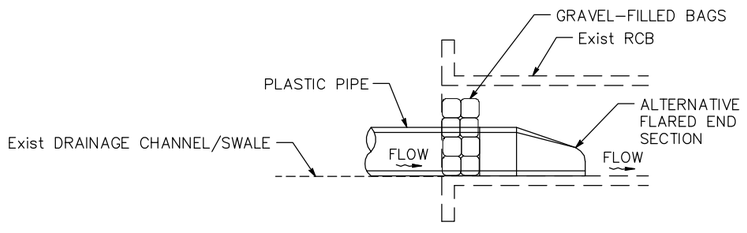
SECTION A–A

COFFER DAM



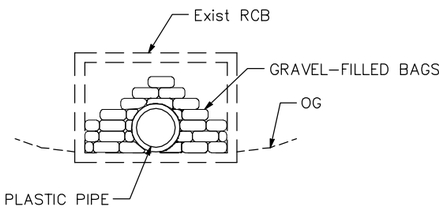
SECTION B–B

COFFER DAM



SECTION C–C

SANDBAG BARRIER DETAILS



SECTION D–D

SANDBAG BARRIER DETAILS

TEMPORARY WATER POLLUTION CONTROL DETAILS (TEMPORARY CREEK DIVERSION SYSTEM)

NO SCALE

WPCD-1

REVISED BY	DATE REVISED
SM	10/3/11

SHERWIN MANALO — GORDON SWEET

CALCULATED–DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 10–3–11 — DATE PLOTTED => Oct 07 2011 — TIME PLOTTED => 2:59 pm

P:\Eng08\087003\DWG\SHEETS\WPC\WPCD-01.dwg 07 Oct 2011 2:59:39pm mana

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER, DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

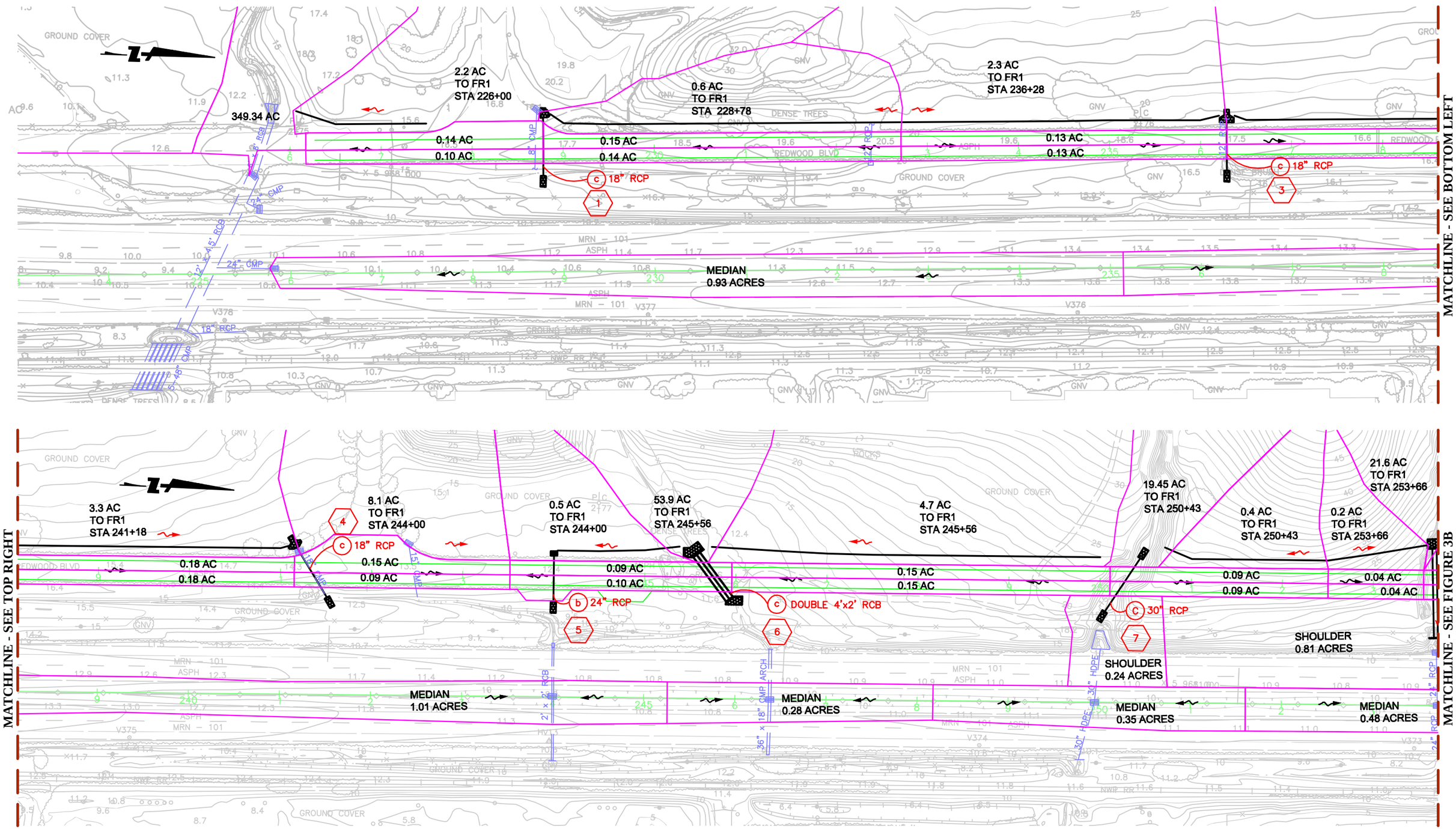
5. Erosion Control Plans and Details

6. Contour Grading Plans

7. Drainage Plans with Discharge Locations and Sampling Locations

8. Drainage Area Maps and Hydrology Data

© BKF Engineers



JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

FIGURE 3A
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

© BKF Engineers

MATCHLINE - SEE FIGURE 3A

53+66

9.9 AC
TO FR1
STA 253+66

0.04 AC
0.04 AC

c DOUBLE 30" RCP
8

0.16 AC
0.16 AC

SHOULDER
1.58 ACRES

4.09 AC

0.17 AC

0.22 AC

0.58 AC

0.20 AC
0.19 AC

2.4 AC
TO FR1
STA 263+70

SHOULDER
0.46 ACRES

MEDIAN
0.99 ACRES

33.8
AC
T0 FR1
STA 263+70

0.16 AC
0.17 AC

c DOUBLE 30" RCP
11

SHOULDER
0.17 ACRES

2.9 AC
TO FR1
STA 267+50

MEDIAN
0.56 ACRES

SLIPLINE a
92

b 24" RCP
12

6.0 AC
TO FR
STA 2

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

6.0 AC
TO FR1
STA 267+50

2.46 AC

0.09 AC

0.11 AC
0.11 AC

b 4' x 2' RCB
79

32.2 AC
TO FR1
STA
270+34

0.2 AC
TO FR1
STA 270+34

0.3 AC
TO FR1
STA 275+00

1.8 AC
TO FR1
STA 275+00

0.16 AC
0.16 AC

d DOUBLE 5' x 2' RCB
14

MEDIAN
0.54 ACRES

MEDIAN
1.31 ACRES

73.1 AC
TO FR1
STA 275+00

0.12 AC
0.12 AC

0.29 AC

0.03 AC

SHOULDER
0.44 ACRES

b 4' x 2' RCB
d 4' x 2' RCB
15
15

MEDIAN
0.29 ACRES

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE
100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-12-11
PLOTTED BY: muro

FIGURE 3B

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3B

18.8 AC
TO BK
STA 281+50

0.26 AC
0.26 AC

SHOULDER
1.47 ACRES

MEDIAN
1.27 ACRES

369.0 AC
TO BK
STA 293+48

SHOULDER
0.42 ACRES

MEDIAN
0.56 ACRES

d DOUBLE 7'x4' RCB

16

SHOULDER
0.40 ACRES

MEDIAN
0.21 ACRES

9.7 AC
TO BK
STA 293+48

0.12 AC
0.12 AC

SHOULDER
0.49 ACRES

MEDIAN
0.49 ACRES

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

6.0 AC TO BK STA 303+00

0.08 AC
0.08 AC

SHOULDER
1.32 ACRES

3.8 AC TO BK
STA 304+30

0.12 AC

b 18" RCP

17

526.8 AC TO BK
STA 305+39

b 18" RCP

18

0.3 AC
TO BK
STA 305+39

d DOUBLE 8'x4' RCB

19

MEDIAN
1.27 ACRES

SHOULDER
1.18 ACRES

0.44 AC

20

d DOUBLE 8'x4' RCB

0.8 AC
TO BK
STA 310+10

0.12 AC

SHOULDER
1.00 ACRES

MEDIAN
1.05 ACRES

2.6 AC
TO BK
STA 310+10

1.4 AC TO BK
STA 310+10

0.07 AC

b 18" RCP

21

MATCHLINE - SEE FIGURE 3D

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE
100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

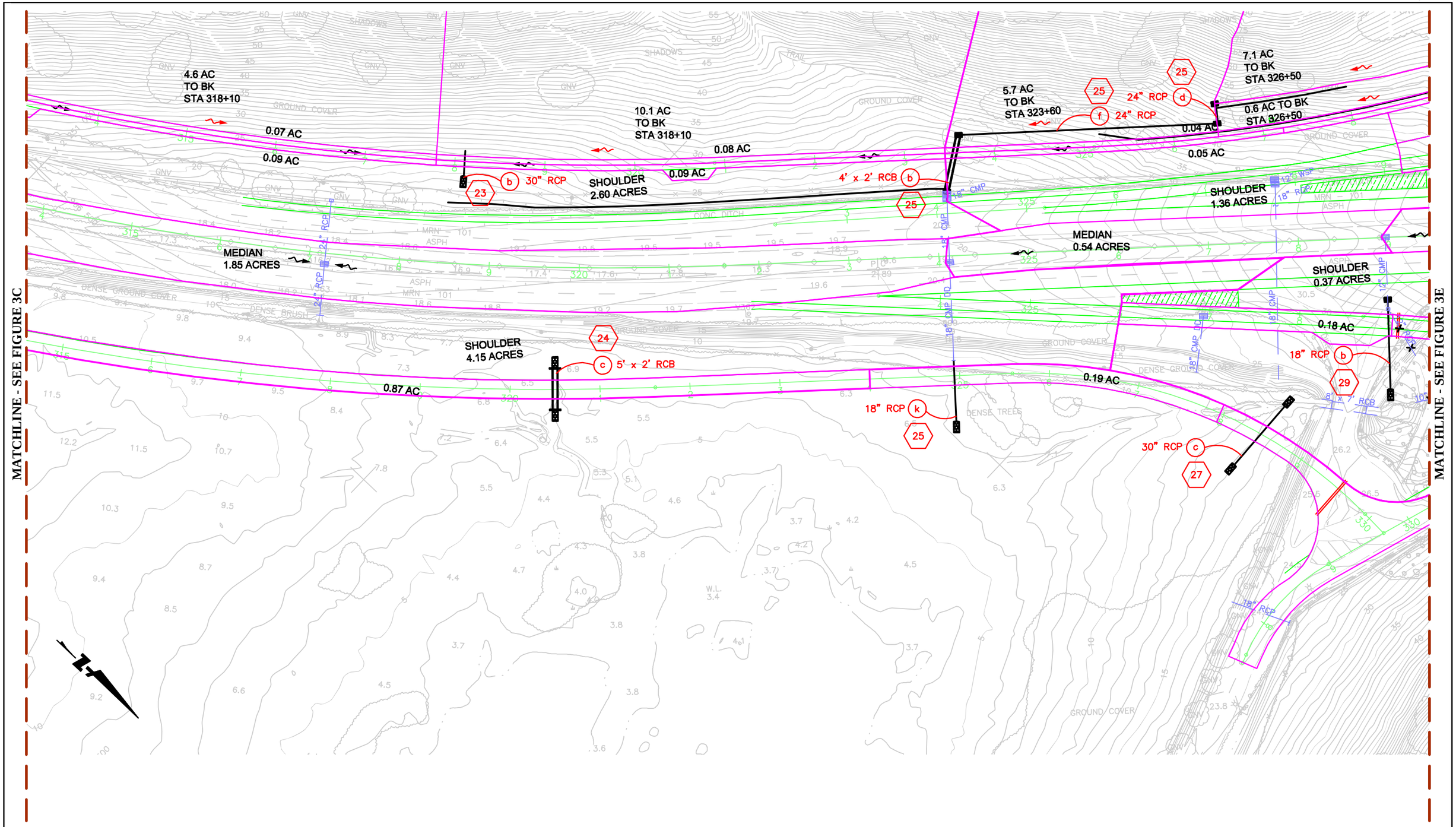
DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

FIGURE 3C

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers



DRAWING NAME: J:\Engd8\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE

100 0 100 200

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

FIGURE 3D

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3D

MATCHLINE - SEE FIGURE 3F

3.2 AC TO RLF STA 334+07

1.3 AC TO BK STA 332+50

0.09 AC

0.12 AC

0.12 AC

12.5 AC TO RLF STA 347+00

0.2 AC TO RLF STA 347+00

4.8 AC TO RLF STA 351+74

18.4 AC TO RLF STA 351+74

SHOULDER 0.31 ACRES

SHOULDER 0.49 ACRES

0.18 AC

0.18 AC

SHOULDER 0.74 ACRES

18" RCP b

32

87

18" RCP b

18" RCP b

36

43

5' x 2' RCB b

5' x 2' RCB e

5' x 2' RCB g

0.07 AC

0.07 AC

0.08 AC

SHOULDER 0.57 ACRES

18" RCP d

32

SHOULDER 1.28 ACRES

6" CMP

0.29 AC

BASIN 1.37 AC

39

18" RCP b

4' x 2' RCB b

37

4' x 2' RCB d

SHOULDER 0.22 ACRES

39

5' x 2' RCB f

18" RCP d

SHOULDER 0.55 ACRES

18" RCP h

MEDIAN 0.57 ACRES

MEDIAN 0.55 ACRES

SLIPLINE b

92

MEDIAN 0.35 ACRES

SHOULDER 1.51 ACRES

SHOULDER 0.54 ACRES

41

18" RCP f

0.09 AC

0.10 AC

0.11 AC

18" RCP b

18" RCP d

18" RCP d

18" RCP h

41

SHOULDER 0.84 ACRES

40

c 18" RCP

c 30" RCP

30

SHOULDER 2.53 ACRES

0.68 AC

HILLSIDE 0.52 ACRES

b 18" RCP

93

HILLSIDE 4.13 ACRES

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-12-11
PLOTTED BY: muro

FIGURE 3E

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers

MATCHLINE - SEE FIGURE 3E

6.5 AC
TO RLF
STA 351+74

0.16 AC
0.16AC

SHOULDER
1.58 ACRES

18" RCP
b
44

SLIPLINE
c
92

d 18" RCP

MEDIAN
0.49 ACRES

0.4 AC
TO RLF
STA 356+00

0.04 AC
0.04 AC

1.3 AC
TO RLF
STA 358+50

0.06 AC
0.06 AC

18" RCP
b
46

0.7 AC
TO RLF
STA 358+50

0.03 AC
TO RLF
STA 358+50

0.04 AC
0.04 AC

SHOULDER
1.41 ACRES

1.8 AC
TO RLF
STA 361+50

0.1 AC
TO RLF
STA 361+50

0.08 AC
0.08 AC

18" RCP
b
47

18" CMP SD

MEDIAN
0.49 ACRES

25.0 AC
TO RLF
STA 365+72

0.31 AC

45.9 AC
TO RLF
STA 365+72

8'x7' RCB
c
48

18" RCP
b
80

ME
0.7

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

5.4 AC
TO RLF
STA 365+72

0.52 AC

MEDIAN
0.79 ACRES

49
c 18" RCP

1.3 AC
TO RLF
STA 373+35

0.23 AC

MEDIAN
0.37 ACRES

6.5 AC
TO RLF
STA 378+42

0.22 AC

MEDIAN
0.68 ACRES

50
d 4'x2' RCB
4'x2' RCB
b

10.3 AC
TO RLF
STA 378+42

85
0.18 AC

18" RCP
b
86

85
f 36" RCP
d 36" RCP

8.8 AC
TO RLF
STA 38

0.20 AC

18" RCP
d
86

MATCHLINE - SEE FIGURE 3G

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE
100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

FIGURE 3F

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-12-11
PLOTTED BY: muro

© BKF Engineers

MATCHLINE - SEE FIGURE 3F

8.8 AC TO RLF STA 380+90

1.6 AC TO RLF STA 383+60

15.1 AC TO RLF STA 385+85

23.3 AC TO RLF STA 388+50

1.7 AC TO RLF STA 388+50

351.7 AC TO RLF STA 393+55

0.48 AC

0.16 AC

0.20 AC

0.29 AC

SHOULDER 1.15 ACRES

MEDIAN 0.55 ACRES

SHOULDER 0.34 ACRES

MEDIAN 1.24 ACRES

18" RCP (j)

30" RCP (h)

30" RCP (l)

30" RCP (n)

36" RCP (b)

18" RCP (d)

18" RCP (f)

18" RCP (h)

DOUBLE 7'x4' RCB (d)

10'x5' RCB (f)

12" RCP

18" CMP

15" x 5" RCB

"NZ" STA 374+25N OFFSITE 1.2 ACRES STA 374+25

MATCHLINE - SEE BOTTOM LEFT

MATCHLINE - SEE TOP RIGHT

3.9 AC TO RLF STA 393+55

3.5 AC TO RLF STA 402+50

3.4 AC TO RLF STA 402+50

5.5 AC TO RLF STA 404+50

0.3 AC

7.20 AC TO RLF STA 409+33

0.8 AC TO RLF STA 412+00

4.0 AC TO RLF STA 412+00

0.17 AC

0.11 AC

0.17 AC

0.31 AC

0.22 AC

0.15 AC

0.2 AC TO RLF STA 409+33

SHOULDER 0.93 ACRES

MEDIAN 0.37 ACRES

SHOULDER 0.23 ACRES

MEDIAN 0.28 ACRES

SHOULDER 0.36 ACRES

MEDIAN 0.45 ACRES

SHOULDER 0.24 ACRES

MEDIAN 0.32 ACRES

SHOU 0.20 A

MEDIAN 0.27 ACR

18" RCP (c)

24" RCP (b)

24" RCP (b)

24" RCP (b)

18" RCP (b)

SLIPLINE (d)

SLIPLINE (e)

SLIPLINE (f)

SLIPLINE (g)

12" RCP

18" CMP

18" RCP

18" CMP

18" CMP

18" CMP

18" CMP

18" CMP

DENSE TREES

GROUND COVER

DENSE BRUSH

ASPH

MRN – 101

GNV

LEGEND:

- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

GRAPHIC SCALE

100 0 100 200

JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

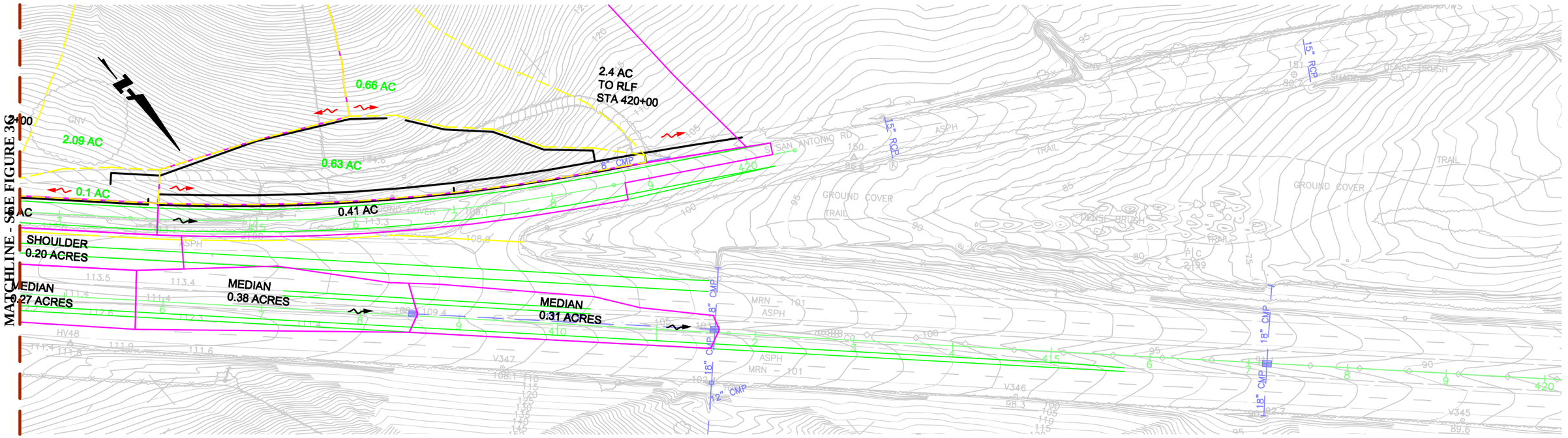
DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-12-11
PLOTTED BY: muro

FIGURE 3G

ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BKF

© BKF Engineers



JOB No: 20087003
DATE: OCT, 2011
BY: R.A.M
REV: E.B.

GRAPHIC SCALE
100 0 100 200

LEGEND:
- EXISTING STORM DRAIN FACILITIES
- PROPOSED STORM DRAIN FACILITIES
- PROPOSED DITCH FLOW DIRECTION

FIGURE 3H
ROUTE 101 IMPROVEMENT MSN B1-
REDWOOD LANFILL INTERCHANGE PROJECT
DRAINAGE REPORT
PROPOSED DRAINAGE AREAS AND DRAINAGE FACILITIES

BkF

DRAWING NAME: J:\Eng08\087003\FIGURES\MSN-Figure-3.dwg
PLOT DATE: 10-09-11
PLOTTED BY: muro

9. Rainfall Data

WINIDF 1.0 OUTPUT TABLE

10/10/2011

Input values: Lat.: 38.105 deg. Long.: 122.537 deg. Return Period: 2 yrs.

Selected Station(s)	Station ID	Elev.	Lat.	Long.	Dist.
		ft	deg.	deg.	miles
NOVATO FS #1	E206290001	35	38.105	122.537	0.00

Output table (Intensities in inches/hour):

Dur.\RP	2-yr	2-yr	10-yr	25-yr	50-yr	100-yr	10000-yr
5-min	1.713	1.725	2.885	3.450	3.889	4.297	6.900
10-min	1.246	1.254	2.098	2.508	2.827	3.124	5.016
15-min	1.034	1.041	1.741	2.081	2.346	2.592	4.163
30-min	0.751	0.757	1.265	1.513	1.706	1.884	3.026
60-min	0.546	0.550	0.920	1.100	1.240	1.370	2.200
120-min	0.397	0.400	0.669	0.800	0.901	0.996	1.599
4-hr	0.289	0.291	0.486	0.581	0.655	0.724	1.163
8-hr	0.210	0.211	0.353	0.423	0.476	0.526	0.845
16-hr	0.153	0.154	0.257	0.307	0.346	0.383	0.615
24-hr	0.127	0.127	0.213	0.255	0.287	0.318	0.510

a = 0.5463 b = -0.460 1.00 min

10. Wetlands and Waters of the U.S.

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

CITY OF NOVATO

P–CWUS: L = 38 FT, AW = 5 FT,
A = 201 SQFT, (0.0046 ACRE)

"FR1" LINE

REDWOOD Blvd

ROUTE 101

"N2R" LINE

SMART RR

2

P–WWUS: L = 188 FT, AW = 7 FT,
A = 1335 SQFT, (0.0306 ACRE)

1

T–WWUS: L = 184 FT, AW = 8 FT,
A = 1427 SQFT, (0.0328 ACRE)

T–NJS: L = 641 FT, AW = 7 FT,
A = 4274 SQFT, (0.0981 ACRE)

SEE SHEET MAP-2

MAP-1

SHEET 1 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 1335 SQFT
TEMPORARY= 1427 SQFT

CULVERTED IMPACTS:
PERMANENT= 201 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

LAST REVISION 00-00-00 | DATE PLOTTED => Nov 08 2011 | TIME PLOTTED => 8:16 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

CITY OF NOVATO

MARIN COUNTY

T-WWUS: L = 110 FT, AW = 4 FT,
A = 522 SQFT, (0.0120 ACRE)

P-CWUS: L = 59 FT, AW = 4 FT,
A = 250 SQFT, (0.0057 ACRE)

P-CWUS: L = 52 FT, AW = 5 FT,
A = 258 SQFT, (0.0059 ACRE)

T-OWUS: L = 12 FT, AW = 6 FT,
A = 71 SQFT, (0.0016 ACRE)

T-OWUS: L = 14 FT, AW = 6 FT,
A = 86 SQFT, (0.0020 ACRE)

7 P-OWUS: L = 75 FT, AW = 4 FT,
A = 281 SQFT, (0.0065 ACRE)

P-OWUS: L = 82 FT, AW = 6 FT,
A = 506 SQFT, (0.0116 ACRE) 5

3 P-WWUS: L = 513 FT, AW = 5 FT,
A = 2395 SQFT, (0.0550 ACRE)

4 T-OWUS: L = 256 FT, AW = 5 FT,
A = 1436 SQFT, (0.0330 ACRE)

6 P-OWUS: L = 9 FT, AW = 3 FT,
A = 29 SQFT, (0.0007 ACRE)

T-OWUS: L = 20 FT, AW = 2 FT,
A = 44 SQFT, (0.0010 ACRE)

T-OWUS: L = 476 FT, AW = 5 FT,
A = 2272 SQFT, (0.0522 ACRE) 8

REDWOOD Blvd

ROUTE 101
"N2R" LINE

FRT "L" LINE

SMART RR

SEE SHEET MAP-1

SEE SHEET MAP-3

MAP-2

SHEET 2 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 2395 SQFT
TEMPORARY= 522 SQFT

CULVERTED IMPACTS:
PERMANENT= 508 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 816 SQFT
TEMPORARY= 3909 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

REVISED BY	DATE REVISED

CALCULATED–DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00

DATE PLOTTED => Nov 08 2011
TIME PLOTTED => 9:15 pm

BORDER LAST REVISED 7/2/2010

USERNAME => $USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

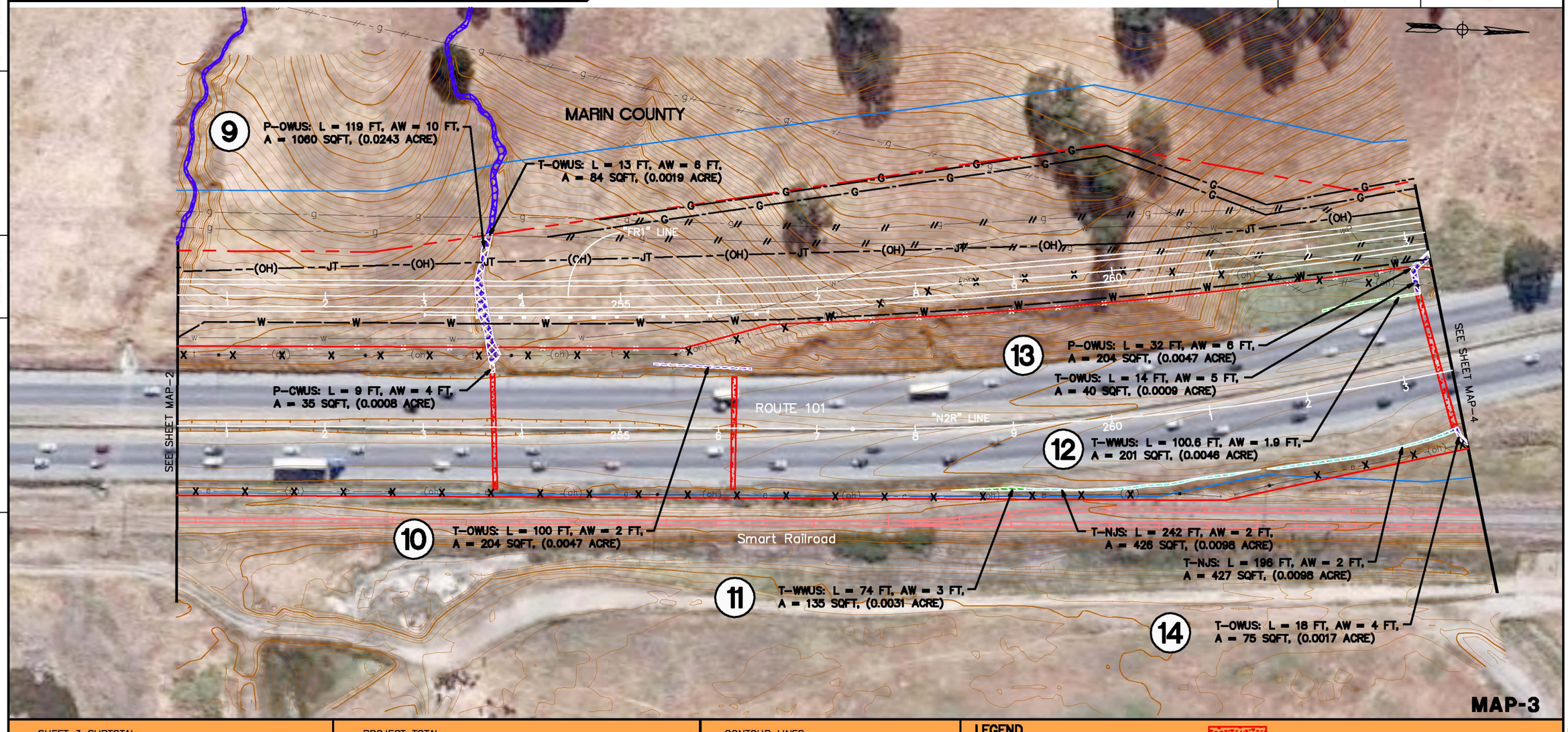
PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



SHEET 3 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 336 SQFT

CULVERTED IMPACTS:
PERMANENT= 35 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 1264 SQFT
TEMPORARY= 403 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 00-00-00 | DATE PLOTTED => Nov 08 2011 | TIME PLOTTED => 9:20 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

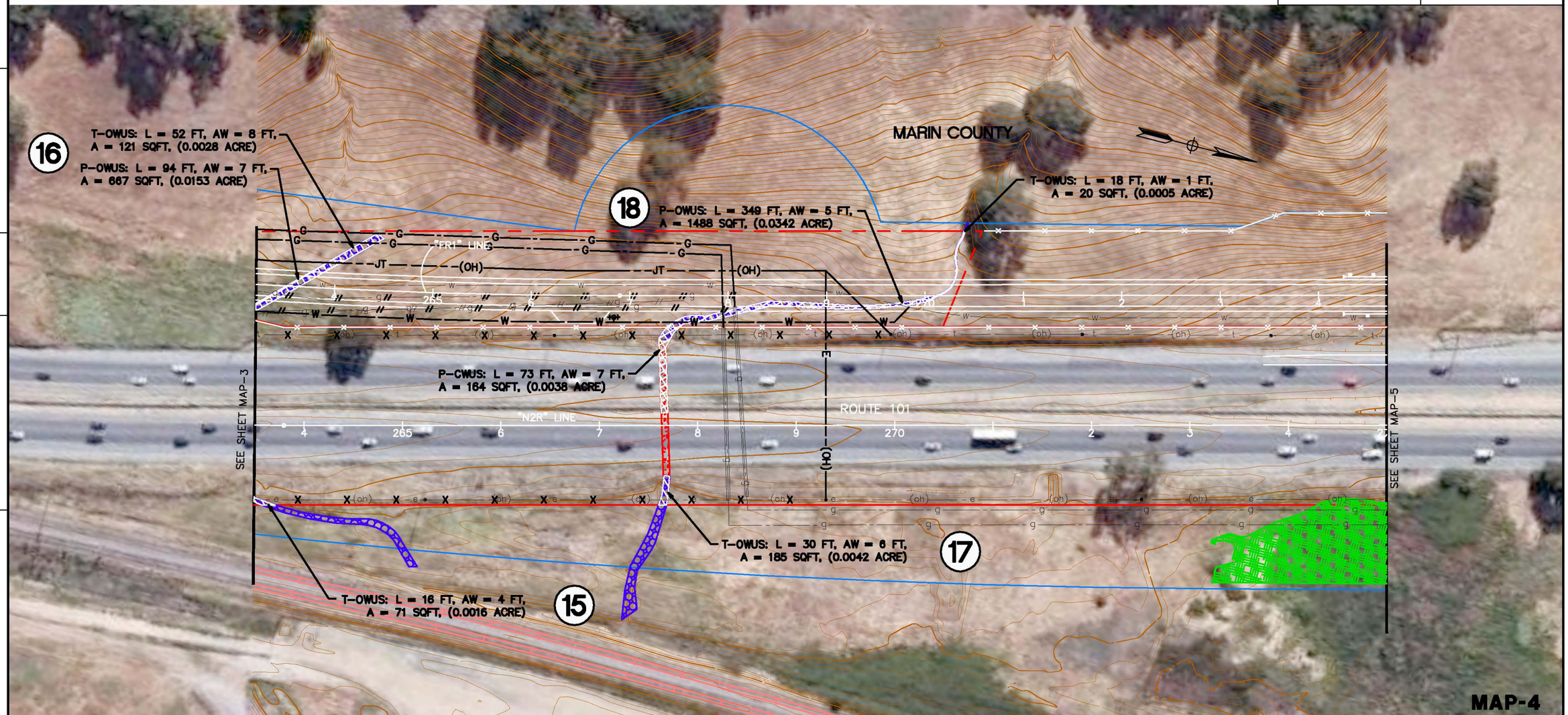
REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

SUPERVISOR | CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans



SHEET 4 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

CULVERTED IMPACTS:
PERMANENT= 164 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 2155 SQFT
TEMPORARY= 397 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

DATE PLOTTED => Nov 08 2011
TIME PLOTTED => 9:27 pm
LAST REVISION 00-00-00

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Gt Gathers

MARIN COUNTY

19

T–OWUS: L = 6 FT, AW = 2 FT,
A = 13 SQFT, (0.0003 ACRE)

T–WWUS: L = 3 FT, AW = 43 FT,
A = 383 SQFT, (0.0083 ACRE)

P–WWUS: L = 386 FT, AW = 84 FT,
A = 8077 SQFT, (0.1854 ACRE)

"FR1" LINE

"BK" LINE

"N2R" LINE

ROUTE 101

SEE SHEET MAP–4

SEE SHEET MAP–6

MAP-5

SHEET 5 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 8077 SQFT
TEMPORARY= 363 SQFT

CULVERTED IMPACTS:
PERMANENT=0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 13 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

LAST REVISION 00–00–00 | DATE PLOTTED => Nov 08 2011 | TIME PLOTTED => 9:47 pm

P:\Dgn\264071\Permit\Mit - 404 Permit\Attachments\MAP-05.dgn 08 Nov 2011 9:47:25pm mana

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

N.V. BERNARDI
No. 45407
Exp. 9/30/12
CIVIL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

MARIN COUNTY

20 P-WWUS: L = 73 FT, AW = 45 FT, A = 2312 SQFT, (0.0531 ACRE)

22 T-OWUS: L = 9 FT, AW = 2 FT, A = 17 SQFT, (0.0004 ACRE)
P-OWUS: L = 53 FT, AW = 2 FT, A = 105 SQFT, (0.0024 ACRE)
T-OWUS: L = 6 FT, AW = 2 FT, A = 11 SQFT, (0.0003 ACRE)

23 P-WWUS: L = 44 FT, AW = 21 FT, A = 938 SQFT, (0.0215 ACRE)
T-WWUS: L = 6 FT, AW = 22 FT, A = 135 SQFT, (0.0031 ACRE)

27 T-WWUS: L = 4 FT, AW = 6 FT, A = 24 SQFT, (0.0006 ACRE)
T-WWUS: L = 81 FT, AW = 19 FT, A = 1375 SQFT, (0.0316 ACRE)
P-WWUS: L = 71 FT, AW = 8 FT, A = 602 SQFT, (0.0138 ACRE)

"BK" LINE

ROUTE 101

"N2R" LINE

24 P-WWUS: L = 82 FT, AW = 19 FT, A = 1461 SQFT, (0.0335 ACRE)
T-WWUS: L = 43 FT, AW = 3 FT, A = 95 SQFT, (0.0022 ACRE)

25 T-WWUS: L = 42 FT, AW = 135 FT, A = 5043 SQFT, (0.1158 ACRE)

21 T-OWUS: L = 19 FT, AW = 4 FT, A = 81 SQFT, (0.0019 ACRE)

26 P-WWUS: L = 68 FT, AW = 125 FT, A = 7374 SQFT, (0.1693 ACRE)
T-WWUS: L = 16 FT, AW = 129 FT, A = 1953 SQFT, (0.0448 ACRE)

SEE SHEET MAP-5

SEE SHEET MAP-7

MAP-6

SHEET 6 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 12687 SQFT
TEMPORARY= 8625 SQFT

CULVERTED IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 105 SQFT
TEMPORARY= 109 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

REVISED BY	DATE REVISED

CALCULATED–DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00 DATE PLOTTED => Nov 08 2011 TIME PLOTTED => 9:49 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

P-WWUS: L = 4 FT, AW = 4 FT, A = 18 SQFT, (0.0004 ACRE)
T-WWUS: L = 38 FT, AW = 6 FT, A = 266 SQFT, (0.0061 ACRE)
28
MARIN COUNTY
T-OWUS: L = 6 FT, AW = 6 FT, A = 36 SQFT, (0.0008 ACRE)
P-OWUS: L = 57 FT, AW = 8 FT, A = 473 SQFT, (0.0109 ACRE)
T-OWUS: L = 15 FT, AW = 8 FT, A = 113 SQFT, (0.0026 ACRE)
T-OWUS: L = 25 FT, AW = 19 FT, A = 397 SQFT, (0.0091 ACRE)
29
T-CWUS: L = 20 FT, AW = 3 FT, A = 53 SQFT, (0.0012 ACRE)
T-OWUS: L = 47 FT, AW = 2 LF, A = 91 SQFT (0.0021 ACRE)
32
"BK" LINE
SEE SHEET MAP-6
SEE SHEET MAP-8
ROUTE 101
"N2R" LINE
"ER2" LINE
34
T-OWUS: L = 117 FT, AW = 4 FT, A = 467 SQFT, (0.0107 ACRE)
T-OWUS: L = 41 FT, AW = 4 LF, A = 162 SQFT (0.0037 ACRE)
30
P-OWUS: L = 202 FT, AW = 4 LF, A = 813 SQFT (0.0187 ACRE)
T-WWUS: L = 692 FT, AW = 56 FT, A = 34722 SQFT, (0.7983 ACRE)
P-WWUS: L = 634 FT, AW = 48 FT, A = 30779 SQFT, (0.7066 ACRE)
T-WWUS: L = 699 FT, AW = 16 FT, A = 11408 SQFT, (0.2619 ACRE)
31
MAP-7

SHEET 7 SUBTOTAL:

WETLANDS IMPACTS:		CULVERTED IMPACTS:	
PERMANENT=	30797 SQFT	PERMANENT=	0 SQFT
TEMPORARY=	46396 SQFT	TEMPORARY=	53 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 1286 SQFT
TEMPORARY= 1266 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:		CULVERTED IMPACTS:	
PERMANENT=	110520 SQFT	PERMANENT=	3174 SQFT
TEMPORARY=	84767 SQFT	TEMPORARY=	286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12526 SQFT
TEMPORARY= 7616 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

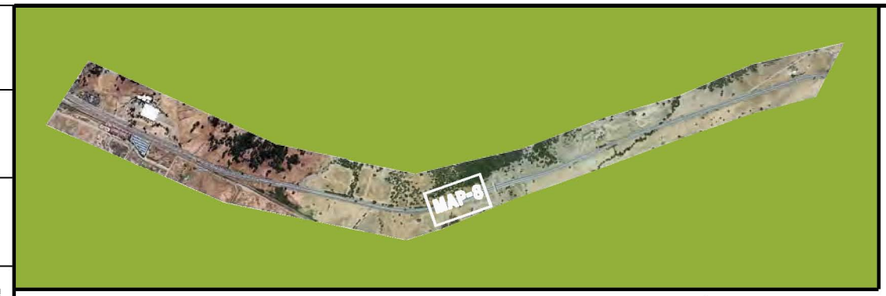
LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

REVISED BY | DATE REVISED
CALCULATED–DESIGNED BY | CHECKED BY
DIST. SUPERVISOR | CONSULTANT FUNCTIONAL SUPERVISOR
STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION DATE PLOTTED => Nov 16 2011
00-00-00 TIME PLOTTED => 10:33 am

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331



MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

MARIN COUNTY

37

EXIST NJS NO LONGER PRESENT
(REMOVED DURING THE REDWOOD LANDFILL OVERCROSSING PROJECT IN 2006)

T-OWUS: L = 23 FT, AW = 1 FT,
A = 58 SQFT, (0.0013 ACRE)

P-OWUS: L = 85 FT, AW = 1 FT,
A = 50 SQFT, (0.0011 ACRE)

EXIST OWUS NO LONGER PRESENT
(REMOVED DURING THE REDWOOD LANDFILL OVERCROSSING PROJECT IN 2006)

"BK" LINE

"N2R" LINE

"RL4" LINE

"RL1" LINE

"RL2" LINE

"RL3" LINE

ROUTE 101

35

T-WWUS: L = 368 FT, AW = 28 FT,
A = 7890 SQFT, (0.1811 ACRE)

38

T-WWUS: L = 30 FT, AW = 29 FT,
A = 482 SQFT, (0.0111 ACRE)
P-WWUS: L = 245 FT, AW = 31 FT,
A = 8852 SQFT, (0.1573 ACRE)

36

P-WWUS: L = 656 FT, AW = 63 FT,
A = 39038 SQFT, (0.8962 ACRE)
T-WWUS: L = 628 FT, AW = 32 FT,
A = 16902 SQFT, (0.3880 ACRE)

39

P-WWUS: L = 63 FT, AW = 13.9 FT,
A = 877 SQFT, (0.0201 ACRE)

SEE SHEET MAP-7

SEE SHEET MAP-9 & MAP-10

MAP-8

SHEET 8 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 46767 SQFT
TEMPORARY= 25274 SQFT

CULVERTED IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 50 SQFT
TEMPORARY= 58 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 00-00-00 | DATE PLOTTED => Nov 08 2011 | TIME PLOTTED => 10:04 am

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

MARIN COUNTY

T–OWUS: L = 18 FT, AW = 2 FT, A = 43 SQFT, (0.0010 ACRE)
P–OWUS: L = 448 FT, AW = 2 FT, A = 1171 SQFT, (0.0269 ACRE)
40
T–OWUS: L = 15 FT, AW = 4 FT, A = 62 SQFT, (0.0014 ACRE)
P–OWUS: L = 31 FT, AW = 6 FT, A = 188 SQFT, (0.0043 ACRE)
41
T–NJS: L = 31 FT, AW = 2 FT, A = 71 SQFT, (0.0016 ACRE)
P–NJS: L = 74 FT, AW = 3 FT, A = 212 SQFT, (0.0049 ACRE)

"BK" LINE
"RLF" LINE
"RL4" LINE
"RL3" LINE
"N2R" LINE
ROUTE 101
OUT HERE
SEE SHEET MAP–8
SEE SHEET MAP–10
SEE SHEET MAP–11
MAP-9

EXIST OWUS NO LONGER PRESENT (REMOVED DURING THE REDWOOD LANDFILL OVERCROSSING PROJECT IN 2006)

EXIST CWUS NO LONGER PRESENT (REMOVED DURING THE REDWOOD LANDFILL OVERCROSSING PROJECT IN 2006)

SHEET 9 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

CULVERTED IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 1359 SQFT
TEMPORARY= 105 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

REVISED BY | DATE REVISED
CALCULATED–DESIGNED BY | CHECKED BY
SUPERVISOR | CONSULTANT FUNCTIONAL SUPERVISOR
STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

LAST REVISION 00–00–00 | DATE PLOTTED => Nov 08 2011 | TIME PLOTTED => 10:07 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

SUPERVISOR | CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

SEE SHEET MAP–9

SEE SHEET MAP–8

ROUTE 101

"RL1" LINE

"RL2" LINE

EXIST CWUS NO LONGER PRESENT
(REMOVED DURING THE REDWOOD LANDFILL OVERCROSSING PROJECT IN 2008)

P–OWUS: L = 43 FT, AW = 3 FT,
A = 125 SQFT, (0.0029 ACRE)
T–OWUS: L = 39 FT, AW = 3 FT,
A = 133 SQFT, (0.0031 ACRE)

43

42

P–WWUS: L = 47 FT, AW = 5 FT,
A = 276 SQFT, (0.0063 ACRE)
T–WWUS: L = 30 FT, AW = 17 FT,
A = 493 SQFT, (0.0113 ACRE)

MARIN COUNTY

SEE SHEET MAP–11

MAP-10

SHEET 10 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 276 SQFT
TEMPORARY= 493 SQFT

CULVERTED IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 125 SQFT
TEMPORARY= 133 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

LAST REVISION => 00–00–00
DATE PLOTTED => Nov 08 2011
TIME PLOTTED => 10:12 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

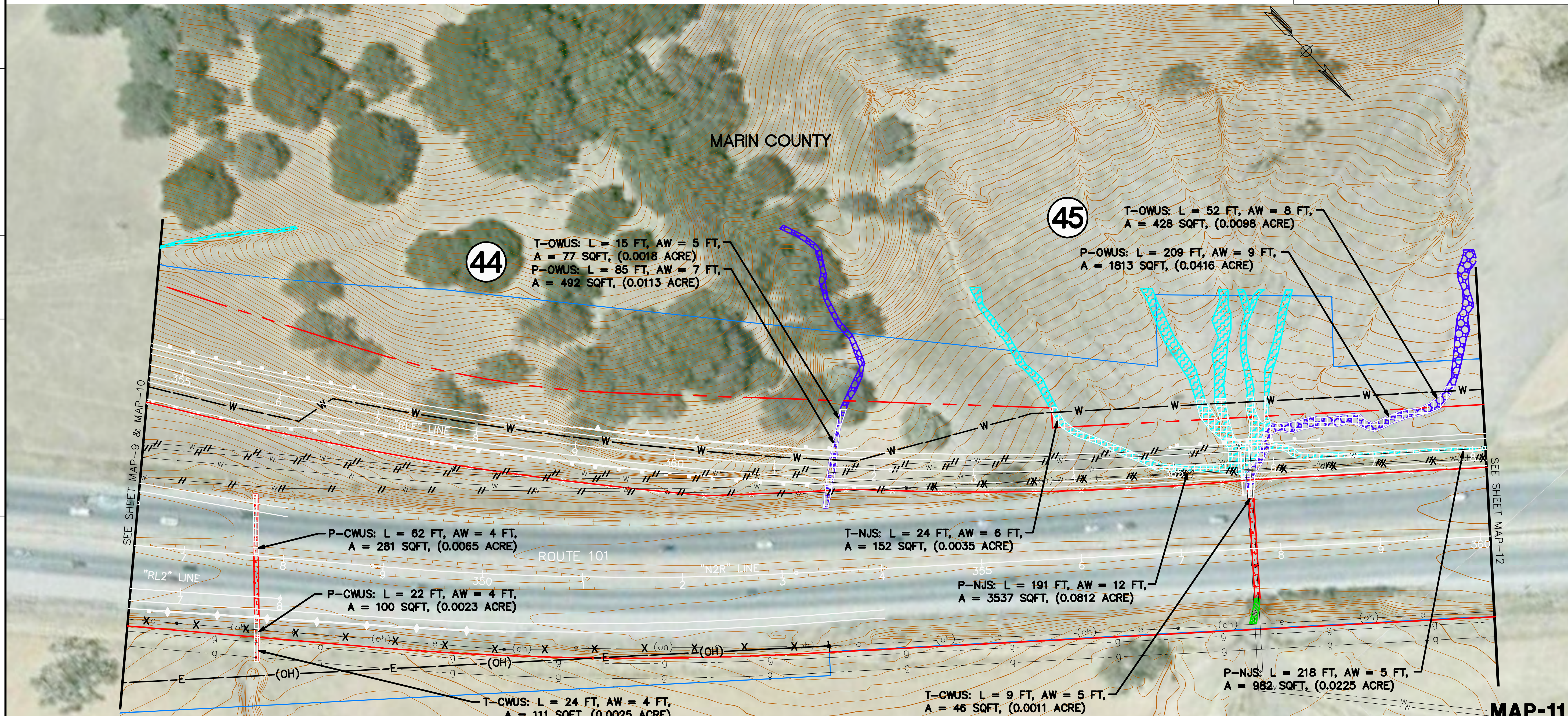
REGISTERED PROFESSIONAL ENGINEER
N.V. BERNARDI
No. 45407
Exp. 9/30/12
CIVIL
STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071



SHEET 11 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

CULVERTED IMPACTS:
PERMANENT= 381 SQFT
TEMPORARY= 157 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 2305 SQFT
TEMPORARY= 505 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

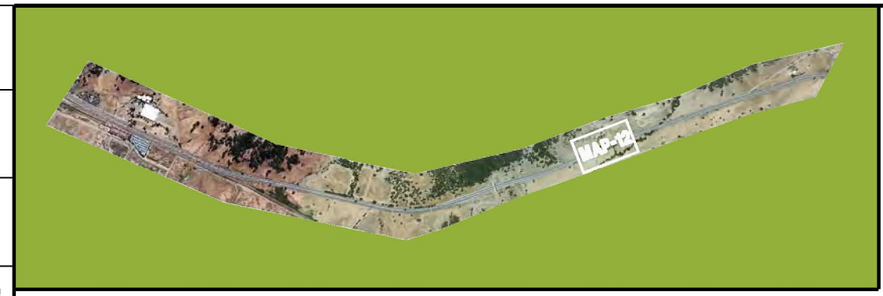
- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR | CALCULATED-DESIGNED BY | CHECKED BY | REVISED BY | DATE REVISED

DATE PLOTTED => Nov 09 2011
TIME PLOTTED => 11:35 am
LAST REVISION 00-00-00

BORDER LAST REVISED 7/2/2010
USERNAME => $USER
DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0716
PROJECT NUMBER & PHASE 04000007331



MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

MARIN COUNTY

T–NJS: L = 28 FT, AW = 5 FT,
A = 135 SQFT, (0.0031 ACRE)

T–WWUS: L = 36 FT, AW = 9 FT,
A = 305 SQFT, (0.0070 ACRE)

T–WWUS: L = 20 FT, AW = 11 FT,
A = 221 SQFT, (0.0051 ACRE)

T–WWUS: L = 217 FT, AW = 4 FT,
A = 805 SQFT, (0.0185 ACRE)

46

P–NJS: L = 58 FT, AW = 4 FT,
A = 253 SQFT, (0.0058 ACRE)

P–WWUS: L = 473 FT, AW = 7 FT,
A = 4338 SQFT, (0.0996 ACRE)

47

"RLF" LINE

"N2R" LINE

ROUTE 101

SEE SHEET MAP–11

SEE SHEET MAP–13

MAP-12

SHEET 12 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 4338 SQFT
TEMPORARY= 1331 SQFT

CULVERTED IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

LAST REVISION | DATE PLOTTED => Nov 08 2011
00–00–00 | TIME PLOTTED => 10:19 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

SUPERVISOR

CONSULTANT FUNCTIONAL

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

MARIN COUNTY

49

T–OWUS: L = 46 FT, AW = 7 FT,
A = 350 SQFT, (0.0080 ACRE)
P–OWUS: L = 164 FT, AW = 13 FT,
A = 2277 SQFT, (0.0523 ACRE)

48

P–WWUS: L = 518 FT, AW = 7 FT,
A = 3348 SQFT, (0.0769 ACRE)

P–CWUS: L = 56 FT, AW = 6 FT,
A = 314 SQFT, (0.0072 ACRE)

T–CWUS: L = 13 FT, AW = 6 FT,
A = 76 SQFT, (0.0017 ACRE)

ROUTE 101

"N2R" LINE

"RLE" LINE

SEE SHEET MAP–12

SEE SHEET MAP–14

MAP-13

SHEET 13 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 3348 SQFT
TEMPORARY= 0 SQFT

CULVERTED IMPACTS:
PERMANENT= 314 SQFT
TEMPORARY= 76 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 2277 SQFT
TEMPORARY= 350 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

LAST REVISION 00-00-00 | DATE PLOTTED => Nov 08 2011 | TIME PLOTTED => 10:22 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION | CONSULTANT FUNCTIONAL SUPERVISOR

Caltrans

MARIN COUNTY

P-CWUS: L = 61 FT, AW = 5 FT,
A = 384 SQFT, (0.0088 ACRE)

T-OWUS: L = 21 FT, AW = 14 FT,
A = 243 SQFT, (0.0056 ACRE)
P-OWUS: L = 83 FT, AW = 10 FT,
A = 784 SQFT, (0.0180 ACRE)

50

P-CWUS: L = 72 FT, AW = 6 FT,
A = 411 SQFT, (0.0094 ACRE)

P-CWUS: L = 66 FT, AW = 4 FT,
A = 293 SQFT, (0.0067 ACRE)

"N2R" LINE

ROUTE 101

"R2N" LINE

P-CWUS: L = 70 FT, AW = 7 FT,
A = 483 SQFT, (0.0111 ACRE)

52

P-WWUS: L = 108 FT, AW = 5 FT,
A = 500 SQFT, (0.0115 ACRE)

T-OWUS: L = 19 FT, AW = 7 FT,
A = 125 SQFT, (0.0029 ACRE)

51

SEE SHEET MAP-13

SEE SHEET MAP-15

MAP-14

SHEET 14 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 500 SQFT
TEMPORARY= 0 SQFT

CULVERTED IMPACTS:
PERMANENT= 1571 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 784 SQFT
TEMPORARY= 368 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50
FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON-JURISDICTIONAL AREAS

LAST REVISION

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

MSN CONTRACT B1
ROUTE 101 - MARIN COUNTY - PM R23.2/27.1
EA 264071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI — No. 45407 — Exp. 9/30/12 — CIVIL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

REVISED BY | DATE REVISED

CALCULATED–DESIGNED BY | CHECKED BY

SUPERVISOR

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

SEE SHEET MAP–14

SAN ANTONIO Rd

"RT" LINE

"N2R" LINE

ROUTE 101

MAP-15

SHEET 15 SUBTOTAL:

WETLANDS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

CULVERTED IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 0 SQFT
TEMPORARY= 0 SQFT

PROJECT TOTAL

WETLANDS IMPACTS:
PERMANENT= 110520 SQFT
TEMPORARY= 84767 SQFT

CULVERTED IMPACTS:
PERMANENT= 3174 SQFT
TEMPORARY= 286 SQFT

OTHER WATERS IMPACTS:
PERMANENT= 12688 SQFT
TEMPORARY= 7454 SQFT

CONTOUR LINES:
INDEX CONTOURS SET AT 5'
INTERMEDIATE CONTOURS SET AT 1'

50 0 50 FEET

LEGEND

- CONTOUR
- USACE VERIFICATION BOUNDARY
- PERMANENT IMPACTS (P)
- TEMPORARY IMPACTS (T)
- CWUS – WATERS OF THE US (CULVERTED)
- WWUS – WATERS OF THE US (WETLANDS)
- OWUS – WATERS OF THE US (OTHER WATERS)
- NJS – STATE & FEDERAL NON–JURISDICTIONAL AREAS

LAST REVISION => 00-00-00
DATE PLOTTED => Nov 08 2011
TIME PLOTTED => 10:30 pm

BORDER LAST REVISED 7/2/2010

USERNAME =>$USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0716

PROJECT NUMBER & PHASE 04000007331

11. CRWQCB 401 Certification

March 26, 2012
CIWQS Place No. 778521
401 Database No.: 02-49-C0300

Sent via electronic mail--no hard copy to follow

California Department of Transportation
Attn: Ms. Betcy Joseph
Betcy_Joseph@dot.ca.gov
111 Grand Ave.
Oakland, CA 94612-3717

Subject: Water Quality Certification for the U.S. 101 Marin Sonoma Narrows Project, Contract B1 at Old Redwood Landfill Interchange, Sonoma County

Department Project No.: EA 04-264071

Dear Ms. Joseph:

We have reviewed and hereby issue water quality certification to the California Department of Transportation (Department) for the United States Highway 101 (U.S. 101) Marin Sonoma Narrows, Old Redwood Landfill Interchange, Contract B1, Project (Project). The Department is seeking an Individual Permit for the Project from the U.S. Army Corps of Engineers (ACOE) pursuant to Section 404 of the Clean Water Act (33 U.S.C. § 1344). As such, the Department has applied to the San Francisco Bay Regional Water Quality Control Board (Water Board) for a Clean Water Act Section 401 water quality certification that the Project will not violate State water quality standards.

Project: The Department is proposing to upgrade U.S. 101 between Novato and Petaluma as part of the Marin-Sonoma Narrows HOV Widening Project (MSN). The Department has divided the overall MSN project into six individual contracts:

- A1, from State Route 37 to just north of Atherton Avenue in Novato. A 401 certification was issued for this project on July 22, 2010;
- A3, between Marin County U.S. 101 post-miles 22.2 and 24.1. A 401 certification application has not yet been submitted to the Water Board for this project;
- B-1, the subject of this certification;

- B-3, in the vicinity of San Antonio Creek between Marin County U.S. 101 post-miles 27.0 and 27.6, and Sonoma County U.S. 101 post-miles 0.0 and 2.5. The Department intends to submit a 401 certification application in 2013;
- B-2/B-4, between Sonoma County U.S. 101 post-miles 0.9 and 3.6. A 401 certification application was submitted to the Water Board on November 10, 2011; and
- C-3, between Sonoma County U.S. 101 post-miles 3.4 and 4.1. A 401 certification application was submitted to the Water Board on February 29, 2012.

This certification addresses activities at and in the vicinity of the Old Redwood Landfill interchange, just north of the Novato city limits, between Marin County U.S. 101 post-miles 23.3 and 27.6. Major elements of the Project include:

- Converting existing U.S. 101 access points to controlled-access facilities. The existing access to Olompali State Historic Park would be replaced by an access point from a new Redwood Boulevard frontage road extension;
- Construction of a tight-diamond interchange at the Redwood Landfill Overcrossing to replace the existing hook on- and off-ramps;
- Roadway and bridge widening. New pavement and four new retaining walls would be constructed. The existing Redwood Landfill Overcrossing would be widened by approximately 10 feet to accommodate 12-foot travel lanes with minimum 8-foot shoulders;
- Construction of new frontage roads. The existing Redwood Boulevard would be extended to the south to provide access to Olompali State Park. From there, a new, 19-foot wide, 2,400-foot long maintenance road would be constructed and extend to the Redwood Sanitary Landfill Road interchange. On the east side of U.S. 101, a 21-foot wide frontage road would be constructed to connect the Mira Monte Marina driveway and Redwood Sanitary Landfill Road. A new frontage road would also be constructed on the west side of U.S. 101 to connect the existing San Antonio Road with the Redwood Sanitary Landfill Road interchange;
- Construction of new bicycle paths. A continuous bikeway would be constructed through the Project; and
- Relocation of utility lines. An approximately 2,000 foot-long, and 8,900 foot-long, segments of the existing North Marin Water District aqueduct would be relocated along the proposed Redwood Boulevard extension, within Olompali State Park, and near the existing Redwood Sanitary Landfill Road interchange. Additionally, the existing 12-inch water line to Redwood Landfill would be relocated and constructed in conjunction with construction of the proposed Redwood Landfill frontage road.

Overhead electrical and underground gas lines would also be relocated. Utility relocation would be accomplished by trenching, directional boring beneath the proposed frontage road, and jack and bore methods beneath U.S. 101.

Utility relocation would require hydrostatic pressure testing and discharge or disposal of water used for testing. Condition number 10 of this certification includes a condition for discharge of hydrostatic pressure testing water.

The Project area drains to the San Antonio Creek and Rush Creek watersheds via unnamed tributaries, but does not cross either creek.

Impacts: Project implementation would result in the permanent fill of approximately 2.539 acres of jurisdictional seasonal freshwater wetlands and approximately 2,220 linear feet of jurisdictional waters. Permanent waters and wetlands impacts are summarized below in Table 1, *Summary of Permanent Impacts.*

Project implementation would result in temporary impacts to approximately 1.948 acres of jurisdictional seasonal freshwater wetlands and approximately 1,578 linear feet of jurisdictional waters as a result of construction access. Temporary Project impacts are summarized below in Table 2, *Summary of Temporary Impacts.*

Table 1: Summary of Permanent Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact
Redwood Boulevard frontage road and culvert construction	Seasonal wetlands (WW-2, WW-3) roadside drainage channel between Redwood Boulevard and southbound U.S. 101	0.086 acres
Redwood Boulevard frontage road and culvert construction	Jurisdictional waters (OW-3, OW-5, OW-6) first drainage north of current terminus of Redwood Boulevard	166 linear feet
Redwood Boulevard frontage road and culvert construction	Jurisdictional water (OW-9) second drainage north of current terminus of Redwood Boulevard	119 linear feet
Redwood Boulevard frontage road and culvert construction	Jurisdictional waters (OW-12, OW-16) third drainage north of current terminus of Redwood Boulevard	126 linear feet
Redwood Boulevard frontage road and culvert construction	Jurisdictional water (OW-17) fourth drainage north of current terminus of Redwood Boulevard	349 linear feet
Redwood Boulevard frontage road and culvert construction	Seasonal wetland (WW-8) adjacent southbound 101, immediately south of existing Olompali State Park entrance	0.185 acres
Maintenance road and culvert construction	Seasonal wetland (WW-9) adjacent southbound 101, just south of Olompali Creek	0.053 acres

Table 1: Summary of Permanent Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact
Maintenance road and culvert construction	Jurisdictional water (OW-23) Olompali Creek, outside of southbound 101	53 linear feet
Maintenance road and culvert construction	Seasonal wetland (WW-10) adjacent southbound 101, just north of Olompali Creek	0.022 acres
Maintenance road and culvert construction	Seasonal wetland (WW-12) adjacent southbound 101, north of Olompali Creek	0.034 acres
Maintenance road and culvert construction	Seasonal wetland (WW-16) adjacent southbound 101, north of Olompali Creek	0.014 acres
Landfill/Marina frontage road construction	Seasonal wetland (WW-18) adjacent southbound 101, south of the existing Redwood Sanitary Landfill Road	0.169 acres
Bike path and culvert construction	Seasonal wetland (WW-20) adjacent southbound U.S. 101	0.001 acres
Bike path and culvert construction	Jurisdictional water (OW-27) adjacent southbound U.S. 101, first drainage north of Olompali Creek	57 linear feet
Landfill/Marina frontage road and culvert construction	Jurisdictional water (OW-31) adjacent northbound 101, downstream segment of OW-27	202 linear feet
Landfill/Marina frontage road and culvert construction	Seasonal wetlands (WW-23, WW-26, WW-29) adjacent northbound U.S. 101, immediately south of the existing Redwood Sanitary Landfill Road	1.760 acres
Construction of bicycle path	Jurisdictional water (OW-35) along southbound U.S. 101, just south of Redwood Landfill interchange	85 linear feet
Construction of northbound U.S. 101 off-ramp to Redwood Landfill	Seasonal wetland (WW-30) adjacent northbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	0.020 acres
San Antonio frontage road extension, southbound U.S. 101 off-ramp, and culvert construction and installation of North Marin Water District aqueduct	Jurisdictional water (OW-37) on west side of southbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	448 linear feet

Table 1: Summary of Permanent Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact
San Antonio frontage road extension and culvert construction, and installation of North Marin Water District aqueduct	Jurisdictional water (OW-39) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	31 linear feet
Northbound U.S. 101 on-ramp and culvert construction	Seasonal wetland (WW-31) on east side of northbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	0.006 acres
Northbound U.S. 101 on-ramp and culvert construction	Jurisdictional water (OW-40) on east side of northbound U.S. 101, just north of WW-31	43 linear feet
San Antonio frontage road extension and culvert construction, and installation of North Marin Water District aqueduct	Jurisdictional water (OW-43) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	85 linear feet
San Antonio frontage road and box culvert extension construction, and installation of North Marin Water District aqueduct	Jurisdictional water (OW-45) on west side of southbound U.S. 101, drainage from Silveira Dairy Ranch	209 linear feet
San Antonio frontage road extension and culvert construction and installation of North Marin Water District aqueduct	Seasonal wetlands (WW-36, WW-37) drainage channel, along west side of southbound U.S. 101, north of the Silveira Dairy driveway	0.177 acres
San Antonio frontage road extension and culvert construction and installation of North Marin Water District aqueduct	Jurisdictional water (OW-47) second drainage from northern Project boundary	164 linear feet
San Antonio frontage road extension and culvert construction and installation of North Marin Water District aqueduct	Jurisdictional water (OW-49), west side of southbound U.S. 101, first drainage from northern Project boundary	83 linear feet
Installation of double thrie-beam barrier	Seasonal wetland in the U.S. 101 median at the northern Project boundary	0.012 acres
	totals:	2.539 acres of wetland fill; 2,220 linear feet of jurisdictional waters

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetland (WW-1), roadside channel adjacent northbound 101	0.033 acres
Redwood Boulevard frontage road and culvert construction access	Seasonal wetland (WW-4) drainage channel between Redwood Boulevard and southbound U.S. 101	0.012 acres
Redwood Boulevard frontage road and culvert construction access	Jurisdictional waters (OW-1, OW-2) drainage channel between Redwood Boulevard and southbound U.S. 101	270 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional waters (OW-4, OW-7) immediately north of current terminus of Redwood Boulevard	32 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-8) roadside drainage channel adjacent northbound U.S. 101 at southern extent of Airport Road	476 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetland (WW-5) roadside channel adjacent northbound 101	0.003 acres
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-14), roadside drainage channel adjacent northbound 101	18 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-10) second drainage north of current terminus of Redwood Boulevard	13 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-11) roadside drainage channel adjacent southbound U.S. 101 mainline	100 linear feet
Redwood Boulevard frontage road and culvert construction access	Seasonal wetland (WW-6) roadside channel adjacent southbound 101	0.005 acres

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Redwood Boulevard frontage road and culvert construction access	Jurisdictional waters (OW-13, OW-15) third drainage north of current terminus of Redwood Boulevard	66 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-18), roadside drainage between northbound 101and Airport Road	16 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-19) roadside drainage between northbound 101and Airport Road	30 linear feet
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-20) fourth drainage north of current terminus of Redwood Boulevard	18 linear feet
Redwood Boulevard frontage road and culvert construction access	Seasonal wetland (WW-7) adjacent OW-21 and southbound 101	0.008 acres
Redwood Boulevard frontage road and culvert construction access	Jurisdictional water (OW-21) fifth drainage north of current terminus of Redwood Boulevard	6 linear feet
Maintenance road and culvert construction access	Jurisdictional waters (OW-22, OW-24) Olompali Creek, outside of southbound 101	15 linear feet
Metal beam guard railing construction	Jurisdictional water (OW-25) Olompali Creek, outside of northbound U.S. 101	19 linear feet
Maintenance road and culvert construction access	Seasonal wetland (WW-11) adjacent southbound U.S. 101, just north of Olompali Creek	0.003 acres
Maintenance road and culvert construction access	Seasonal wetland (WW-13) adjacent southbound U.S. 101, north of Olompali Creek	0.002 acres
Maintenance road and culvert construction access	Seasonal wetlands (WW-14, WW-15) adjacent southbound U.S. 101, north of Olompali Creek	0.033 acres
Landfill/Marina frontage road construction access and access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetlands (WW-17, WW-19) adjacent northbound U.S. 101, south of Redwood Sanitary Landfill Road	0.161 acres
Bike path and culvert construction access	Seasonal wetland (WW-21) adjacent southbound U.S. 101	0.006 acres

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Bike path and culvert construction access	Jurisdictional waters (OW-26, OW-28, OW-29) adjacent southbound U.S. 101, first drainage north of Olompali Creek	46 linear feet
Landfill/Marina frontage road and culvert construction access	Jurisdictional water (OW-30) adjacent southbound 101, downstream segment of OW-26 OW-28, OW-29	41 linear feet
Access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-32) roadside drainage adjacent southbound 101	47 linear feet
Landfill/Marina frontage road and culvert construction access and access for removal and relocation of existing overhead electrical and underground gas lines	Seasonal wetlands (WW-22, WW-24, WW-25, WW-27, WW-28) adjacent northbound U.S. 101, immediately south of the existing Redwood Sanitary Landfill Road	1.640 acres
Landfill/Marina frontage road and culvert construction access and access for removal and relocation of existing overhead electrical and underground gas lines	Jurisdictional water (OW-33) roadside drainage just south of the existing Redwood Sanitary Landfill Road, adjacent northbound U.S. 101	117 linear feet
Access for construction of bicycle path	Jurisdictional water (OW-34) adjacent southbound U.S. 101, just south of the existing Redwood Sanitary Landfill Road	23 linear feet
San Antonio frontage road extension, southbound U.S. 101 off-ramp, and culvert construction access and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-36) on west side of southbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	18 linear feet
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-38) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	15 linear feet
Northbound U.S. 101 on-ramp and culvert construction access	Seasonal wetland (WW-32) on east side of northbound U.S. 101, just north of the existing Redwood Sanitary Landfill Road	0.011 acres

Table 2: Summary of Temporary Impacts, From South to North (continued)

Activity	Jurisdictional Feature Impacted (Feature ID, as provided in application materials)	Acreage and/or Linear Footage of Temporary Impact
Northbound U.S. 101 on-ramp and culvert construction access	Jurisdictional water (OW-41) on east side of northbound U.S. 101, just north of WW-32	39 linear feet
San Antonio frontage road extension and culvert construction access, and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-42) on west side of southbound U.S. 101, second drainage north of the existing Redwood Sanitary Landfill Road	15 linear feet
San Antonio frontage road and box culvert extension construction access, and access for installation of North Marin Water District aqueduct	Jurisdictional water (OW-44) on west side of southbound U.S. 101, drainage from Silveira Dairy Ranch	52 linear feet
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct	Seasonal wetlands (WW-33, WW-34) on west side of southbound U.S. 101, north of the Silveira Dairy driveway	0.012 acres
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct	Seasonal wetland (WW-35) drainage channel, along west side of southbound U.S. 101, north of Silveira Dairy driveway	0.019 acres
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct. Access for removal of existing overhead electrical lines	Jurisdictional water (OW-46), west side of southbound U.S. 101, second drainage from northern Project boundary	46 linear feet
San Antonio frontage road extension and culvert construction access and access for installation of North Marin Water District aqueduct. Access for removal of existing overhead electrical lines	Jurisdictional water (OW-48), west side of southbound U.S. 101, first drainage from northern Project boundary	21 linear feet
Construction of right-of-way fencing	Jurisdictional water (OW-50), east side of southbound U.S. 101, first drainage from northern Project boundary	19 linear feet
	totals:	1.948 acres of wetlands; 1,578 linear feet of waters

Roadway Pollutant Impacts: Project implementation would result in approximately 10.25 acres of new and 5.17 acres of reworked impervious area (the new impervious figure excludes 0.87 acres of new bike paths). Stormwater runoff from impervious areas may contain hydrocarbons, metals, volatile organic compounds, trash, and sediment at levels that may significantly impact jurisdictional waters if left untreated.

Hydromodification Impacts: Added impervious areas may result in alterations to existing hydrologic regimes, resulting in erosion and/or changes of sediment transport in receiving waters (hydromodification). Project implementation would result in approximately 11.12 acres of added impervious area and therefore the Department is required to evaluate and mitigate potential hydromodification impacts. The Department evaluated susceptibility for hydromodification impacts to all receiving waters within the Project limits. The Department proposed mitigation as appropriate (see Hydromodification Mitigation, page 13).

Avoidance and Minimization: The Department has avoided and minimized impacts to wetland and waters by incorporating retaining walls, selecting a project alternative with fewer impacts to wetlands, particularly the wetlands south of Redwood Sanitary Landfill Road, and minimizing the width of the frontage road connecting Mira Monte Marina and Redwood Sanitary Landfill Road.

Mitigation: To mitigate for permanent impacts to 2.539 acres of jurisdictional seasonal freshwater wetlands, the Department purchased 3.5 acres of wetland mitigation bank credits from Burdell Ranch Wetland Conservation Bank on December 2, 2010.

To mitigate for the approximately 2,220 linear feet of permanent impacts to jurisdictional waters, the Department shall enhance Tolay Creek by providing riparian tree re-vegetation along 4,760 linear feet of the creek, and 115 linear feet of a Tolay Creek tributary. Riparian tree species established shall include a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple. The Department shall also provide cattle exclusion along 115 linear feet of a Tolay Creek tributary (see condition 3). The 4,760 linear feet of Tolay Creek has already been provided with cattle exclusion by the Sonoma Land Trust. Mitigation shall be done in cooperation with the land owner, Sonoma Land Trust.

Additionally, the Department will mitigate off-site as well as re-build on-site for impacted drainage channels. The Department shall reconstruct 2,077 linear feet of natural bottom channels near their former locations (see Condition No. 7).

To mitigate for temporarily impacted wetlands and waters, the Department shall restore those areas to their original or improved conditions (see Condition No. 6).

Roadway Pollutant Mitigation: As mitigation for increased pollutant loads associated with impervious areas, the Department shall provide treatment of stormwater runoff from no less than 15.71 acres of impervious area using 28 bioretention swales and 22 biofiltration strips (see Tables 3 and 4, below, for swale and strip information). The swales and strips would treat approximately 11.74 and 3.97 acres of impervious area, respectively. This would be 0.29 acres more than the required 15.71 acres. The Department may use the 0.29 acres of surplus treatment as credit towards the treatment obligations of a future, neighboring project (see certification Condition No. 2).

The following bioretention swales and strips would mitigate water quality impacts resulting from Project implementation:

Table 3: Bioretention Swale Summary (continued)

Location	Swale Surface Area (feet^2)	From Post Mile	To Post Mile	Treated Impervious Area (acres)
West side of Redwood Boulevard	576	23.23	23.26	0.17
West side of Redwood Boulevard	1,474	23.49	23.63	0.27
West side of Redwood Boulevard	946	23.63	23.72	0.18
West side of Redwood Boulevard	268	23.78	23.80	0.06
West side of Redwood Boulevard	1,068	23.81	23.89	0.18
West side of Redwood Boulevard	582	23.90	23.96	0.10
West side of Redwood Boulevard	1,074	23.96	24.00	0.09
West side of Redwood Boulevard	1,100	24.00	24.11	0.06
West side of Redwood Boulevard	440	24.11	24.15	0.23
West side of Redwood Boulevard	950	24.15	24.22	0.14
West side of Redwood Boulevard	600	24.22	24.25	0.06
West side of Redwood Boulevard	260	24.25	24.27	0.04
West side of Redwood Boulevard	902	24.27	24.36	0.16
West side of access road, north of Redwood Boulevard entrance to Olompali State Park	3,570	24.49	24.71	0.26
West side of access road, north of Redwood Boulevard entrance to Olompali State Park	2,274	24.72	24.82	0.11
West side of access road, north of Redwood Boulevard entrance to Olompali State Park	1,200	24.82	24.89	0.09
West side of San Antonio Road	1,800	26.99	27.11	0.45
Adjacent southbound U.S. 101	942	25.18	25.21	0.14
Adjacent southbound U.S. 101	1,185	25.21	25.29	0.39
Adjacent southbound U.S. 101	2,100	25.45	25.55	0.24
Adjacent southbound 101	2,024	25.55	25.64	0.25
Adjacent east side of Redwood Landfill on-ramp to northbound U.S. 101	913	25.61	25.62	0.30
			total:	*3.97*

Table 4: Biofiltration Strip Summary (continued)

Location	Width (feet)	Strip Surface Area (acres)	From Post Mile	To Post Mile	Treated Impervious Area (acres)
East side of Redwood Boulevard	8	0.31	23.26	23.78	0.63
East side of Redwood Boulevard	8	0.01	23.80	23.81	0.07
East side of Redwood Boulevard	8	0.37	23.81	24.20	0.78
East side of Redwood Boulevard	8	0.24	24.21	24.46	0.49
West side of Redwood Boulevard at entrance to Olompali State Park	8	0.02	24.46	24.49	0.03
East side of Redwood Boulevard at entrance to Olompali State Park	8	0.01	24.48	24.49	0.06
East side of access road, north of Redwood Boulevard entrance to Olompali State Park	5	0.15	24.47	24.71	0.26
East side of access road, north of Redwood Boulevard entrance to Olompali State Park	5	0.12	24.72	24.92	0.25
West side of frontage road connecting Redwood Sanitary Landfill Road and Mira Monte Marina Driveway	15	0.19	24.83	24.93	0.47
West side of frontage road connecting Redwood Sanitary Landfill Road and Mira Monte Marina Driveway	15	0.66	24.94	25.30	0.94
East side of frontage road connecting Redwood Sanitary Landfill Road and Mira Monte Marina Driveway	15	0.18	25.30	25.40	0.34
Redwood Sanitary Landfill Road at frontage road, west side	15	0.02	25.40	25.41	0.02
Adjacent northbound U.S. 101	15	0.26	25.35	25.50	0.60
Adjacent northbound U.S. 101	15	0.05	25.58	25.61	0.10
Adjacent southbound U.S. 101	15	0.14	26.87	26.95	0.19
Adjacent northbound U.S. 101 off-ramp to Redwood Sanitary Landfill Road	15	0.44	25.25	25.49	1.01
Adjacent east side of southbound U.S. 101 off-ramp to Redwood Sanitary Landfill Road	15	0.20	25.61	25.60	0.34
Adjacent south side of Redwood Sanitary Landfill Road between southbound U.S. 101 on-ramp and mainline	15	0.02	25.61	25.62	0.03
Adjacent east side of San Antonio Frontage Road	15	0.13	25.63	25.71	0.16
Adjacent east side of San Antonio	12	0.27	25.71	25.90	0.73

Table 4: Biofiltration Strip Summary (continued)

Location	Width (feet)	Strip Surface Area (acres)	From Post Mile	To Post Mile	Treated Impervious Area (acres)
Frontage Road					
Adjacent west side of San Antonio Frontage Road	11	0.06	26.03	26.07	0.17
Adjacent west side of San Antonio Frontage Road	12	0.16	26.10	26.21	0.65
Adjacent west side of San Antonio Frontage Road	12	0.12	26.23	26.31	0.38
Adjacent west side of San Antonio Frontage Road	13	0.39	26.33	26.59	1.01
Adjacent west side of San Antonio Frontage Road	13	0.11	26.62	26.69	0.51
Adjacent west side of San Antonio Frontage Road	12	0.40	26.71	26.99	1.07
Adjacent west side of southbound U.S. 101 off-ramp to Redwood Sanitary Landfill Road	15	0.16	25.60	25.69	0.33
Adjacent west side of Redwood Sanitary Landfill Road on-ramp to southbound U.S. 101	15	0.07	25.46	25.50	0.12
				total:	11.74

Hydromodification mitigation: To mitigate for receiving waters susceptible to hydromodification impacts, the Department shall construct a detention basin in the northwest quadrant of the Old Redwood Landfill interchange, between the southbound off-ramp and the southbound mainline. The Department shall also install compost-amended biofiltration strips to help attenuate peak runoff.

CEQA Compliance: The Department prepared and approved an Environmental Impact Report for this Project pursuant to the provisions of the California Environmental Quality Act. The Department filed a Notice of Determination on July 27, 2009 (SCH No. 2001042115).

California Wetlands Portal: It has been determined through regional, state, and national studies that tracking of mitigation/restoration projects must be improved to better assess the performance of these projects, following monitoring periods that last several years. In addition, to effectively carry out the State's No Net Loss Policy for wetlands, the State needs to closely track wetland losses, gains, and mitigation/restoration project success. Therefore, we require that the Department use the California Wetlands Standard Form to provide Project information related to impacts and mitigation/restoration measures (see

Condition Nos. 8 and 9 of this certification). An electronic copy of the form and instructions can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml

Project information concerning impacts and mitigation/restoration will be made available at the web link: http://www.californiawetlands.net

Certification: I hereby issue an order certifying that any discharge from the referenced project will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003 - 0017 – DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification" which requires compliance with all conditions of this Water Quality Certification. The following conditions are associated with this certification:

1. To mitigate for receiving waters susceptible to hydromodification impacts, the Department shall construct a detention basin in the northwest quadrant of the Old Redwood Landfill interchange, between the southbound off-ramp and the southbound mainline;

2. As mitigation for increased pollutant loads associated with impervious areas, the Department shall treat stormwater runoff from no less than 15.71 acres of impervious area using 28 bioretention swales and 22 biofiltration strips. The swales and strips shall be installed consistent with the swale and strips summaries in Tables 3 and 4, and Attachment A of this certification. Any change in swale and strip dimensions and placement shall be prohibited without acceptance by Water Board staff. The Department shall regularly inspect and maintain swales and strips to perform optimally. The Department may use the 0.29 acres of surplus treatment as credit towards the treatment obligations of a future, neighboring project;

3. The Department shall submit, subject to the acceptance of Water Board staff, a Final Mitigation and Monitoring Plan for restoration and enhancement activities on Sonoma Land Trust property at Tolay Creek (Plan). The Plan shall be submitted not later than September 1, 2012. Project construction is prohibited until a Plan has been found acceptable to Water Board staff. The Plan shall include:

    a. A proposal to re-vegetate 2,260 linear feet of Tolay Creek (both banks) in "Area B" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a

combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

b. A proposal to re-vegetate 2,500 linear feet of Tolay Creek (both banks) in "Area D" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

c. A proposal to re-vegetate 115 linear feet of Tolay Creek (both banks) in "Area T1.2" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

d. A proposal to install cattle exclusion fencing around "Area T1.2" as identified in Attachment B, "Tolay Creek Mitigation Site Map";

e. An invasive species control plan for areas B, D, and T1.2;

f. Success criteria for all plantings;

g. A monitoring period no less than ten years;

h. A plan to provide additional planting, maintenance and monitoring until the success criteria are satisfied, if the required success criteria are not met;

i. A plan to not consider any plantings successful if supplemental watering has been employed at any time during the previous two growing seasons;

j. A plan to submit Annual Reports to the Water Board. At a minimum, mitigation monitoring reports shall be submitted for years 0 (as-built report), 1, 3, 5, 7, and 10. All monitoring reports shall include photo-documentation utilizing consistent photo vantage points. If the monitoring report includes management recommendations, then the report must express whether the Department has the intention to immediately implement those recommendations;

4. All mitigation required in Tolay Creek areas B and D shall be fully implemented prior to Project completion. Failure to meet this deadline may result in additional mitigation requirements. Area T1.2 mitigation may be incorporated into the mitigation plan required by the Water Board for the MSN B3 contract certification. Completion of Area T1.2 mitigation activities shall be completed by the MSN B3 certification deadlines. The Department intends to apply for MSN B3 certification in 2013;

5. Mitigation areas at Tolay Creek shall be subject to the terms of the December 21, 2007, Grant Deed of Conservation Easement (Easement), and the November 2009,

Tolay Creek Ranch Management Plan (Management Plan). Any subsequent change to the Easement or Management Plan shall be subject to the acceptance of Water Board staff;

6. The Department shall restore all jurisdictional wetlands and waters to their pre-project or improved conditions, within the first growing season following cessation of construction activity in those areas. All temporarily disturbed areas shall be re-vegetated using only native plant species. The Department shall not cause, through operation of heavy machinery, or any other construction activity, compaction of wetlands or waters. Any compaction of wetlands or waters shall require mitigation. The Department shall submit photo-documentation to the Water Board of the pre- and post-project conditions of temporarily impacted areas annually during Project construction;

7. The Department shall construct no less than 2,077 linear feet of unlined channels at the following nine locations:

    a. Line N2R, station 275+61, to station N2R, station 279+82 ;
    b. Line BK, station 303+00, to station BK, station 303+66 ;
    c. Line BK, station 303+66, to station BK, station 304+30 ;
    d. Line BK, station 304+30, to station BK, station 305+19 ;
    e. Line RL3, station 336+19, to station RL3, station 338+51 ;
    f. Line RL3, station 338+51, to station RL3, station 341+49 ;
    g. Line RL3, station 341+49, to station RL3, station 345+47 ;
    h. Line RL2, station 336+20, to station RL2, station 339+78 ; and
    i. Line RL3, station 345+47, to station N2R, station 347+65 .

    The Department shall submit an as-built report of all nine constructed channels, not later than three months from the Project completion date. Photo-documentation shall be provided each year thereafter, for three years, to demonstrate that the nine channels are exhibiting wetland and water characteristics;

8. The Department is required to use the California Wetlands Standard Form to provide project information describing impacts and mitigation/restoration measures within 30 days from the date of this certification. An electronic copy of the form can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml. The completed California Wetlands form shall be submitted electronically to habitatdata@waterboards.ca.gov or shall be submitted as a hard copy to both: 1) The Water Board, 1515 Clay St., Suite 1400, Oakland, CA 94612, to the attention of California Wetlands Portal; and 2) San Francisco Estuary Institute, 4911 Central Ave., Richmond, CA 94804, to the attention of Mike May;

9. Tolay Creek mitigation monitoring reports shall be submitted to the Water Board by January 1 of each year. Modification of this deadline is subject to the acceptance of Water Board staff. The reports may be submitted by upload to the California Wetlands Portal website at http://www.californiawetlands.net/tracker/ba/list. Select the Tolay Creek restoration project from the Bay Area Project List and then use the "Files & Links" web-link on the mitigation site project page to upload the report. The Department shall immediately notify appropriate Water Board staff once the monitoring report has been uploaded. If the Department cannot, or chooses not to submit the report using the California Wetlands Portal, the report may be submitted directly to Water Board staff electronically, via e-mail;

10. Discharge of utility line hydrostatic testing water shall not be discharged if residual chlorine levels exceed 0.0 mg/L, or pH is below 6.5, or above 8.5. Chlorine residual detection methods shall have a detection limit no greater than 0.5 mg/L. Discharge of hydostatic testing water shall be subject to pH testing every 15 minutes until a steady state of discharge is reached. Discharge of water shall not cause erosion at the point of discharge;

11. The Project shall be constructed in conformance with the Project Description described in this certification and certification application materials. Any change in the Project may require modification to the certification and shall be reported to the Water Board prior to implementation of the changes;

12. The Department shall adhere to the conditions imposed by the Individual Permit issued to the Department by the Corps, to the Streambed Alteration Agreement issued to the Department by the California Department of Fish and Game, and to the Biological Opinion issued to the Department by the U.S. Fish and Wildlife Service on April 1, 2009;

13. Regardless of date, erosion control measures shall be utilized throughout all phases of construction where sediment-laden runoff threatens to enter waters of the State. At no time shall sediment-laden runoff be allowed to enter waters of the State;

14. No fueling, cleaning or maintenance of vehicles or equipment shall take place within jurisdictional waters or within any areas where an accidental discharge to waters of the State may occur;

15. Except as expressly allowed in this Certification, the discharge, or creation of the potential for discharge, to waters of the State of any construction wastes and/or soil materials including cement, fresh concrete, or washings thereof, silts, clay, sand, oil or petroleum products and other organic materials to waters of the State is prohibited;

16. This certification does not allow for the take, or incidental take, of any special status species. The Department shall use the appropriate protocols, as approved by the California Department of Fish and Game and the U.S. Fish and Wildlife Service, to ensure that Project activities do not impact the Beneficial Use of the Preservation of Rare and Endangered Species;

17. The Department shall maintain a copy of this water quality certification at the Project site so as to be available at all times to site operating personnel. It is the responsibility of the Department to assure that all personnel (employees, contractors, and subcontractors) are adequately informed and trained regarding the conditions of this certification;

18. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section 13330 of the California Water Code (CWC) and Section 3867 of Title 23 of the California Code of Regulations(23 CCR);

19. This certification action does not apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license, unless the pertinent certification application was filed pursuant to California Code of Regulations (CCR) Title 23, Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought; and

20. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR Section 3833). Water Board staff received full payment of $13,634.00 on December 20, 2011.

We anticipate your cooperation in implementing these conditions. However, please be advised that any violation of water quality certification conditions is a violation of State law and subject to administrative civil liability pursuant to California Water Code (CWC) section 13350. Failure to respond, inadequate response, late response, or failure to meet any condition of this certification may subject you to civil liability imposed by the Water Board to a maximum of $5,000 per day per violation or $10 for each gallon of waste discharged in violation of this certification.

Condition numbers 3, and 6-9 are requirements for information and reports. Any requirement for a report made as a condition to this action is a formal requirement pursuant to CWC section 13267, and failure or refusal to provide, or falsification of such required report is subject to civil liability as described in CWC section 13268.

We anticipate no further action on this request. Should new information come to our attention that indicates a water quality problem with this project, the Water Board may issue Waste Discharge Requirements pursuant to 23 CCR Section 3857.

If you have any question, please contact Brendan Thompson at (510) 622-2506, or via e-mail to BThompson@waterboards.ca.gov.

Sincerely,

Bruce H. Wolfe
Executive Officer

cc (via e-mail): Mr. Bill Orme SWRCB-DWQ
Ms. Laurie Monnrres, USACE
Ms. Jane Hicks, Regulatory Branch, USACE
Mr. Tim Dodson, CDFG
Mr. Bob Neale, Sonoma Land Trust
Mr. Dale Bowyer, Water Board
Mr. Cyrus Vafai, Caltrans
Mr. Hardeep Takhar, Caltrans
Mr. Jason Brush, USEPA
Ms. Paula Gill, USAC

Attachment A

Biofiltration Swale and Strip Specifications

10-1.__ IMPORTED BIOFILTRATION SOIL

GENERAL

Summary

This work includes furnishing, and applying biofiltration soil mix.

Submittals

Imported biofiltration soil must be accompanied by a Certificate of Compliance, from the soil supplier, in conformance with the provisions in Standard Specification Section 6-1.07, "Certificates of Compliance."

Before mixing compost with sand and soil, submit a copy of the compost producer's compost technical data sheet and a copy of the compost producer's Seal of Testing Assurance certification. The compost technical data sheet must include:

1. Laboratory analytical test results
2. List of product ingredients

Before mixing compost with sand and soil, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Quality Control and Assurance

Saturated hydraulic conductivity for imported biofiltration soil must be at least 5 inches per hour.

MATERIAL

Imported biofiltration soil consists of a uniform mixture of sand, compost, and soil. The ratio of the components of imported biofiltration soil by volume must consist of two parts sand; one part compost; and 0.5 part soil.

Sand

Sand must be free of wood, waste, coating such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing No. 200 sieve size must be non-plastic. Sand must be graded within the following limits:

Sieve Sizes	Percentage Passing
3/8"	100
No. 4	90 - 100
No. 8	70 - 100
No. 16	40 - 95
No. 30	15 - 70
No. 40	5-55
No. 100	0 - 15
No. 200	0 - 5

Grain size analysis results of the sand component must be performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.

Compost

The compost producer must be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate solid waste facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

The compost producer must be a participant in the United States Composting Council's Seal of Testing Assurance program.

Compost may be derived from any single or mixture of any of the following feedstock materials:

1. Green material consisting of chipped, shredded, or ground vegetation; or clean processed recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

Compost feedstock materials such that weed seeds, pathogens and deleterious materials are reduced as specified under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3.

Compost must not be derived from mixed municipal solid waste and must be reasonably free of visible contaminates. Compost must not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Compost must not possess objectionable odors.

Metal concentrations in compost must not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

Compost must comply with the following:

Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.5–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–6.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	35–75
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	 8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification	Inches % Passing 3 100%

	% Dry Weight Basis	1/2 0 – 95% 1/4 0-75% Max. Length 4 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

NOTE: TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Soil

Soil must be free of wood, waste or other deleterious material. The soil texture must be loamy. Overall dry weight percentages must be 60 to 90 percent sand, with less than 20 percent passing the No.200 sieve, less than 5 percent clay, and no gravel.

CONSTRUCTION

Comply with Section 20-3.02, "Preparation," of the Standard Specifications.

Place imported biofiltration soil in lifts 8 to 12 inches. Lifts are not to be compacted.

MEASUREMENT AND PAYMENT

Imported biofiltration soil is measured by the cubic yard.

The contract price paid per cubic yard for imported biofiltration soil includes full compensation for furnishing all labor, materials, tools, equipment, incidentals, and for doing all the work involved in imported biofiltration soil, including testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

NOTES:

1. DIMENSIONS MAY VARY TO FIT ACTUAL FIELD CONDITIONS.
2. BEGINNING AND END OF BIORETENTION SWALES MAY VARY. EXACT DIMENSIONS SHALL BE DETERMINED BY THE ENGINEER.
3. WHERE ROLLED EROSION CONTROL PRODUCT (NETTING) IS PROPOSED, INSTALLATIONS SHALL CONFORM TO MANUFACTURER'S SPECIFICATIONS AND THE SPECIAL PROVISIONS.
4. FOR LINEAR BIORETENTION SWALE DIMENSIONS, SEE DRAINAGE SHEET DD-5.
5. FOR PERFORATED PLASTIC PIPE (PPP) AND PLASTIC PIPE (PP) QUANTITIES, SEE DRAINAGE QUANTITIES SHEETS.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER 10/3/11 DATE

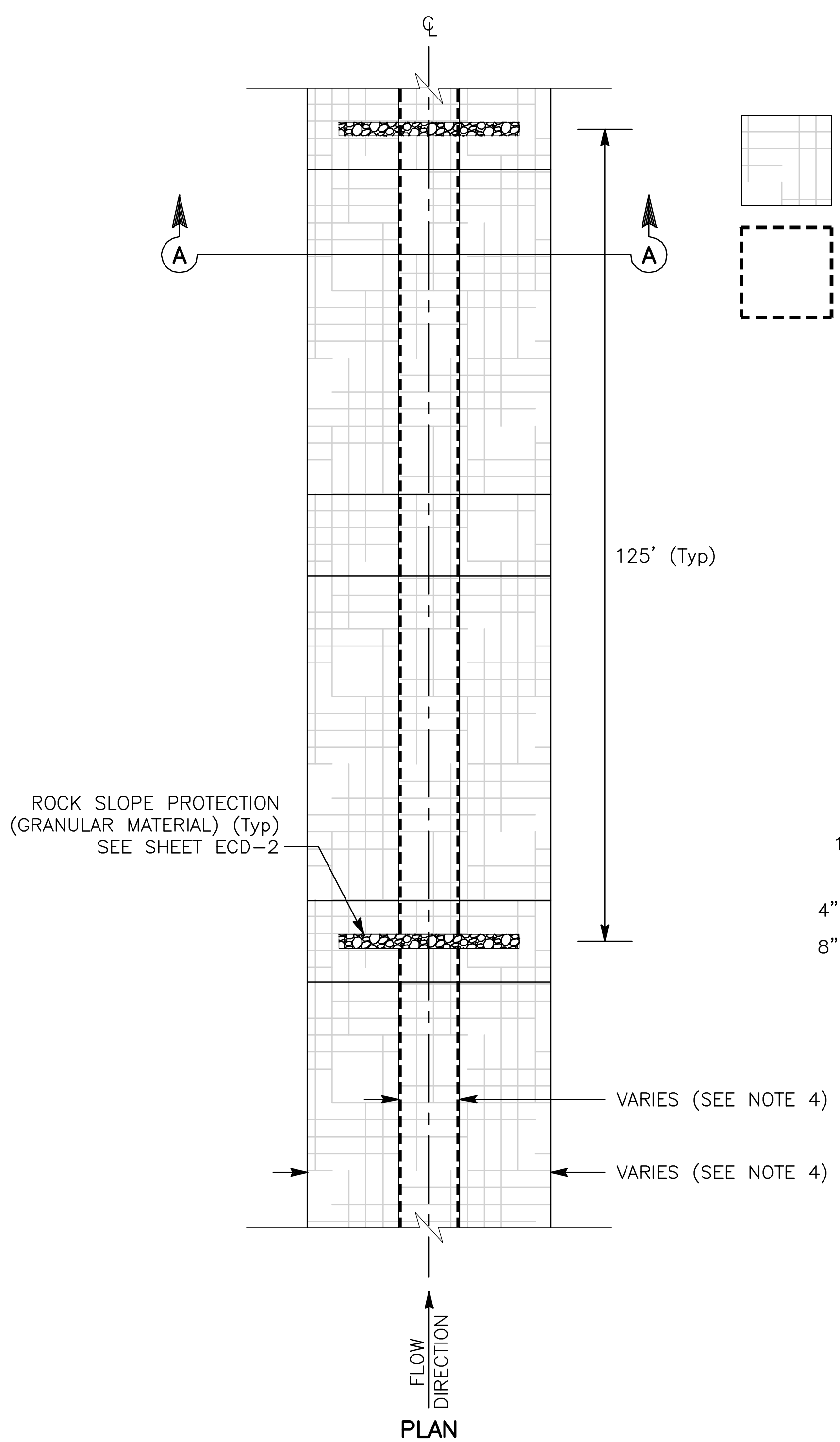
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

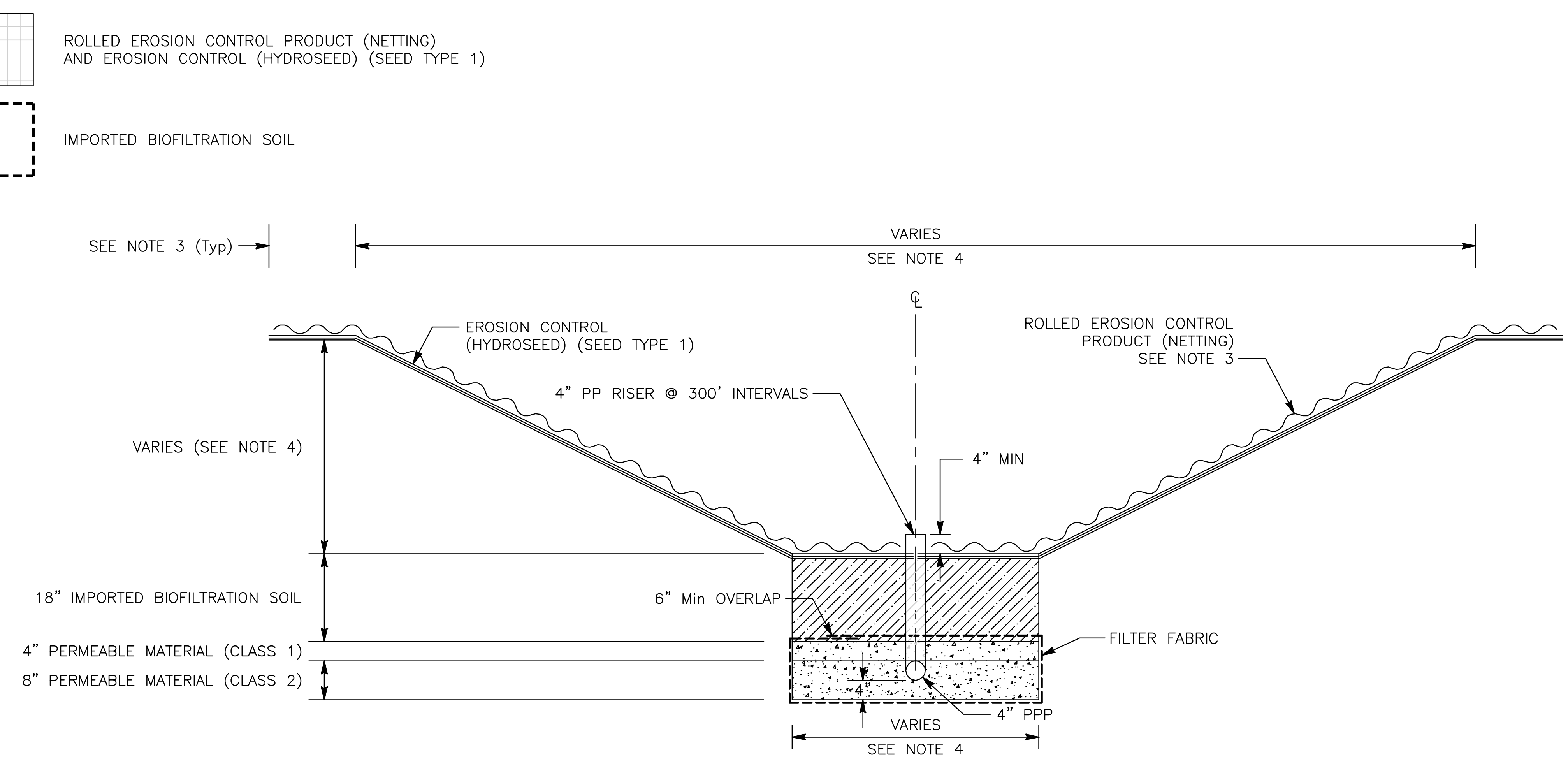
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901



PLAN

TYPICAL LINEAR BIORETENTION SWALE



SECTION A-A

LINEAR BIORETENTION SWALE

EROSION CONTROL DETAILS

NO SCALE

ECD-1

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans®

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI
CALCULATED-DESIGNED BY: SHERWIN MANALO
CHECKED BY: GORDON SWEET
REVISED BY: SM
DATE REVISED: 10/3/11

DATE PLOTTED => Oct 07 2011
TIME PLOTTED => 6:32 pm
LAST REVISION 10-3-11

BORDER LAST REVISED 7/2/2010
USERNAME => $USER
DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0716
PROJECT NUMBER & PHASE 04000007331

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Mrn	101	R23.2/27.1		

REGISTERED CIVIL ENGINEER — DATE 10/3/11

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — N.V. BERNARDI No. 45407 Exp. 9/30/12 CIVIL — STATE OF CALIFORNIA

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

TAM
750 LINDARO ST. SUITE 200
SAN RAFAEL, CA 94901

NOTES:

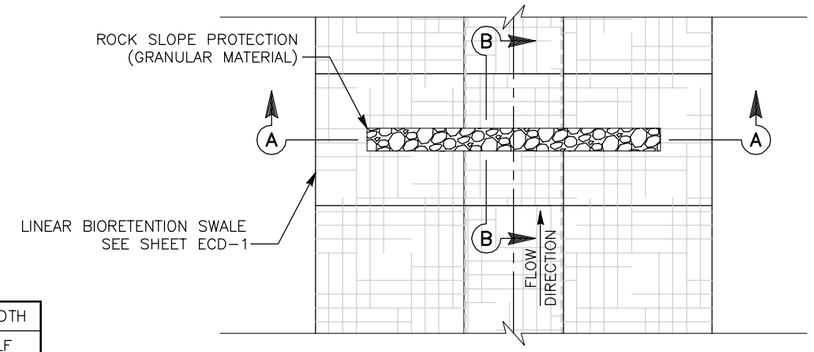
1. WIDTH OF GRAVEL BERM SHALL BE THE LENGTH REQUIRED TO ACHIEVE A MININMUM HEIGHT OF 4.5" FROM THE BOTTOM OF THE SWALE.
2. DIMENSIONS MAY VARY TO FIT ACTUAL FIELD CONDITIONS.
3. ROCK SLOPE PROTECTION (GRANULAR MATERIAL) SHALL BE 7-INCH THICK COBBLE. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.
4. ROCK SLOPE PROTECTION (GRANULAR MATERIAL) SHALL BE KEYED IN A MINIMUM OF 3 INCHES BELOW SWALE SURFACE.
5. FOR LINEAR BIORETENTION SWALE DIMENSIONS, SEE DRAINAGE SHEETS DD-5.
6. STATION LIMITS ARE APPROXIMATE AND MAY VARY TO FIT ACTUAL FIELD CONDITIONS.
7. SEE TYPICAL CROSS SECTIONS AND LAYOUT SHEETS FOR MORE INFORMATION.

STATION LIMITS*	WIDTH LF
"FR1" 227+37.18 Rt TO "FR1" 244+47.66 Rt	8.0
"FR1" 245+08.81 Rt TO "FR1" 245+89.09 Rt	8.0
"FR1" 246+07.41 Rt TO "FR1" 266+19.52 Rt	8.0
"FR1" 266+80.48 Rt TO "FR1" 279+99.17 Rt	8.0
"FR1" 279+99.17 Lt TO "FR1" 281+58.97 Lt	8.0
"FR1" 281+02.62 Rt TO "FR1" 281+56.97 Rt	8.0
"BK" 280+57.32 Rt TO "BK" 293+32.59 Rt	5.0
"BK" 293+64.47 Rt TO "BK" 304+58.75 Rt	5.0
"FR2" 299+46.03 Lt TO "FR2" 305+01.29 Lt	15.0
"FR2" 305+38.31 Lt TO "FR2" 324+58.51 Lt	15.0
"FR2" 324+58.51 Rt TO "FR2" 329+75.70 Rt	15.0
"FR2" 329+58.14 Lt TO "FR2" 330+08.96 Lt	15.0
"N2R" 327+30.69 Rt TO "RL1" 335+00.00 Rt	15.0
"N2R" 339+52.58 Rt TO "N2R" 340+89.15 Rt	15.0
"N2R" 407+50.00 Lt TO "N2R" 411+49.95 Lt	15.0

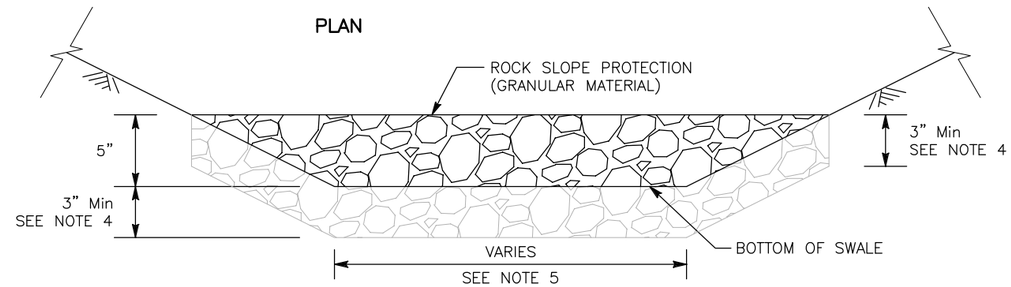
* SEE NOTE 6.

STATION LIMITS*	WIDTH LF
"N2R" 321+89.92 Rt TO "RL1" 334+68.42 Rt	15.0
"RLF" 340+85.00 Rt TO "RL3" 340+34.71 Rt	15.0
"RLF" 340+85.00 Lt TO "RLF" 341+55.69 Lt	15.0
"RLF" 342+02.85 Rt TO "RLF" 346+35.53 Rt	15.0
"RLF" 346+35.53 Rt TO "RLF" 356+19.44 Rt	12.0
"RLF" 363+00.00 Lt TO "RLF" 365+25.00 Lt	11.0
"RLF" 366+75.00 Lt TO "RLF" 372+62.93 Lt	12.0
"RLF" 373+62.97 Lt TO "RLF" 378+00.28 Lt	12.0
"RLF" 378+84.28 Lt TO "RLF" 392+45.07 Lt	13.0
"RLF" 394+23.62 Lt TO "RLF" 398+04.38 Lt	13.0
"RLF" 398+98.23 Lt TO "RLF" 413+49.91 Lt	12.0
"RL3" 340+34.71 Lt TO "RL3" 345+00.00 Lt	15.0
"RL4" 332+96.22 Lt TO "RL4" 334+87.25 Lt	15.0

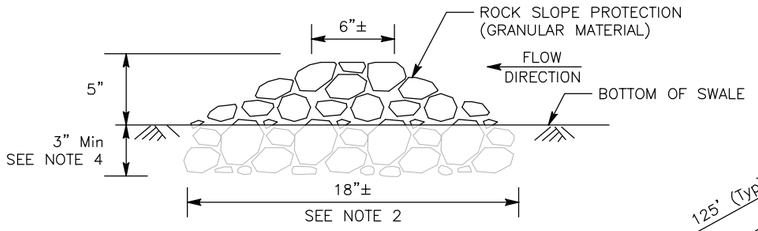
* SEE NOTE 6.



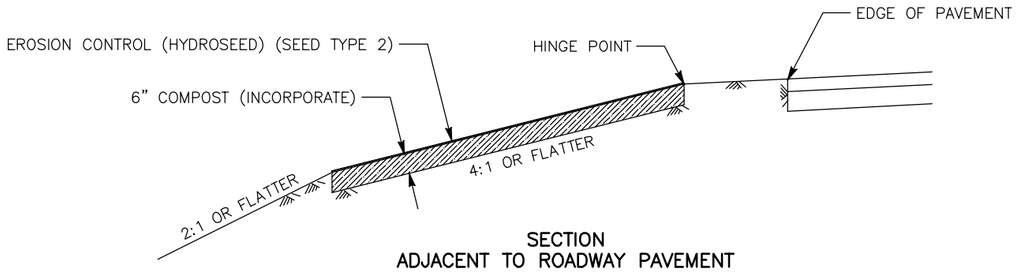
PLAN



SECTION A-A

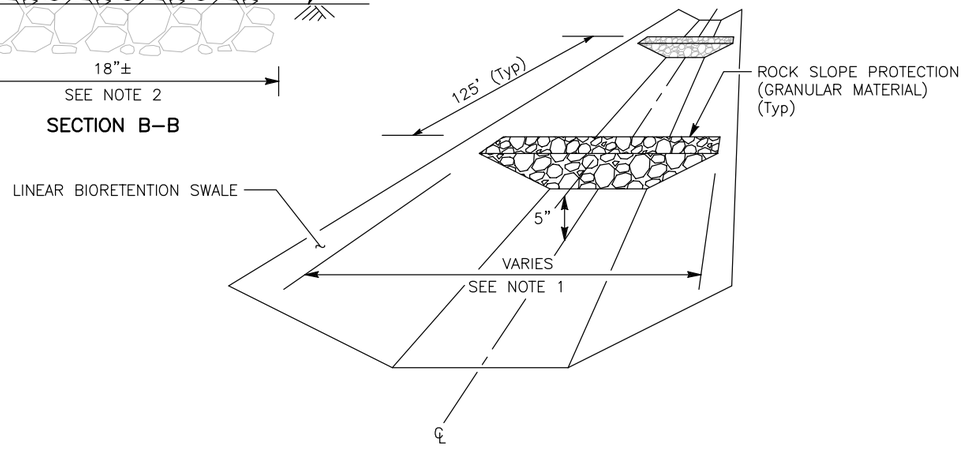


SECTION B-B



SECTION
ADJACENT TO ROADWAY PAVEMENT

BIOFILTRATION STRIP



PERSPECTIVE

ROCK SLOPE PROTECTION (GRANULAR MATERIAL)

EROSION CONTROL DETAILS

NO SCALE

ECD-2

REVISED BY	DATE REVISED
SM	10/3/11

CALCULATED-DESIGNED BY: SHERWIN MANALO
CHECKED BY: GORDON SWEET
CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

P:\Proj\BKF\07003\DWG\SHEETS\EROSION CONTROL\ECD-02.dwg 07 Oct 2011 6:33:44pm mana

LAST REVISION 10-3-11 — DATE PLOTTED => Oct 07 2011 — TIME PLOTTED => 6:33 pm

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0716 | PROJECT NUMBER & PHASE 04000007331

Attachment B

Tolay Creek Mitigation Site Map

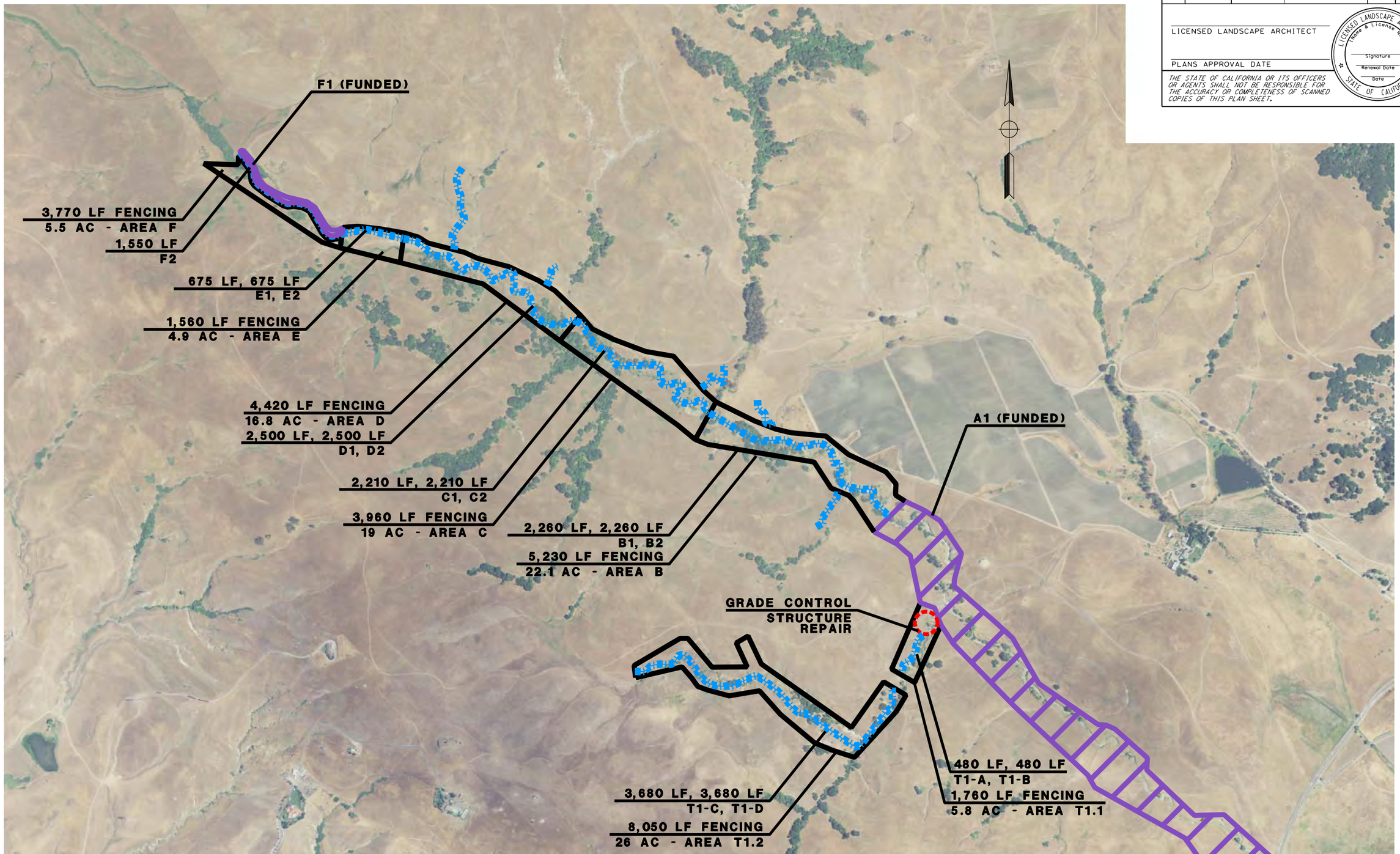
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

LICENSED LANDSCAPE ARCHITECT

PLANS APPROVAL DATE

LICENSED LANDSCAPE ARCHITECT (Name & License No.) Signature Renewal Date Date STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.



TOLAY CREEK & TRIBUTARY MITIGATION COUNT

0 500 1000 1500

SCALE: 1" = 500'

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

SENIOR LANDSCAPE ARCHITECT

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

02-29-12

USERNAME => $USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0000

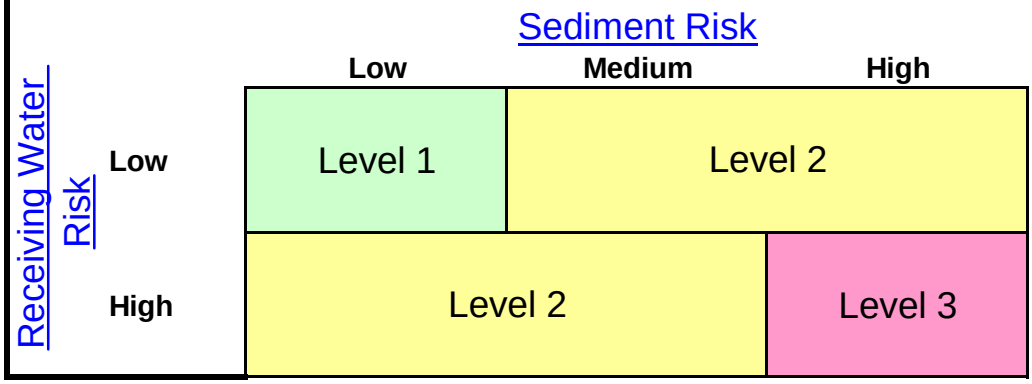
PROJECT NUMBER & PHASE 00000000001

Tolay Creek Ranch2.dgn 2/29/2012 1:49:59 PM

12. Risk Assessment

MSN B1

Combined Risk Level Matrix



Project Sediment Risk:	**Medium**
Project RW Risk:	**High**
Project Combined Risk:	**Level 2**

	A	B	C
1	**MSN B1**		
2	**Sediment Risk Factor Worksheet**		**Entry**
3	**A) R Factor**		
4	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
5	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
6	**R Factor Value**		70.03
7	**B) K Factor (weighted average, by area, for all site soils)**		
8	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
9	Site-specific K factor guidance		
10	**K Factor Value**		0.355
11	**C) LS Factor (weighted average, by area, for all slopes)**		
12	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
13	LS Table		
14	**LS Factor Value**		1.80
15			
16	**Watershed Erosion Estimate (=RxKxLS) in tons/acre**		45
17	**Site Sediment Risk Factor**		**Medium**
18	Low Sediment Risk: < 15 tons/acre		
19	Medium Sediment Risk: >=15 and <75 tons/acre		
20	High Sediment Risk: >= 75 tons/acre		
21			

MSN B1

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment**? For help with impaired waterbodies please check the attached worksheet or visit the link below: 2006 Approved Sediment-impared WBs Worksheet http://www.waterboards.ca.gov/water_issues/programs/tmdl/303d_lists2006_epa.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? http://www.ice.ucdavis.edu/geowbs/asp/wbguse.asp	**Yes**	**High**

Basic Information
eNOI
Municipal MS4s
Construction Activities
Industrial Activities
Road-Related MS4s
Menu of BMPs
Green Infrastructure
Urban BMP Tool

Stormwater Home

NPDES Topics Alphabetical Index Glossary About NPDES

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

Facility Name: MSN B1
Start Date: 06/01/2012
End Date: 06/01/2014
Latitude: 38.1666
Longitutde: -122.5666

Erosivity Index Calculator Results

AN EROSIVITY INDEX VALUE OF **70.03** HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **06/01/2012** - **06/01/2014**.

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do not qualify for a waiver from NPDES permitting requirements**.

Start Over

Stormwater Information
Recent Additions
FAQs
Publications
Regulations
Training & Meetings
Links
Contacts

Sign Up For NPDES NEWS

Get Acrobat Reader
The documents on this site are best viewed with Acrobat 8.0

Search

Properties and Qualities Ratings

Open All | Close All

Soil Chemical Properties

Soil Erosion Factors

K Factor, Rock Free

K Factor, Whole Soil

View Description | View Rating

View Options

Map ☑
Table ☑
Description of Rating ☑
Rating Options ☑
Detailed Description ☐

Advanced Options

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Lower / Higher

Layer Options: Surface Layer / Depth Range

Top Depth:
Bottom Depth:
Inches / Centimeters

All Layers

View Description | View Rating

T Factor

Wind Erodibility Group

Wind Erodibility Index

Soil Physical Properties

Soil Qualities and Features

Water Features

Map — K Factor, Whole Soil

Scale (not to scale)

Tables — K Factor, Whole Soil — Summary By Map Unit

Summary by Map Unit — Marin County, California

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
105	BLUCHER-COLE COMPLEX, 2 TO 5 PERCENT SLOPES	.37	165.0	49.3%
128	GILROY-GILROY VARIANT-BONNYDOON VARIANT LOAMS, 30 TO 50 PERCENT SLOPES	.32	22.3	6.7%
140	LOS OSOS-BONNYDOON COMPLEX, 5 TO 15 PERCENT SLOPES	.37	42.6	12.7%
142	LOS OSOS-BONNYDOON COMPLEX, 30 TO 50 PERCENT SLOPES	.37	30.9	9.2%
158	REYES CLAY	.20	3.3	1.0%
179	TOCALOMA-MCMULLIN COMPLEX, 30 TO 50 PERCENT SLOPES	.32	52.2	15.6%
184	TOCALOMA-SAURIN ASSOCIATION, VERY STEEP	.32	1.6	0.5%
203	XERORTHENTS, FILL		16.3	4.9%
206	YORKVILLE CLAY LOAM, 15 TO 30 PERCENT SLOPES	.32	0.3	0.1%
Totals for Area of Interest			334.5	100.0%

Description — K Factor, Whole Soil

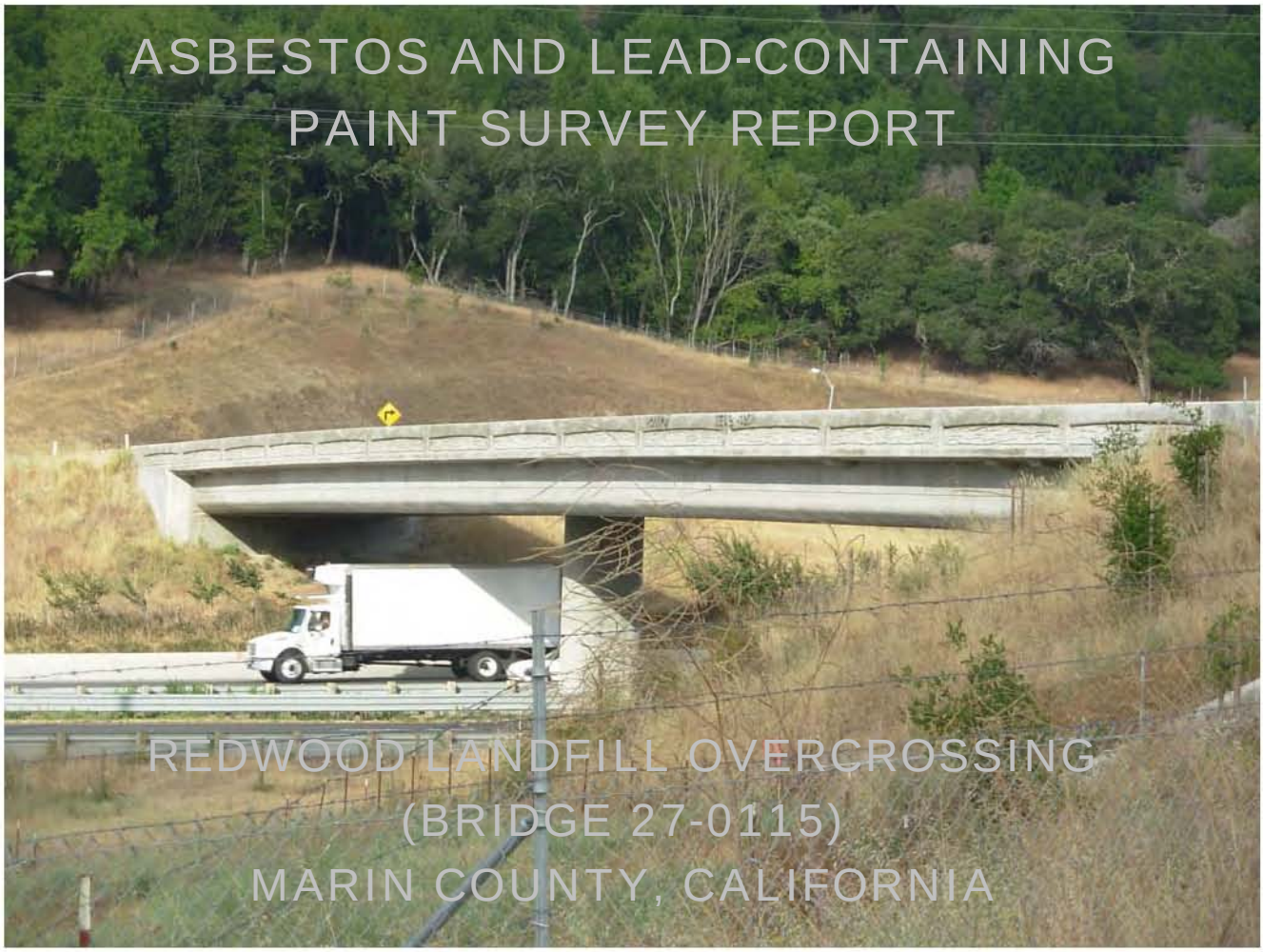
MSN B1 IMPROVEMENTS
Weighted LS Factor

Station	Line Segment 1			Line Segment 2			Line Segment 3					Weighted Ave by Length	Table Value
	Length ft	Slope	LxS	Length ft	Slope	LxS	Length ft	Slope	LxS	$S_1+S_2+S_3$	$L_1+L_2+L_3$	S	LS
230	48	0.020	0.96							0.020	48	0.02	0.21
235	52	0.020	1.04							0.020	52	0.02	0.21
240	46	0.020	0.92							0.020	46	0.02	0.21
245	49	0.020	0.98							0.020	49	0.02	0.21
250	76	0.110	8.36							0.110	76	0.11	1.37
255	109	0.080	8.72							0.080	109	0.08	1.10
260	162	0.230	37.26							0.230	162	0.23	5.58
265	66	0.080	5.28							0.080	66	0.08	0.70
270	75	0.090	6.75							0.090	75	0.09	1.06
275	75	0.130	9.75							0.130	75	0.13	1.71
280	50	0.030	1.50							0.030	50	0.03	0.30
285	30	0.050	1.50							0.050	30	0.05	0.46
290	33	0.020	0.66							0.020	33	0.02	0.16
295	30	0.050	1.50							0.050	30	0.05	0.31
300	30	0.030	0.90				134	0.030	4.02	0.060	164	0.03	0.50
305	35	0.080	2.80				66	0.030	1.98	0.110	101	0.05	0.68
310	25	0.100	2.50				45	0.050	2.25	0.150	70	0.07	0.80
315	26	0.190	4.94				43	0.020	0.86	0.210	69	0.08	0.91
320	87	0.120	10.44				48	0.020	0.96	0.140	135	0.08	1.27
325	60	0.150	9.00				65	0.060	3.90	0.210	125	0.10	1.69
330	165	0.200	33.00				104	0.140	14.56	0.340	269	0.18	7.19
335	210	0.220	46.20				113	0.400	45.20	0.620	323	0.28	12.08
340							75	0.180	13.50	0.180	75	0.18	2.54
345	390	0.120	46.80							0.120	390	0.12	5.01
350	260	0.100	26.00							0.100	260	0.10	2.72
355	188	0.160	30.08							0.160	188	0.16	4.56
360	74	0.290	21.46							0.290	74	0.29	4.44
365	55	0.100	5.50							0.100	55	0.10	0.91
370	57	0.080	4.56							0.080	57	0.08	0.70
375	70	0.050	3.50							0.050	70	0.05	0.58
380	68	0.060	4.08							0.060	68	0.06	0.69
385	65	0.050	3.25							0.050	65	0.05	0.58
390	55	0.050	2.75							0.050	55	0.05	0.46
395	52	0.040	2.08							0.040	52	0.04	0.38
400	55	0.030	1.65							0.030	55	0.03	0.30
405	57	0.040	2.28							0.040	57	0.04	0.38
410	85	0.120	10.20							0.120	85	0.12	1.88
415	117	0.220	25.74							0.220	117	0.22	4.08
420	74	0.100	7.40							0.100	74	0.10	1.20
											Weighted Average LS Factor =		1.80

Note: LS Computed using the cross section method as outlined in the Project Risk Level Determination Guidance by Caltrans dated July 2010

10. “Asbestos and Lead-Containing Paint Survey Report, Redwood Landfill Overcrossing (Bridge 27-0115, Marin County, California.” – December 2009

ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT



REDWOOD LANDFILL OVERCROSSING (BRIDGE 27-0115) MARIN COUNTY, CALIFORNIA

PREPARED FOR:
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CALIFORNIA

PREPARED BY:
GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA

GEOCON

GEOCON PROJECT No. E8469-06-01C

DECEMBER 2009

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. E8469-06-01C
December 11, 2009

Natalina Bernardi
BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, California 94588

Subject: ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT
REDWOOD LANDFILL OVERCROSSING (BRIDGE 27-0115)
US HIGHWAY 101, MARIN-SONOMA NARROWS
SEGMENT B1 – SOUTHERLY INTERCHANGE
MARIN COUNTY, CALIFORNIA

Dear Ms. Bernardi:

We have performed an asbestos and deteriorated lead-containing paint survey of the subject location in Marin County, California. The scope of services provided by Geocon included surveying the Redwood Landfill Overcrossing (Bridge 27-0115) for suspect asbestos-containing materials and deteriorating lead-containing paint (LCP), collecting bulk samples, and submitting the samples to a laboratory for analysis.

The accompanying report summarizes the services performed and the results of laboratory testing.

The contents of this report reflect the views of Geocon, who are responsible for the facts and accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.

If there are any questions concerning the contents of this report, or if Geocon may be of further service, please contact me at your convenience.

Sincerely,

GEOCON CONSULTANTS, INC.

David Watts, CAC
Senior Project Scientist

DAW:daw

(5 + CD) Addressee
(1) Chris Wilson, Caltrans District 4

TABLE OF CONTENTS

ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT Page

1.0 INTRODUCTION 1
1.1 Site Description 1
1.2 Objectives 1
2.0 BACKGROUND 1
2.1 Asbestos 1
2.2 Lead Paint 2
3.0 HISTORY 3
3.1 Previous Survey Activities 3
3.2 Architectural Plans 3
4.0 SCOPE OF SERVICES 4
4.1 Asbestos 4
4.2 Deteriorated LCP 4
5.0 INVESTIGATIVE RESULTS 4
6.0 CONCLUSIONS AND RECOMMENDATIONS 5
6.1 Asbestos 5
6.2 Lead Paint 5
7.0 REPORT LIMITATIONS 6

FIGURES
1. Vicinity Map
2. Site Plan

SITE PHOTOGRAPHS (1 through 6)

TABLE
1. Summary of Analytical Laboratory Test Results – Asbestos

APPENDIX
A. Laboratory Report and Chain-of-custody Documentation

ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT

1.0 INTRODUCTION

This Asbestos and Lead-Containing Paint Survey Report for the United States Highway (US) 101 Marin-Sonoma Narrows (MSN) - Segment B1 – Southerly Interchange project, was prepared by Geocon Consultants, Inc. at the request of BKF Engineers (BKF), and in accordance with our workplan dated May 12, 2009 (revised June 2, 2009).

1.1 Site Description

The project consists of the Redwood Landfill Overcrossing (Bridge 27-0115) at Post Mile 25.5 on US 101 in Marin County, California (the project location). The approximate project location is depicted on the Vicinity Map, Figure 1, and Site Plan, Figure 2.

1.2 Objectives

Our objectives were to assess the potential presence and quantity of asbestos and deteriorated lead-containing paint (LCP) at the project location prior to planned demolition activities. The information obtained from this investigation will be used by BKF Engineers for waste profiling, determining California Occupational Safety and Health Administration (Cal/OSHA) applicability, and coordinating asbestos and LCP disturbance activities.

> *It was not Geocon's intent during this inspection to conduct an evaluation of lead-based paint hazards in accordance with HUD guidelines.*

2.0 BACKGROUND

2.1 Asbestos

The *Code of Federal Regulations (CFR),* 40 CFR 61, Subpart M, National Emissions Standards for Hazardous Air Pollutants (NESHAP) and Federal Occupational Safety and Health Administration (FED OSHA) classify asbestos-containing material (ACM) as any material or product that contains *more than* 1% asbestos. Nonfriable ACM is classified by NESHAP as either Category I or Category II material defined as follows:

- **Category I** – asbestos-containing packings, gaskets, resilient floor coverings, and asphalt roofing products.
- **Category II** – all remaining types of non-friable asbestos-containing material not included in Category I that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Regulated asbestos-containing material (RACM), a hazardous waste when friable, is classified as any manufactured material that contains *greater than* 1% asbestos by dry weight *and* is:

- Friable; or
- Category I material that has become friable; or
- Category I material that has been subjected to sanding grinding, cutting or abrading; or
- Category II non-friable material that has a high probability of becoming crumbled, pulverized, or reduced to a powder during demolition or renovation activities.

Activities that disturb materials containing *any* amount of asbestos are subject to certain requirements of the Cal/OSHA asbestos standard contained in Title 8, California Code of Regulations (CCR) Section 1529. Typically, removal or disturbance of more than 100 square feet of material containing more than 0.1% asbestos must be performed by a registered asbestos abatement contractor, but associated waste labeling is not required if the material contains 1% or less asbestos. When the asbestos content of a material exceeds 1%, virtually all requirements of the standard become effective.

Materials containing more than 1% asbestos are also subject to NESHAP regulations (40 CFR Part 61, Subpart M). RACM (friable ACM and nonfriable ACM that will become friable during demolition or renovation operations) must be removed from buildings prior to demolition or renovation. Certain nonfriable ACM and materials containing 1% or less asbestos may remain in buildings during demolition; however, there are waste handling/disposal issues and Cal/OSHA work requirements that must be followed. Contractors are responsible for segregating and characterizing waste streams prior to disposal.

With respect to potential worker exposure, notification, and registration requirements, Cal/OSHA defines asbestos-containing construction material (ACCM) as construction material that contains more than 0.1% asbestos (Title 8, CCR 341.6).

2.2 Lead Paint

Construction activities (including demolition) that disturb materials or paints containing *any* amount of lead are subject to certain requirements of the Cal/OSHA lead standard contained in Title 8, CCR, Section 1532.1. Deteriorated paint is defined by Title 17, CCR, Division 1, Chapter 8, §35022 as a surface coating that is cracking, chalking, flaking, chipping, peeling, non-intact, failed, or otherwise separating from a component. Demolition of a deteriorated LCP component would require waste characterization and appropriate disposal. Intact LCP on a component is currently accepted by most landfill facilities; however, contractors are responsible for segregating and characterizing waste streams prior to disposal.

For a solid waste containing lead, the waste is classified as California hazardous when: 1) the total lead content exceeds the respective Total Threshold Limit Concentration (TTLC) of 1,000 milligrams per kilogram (mg/kg); or 2) the soluble lead content exceeds the respective Soluble Threshold Limit

Concentration (STLC) of 5 milligrams per liter (mg/l) based on the standard Waste Extraction Test (WET). A waste has the potential for exceeding the lead STLC when the waste's total lead content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when total lead is detected at a concentration greater than or equal to 50 mg/kg, and assuming that 100 percent of the total lead is soluble, soluble lead analysis is required. Lead-containing waste is classified as "Resource, Conservation, and Recovery Act" (RCRA) hazardous, or Federal hazardous, when the soluble lead content exceeds the Federal regulatory level of 5 mg/l based on the Toxicity Characteristic Leaching Procedure (TCLP).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability; however, for the purposes of this investigation, toxicity (i.e., lead concentrations) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified as either California hazardous or RCRA hazardous requires management as a hazardous waste.

Potential hazards exist to workers who remove or cut through LCP coatings during demolition. Dust containing hazardous concentrations of lead may be generated during scraping or cutting materials coated with lead-containing paint. Torching of these materials may produce lead oxide fumes. Therefore, air monitoring and/or respiratory protection may be required during the demolition of materials coated with LCP. Guidelines regarding regulatory provisions for construction work where workers may be exposed to lead are presented in the Title 8, CCR, Section 1532.1.

3.0 HISTORY

3.1 Previous Survey Activities

Previous asbestos or LCP survey reports of the project location were not available for our review.

3.2 Architectural Plans

Architectural plans of the project location were not available for our review.

4.0 SCOPE OF SERVICES

Mr. David Watts, a California-Certified Asbestos Consultant (CAC), certification No. 98-2404 (expiration September 16, 2010), and Certified Lead Paint Inspector/Assessor and Project Monitor with the California Department of Public Health (DPH), certification numbers I-1734 and M-1734 (expiration December 4, 2010) completed an asbestos and deteriorated LCP survey of the project location on July 1, 2009.

4.1 Asbestos

Suspect ACM were grouped into homogeneous areas with representative samples randomly collected from each. In addition, each potential ACM was evaluated for quantity and friability. A total of four bulk asbestos samples were collected from the project location.

Our procedures for inspection and sampling are discussed below:

- Collected bulk asbestos samples after first wetting friable material with a light mist of water. The samples were then cut from the substrate and transferred to a labeled container. Note that when multiple samples were collected, the sampling locations were distributed throughout the homogeneous area (spaces where the material was observed).
- Relinquished bulk asbestos samples to EMSL Analytical, Inc., a California-licensed laboratory, for asbestos analysis in accordance with EPA Test Method 600/R-93/116 using polarized light microscopy (PLM) under standard chain-of-custody procedures. EMSL Analytical, Inc. is a laboratory accredited by the National Institute of Standards and Technology National Voluntary Laboratory Accreditation Program (NIST-NVLAP) for bulk asbestos fiber analysis. The laboratory analyses were requested on a 5-workday turn-around-time.

Sample locations are presented on the Site Plan, Figure 2. Geocon sample identification numbers, material descriptions, approximate quantities, friability assessments, and photo references are summarized in Table 1. Photos of suspect asbestos-containing materials are presented with the Site Photographs.

4.2 Deteriorated LCP

We observed no deteriorated LCP during the survey. Consequently, we collected no LCP samples.

5.0 INVESTIGATIVE RESULTS

No asbestos fibers were observed in samples of suspect materials collected at the project location. A summary of the analytical laboratory test results for asbestos is presented on Table 1.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Asbestos

Since no asbestos was detected, the Cal/OSHA asbestos standard does not apply for activities disturbing suspect materials represented by samples collected during our survey. In addition, suspect materials represented by samples collected during our survey would not be considered a California hazardous waste based on asbestos content.

In accordance with Bay Area Air Quality Management District (BAAQMD) Regulation 11, Rule 2, written notification is required ten working days prior to commencement of *any* demolition activity (whether asbestos is present or not).

6.2 Lead Paint

We recommend that various paints that may be encountered at the project location (graffiti, graffiti abatement, signage, traffic striping, etc.) be treated as lead-containing for purposes of determining the applicability of the Cal/OSHA lead standard (Title 8, CCR Section 1532.1) during any future maintenance, renovation, and demolition activities. This recommendation is based on the fact that lead is still an ingredient of some industrial and consumer paints.

7.0 REPORT LIMITATIONS

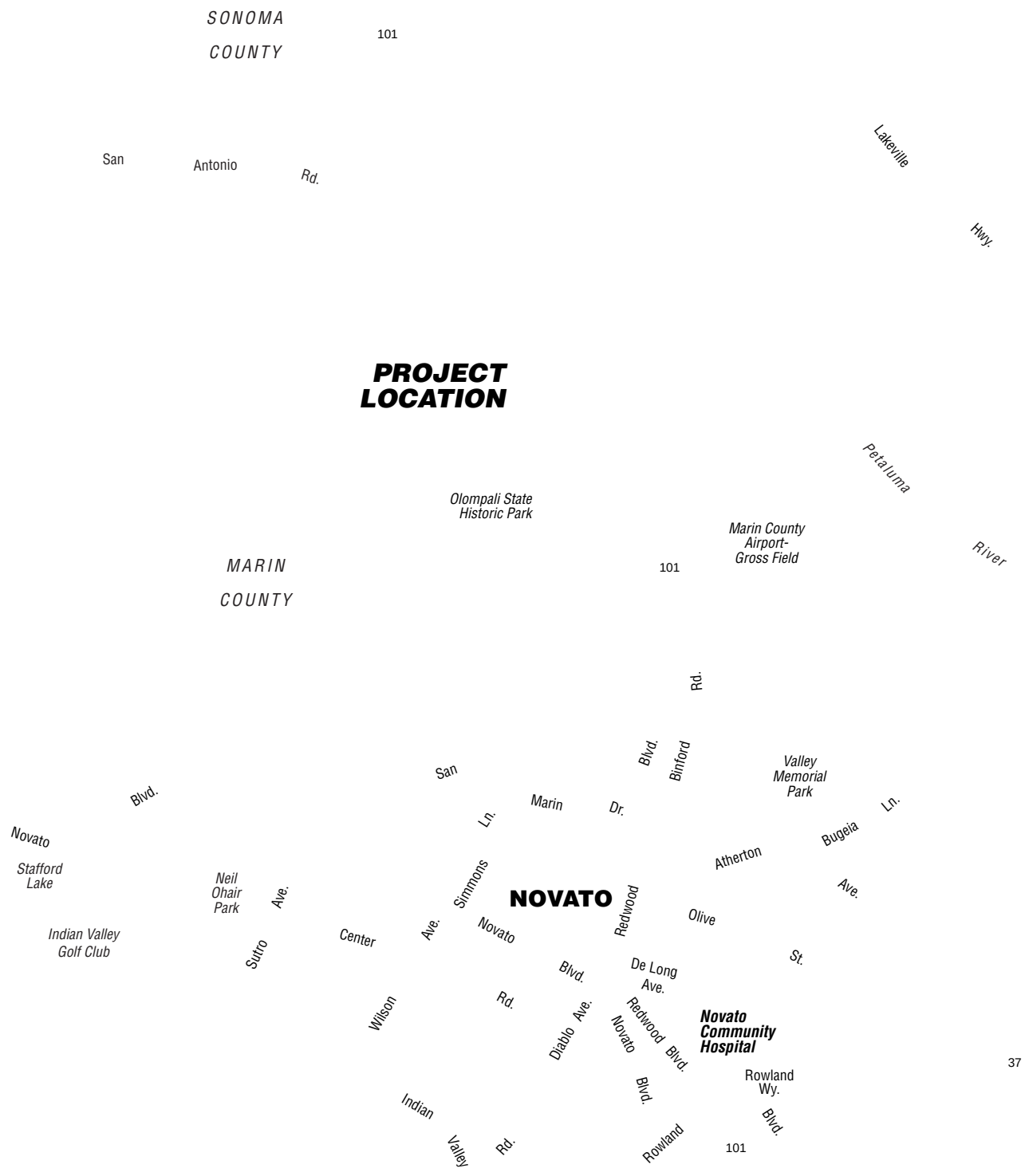
This report has been prepared exclusively for BKF Engineers. The information contained herein is only valid as of the date of the report and will require an update to reflect additional information obtained.

The asbestos and deteriorated LCP survey was conducted in conformance with generally accepted standards of practice for identifying and evaluating asbestos and LCP in structures. The survey addressed only the structure identified in Section 1.1. Due to the nature of structure surveys, asbestos and LCP use, and laboratory analytical limitations, some asbestos or deteriorated LCP at the structure may not have been identified. Spaces, such as cavities, crawlspaces, voids, and pipe chases may have been concealed to our investigator. Previous work may have concealed or covered spaces or materials, or may have partially demolished materials and left debris in inaccessible areas. Additionally, renovation activities may have partially replaced asbestos with indistinguishable non-asbestos. Asbestos and/or LCP may exist in areas not accessible or sampled in conjunction with our scope of services.

During renovation or demolition operations, suspect materials may be uncovered which are different from those accessible for sampling during this assessment. Personnel in charge of renovation/demolition should be alerted to note materials uncovered during such activities that differ substantially from those included in this or other assessment reports. If additional suspect materials are found, they should be treated as ACM and/or LCP until/unless sampling and analysis indicate otherwise.

This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty, express or implied, with respect to the content of this report or any subsequent reports, correspondence, or consultation. Geocon strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.



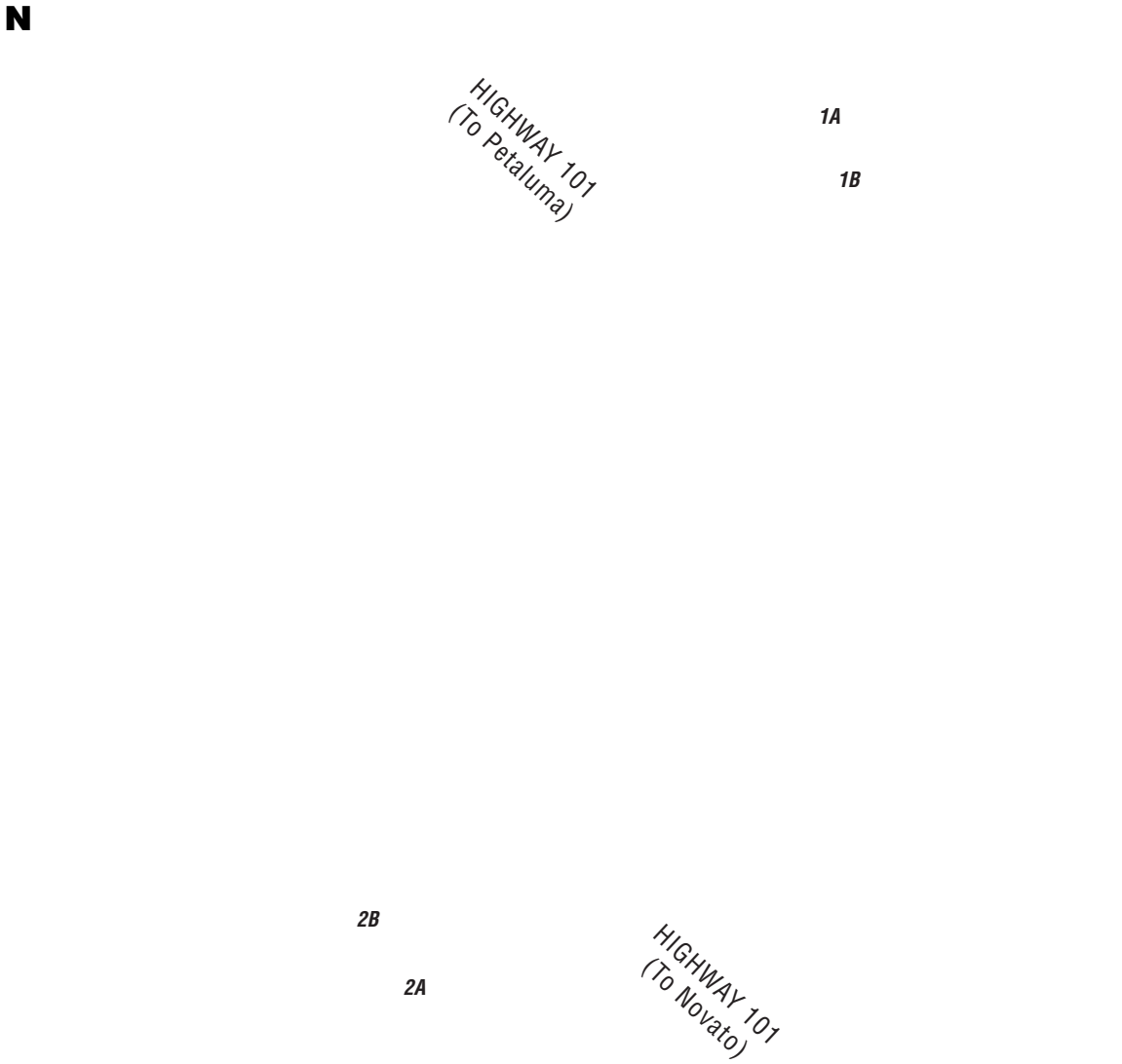
GEOCON CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

0 1/2
Scale in Miles

Redwood Landfill Overcrossing
Marin County, California

VICINITY MAP

E8469-06-01C December 2009 Figure 1



LEGEND:

Approximate Asbestos Sample Location

GEOCON
CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

Redwood Landfill Overcrossing

Marin County,
California

SITE PLAN

E8469-06-01C December 2009 Figure 2

Photo 1 – Redwood Landfill Overcrossing (Bridge 27-0115)

Photo 2 – Abutment joint fill material

Photo 3 – Box girder drain (non-suspect)

Photo 4 – Deck joint seal (non-suspect)

Photo 5 – Deck joint seal (non-suspect)

Photo 6 – Abutment joint fill material

TABLE 1
SUMMARY OF ANALYTICAL LABORATORY TEST RESULTS - ASBESTOS
REDWOOD LANDFILL OVERCROSSING (BRIDGE 27-0115) IN MARIN COUNTY, CALIFORNIA

Polarized Light Microscopy (PLM) - EPA Test Method 600/R-93/116

Sample ID	Description of Suspect Material	Approximate Quantity	Friable	Site Photo	Asbestos Content
1A	Joint fill material (1/4-inch)	NA	NA	2	ND
1B					ND
2A	Joint fill material (1/2-inch)	NA	NA	6	ND
2B					ND

Notes:
NA = Not applicable
ND = No asbestos fibers detected

APPENDIX A

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **David Watts**
Geocon Consultants
6671 Brisa Street
Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8469-06-01, Hwy. 101**

Customer ID: GECN21
Customer PO: E8469-06-01
Received: 07/02/09 9:00 AM
EMSL Order: 090905209

EMSL Proj:
Analysis Date: 7/2/2009

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	Description	Appearance	% Fibrous		% Non-Fibrous	% Type
0115-1A Joint Fill Material (1/4") *090905209-0001*	Hwy. 101	Tan Fibrous Homogeneous	90%	Cellulose	10% Non-fibrous (other)	None Detected
0115-1B Joint Fill Material (1/4") *090905209-0002*	Hwy. 101	Tan Fibrous Homogeneous	90%	Cellulose	10% Non-fibrous (other)	None Detected
0115-2A Joint Fill Material (1/2") *090905209-0003*	Hwy. 101	Black Fibrous Homogeneous	90%	Cellulose	10% Non-fibrous (other)	None Detected
0115-2B Joint Fill Material (1/2") *090905209-0004*	Hwy. 101	Black Fibrous Homogeneous	90%	Cellulose	10% Non-fibrous (other)	None Detected

Analyst(s)

Adam C. Fink (4)

Baojia Ke, Laboratory Manager
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted.

Samples analyzed by EMSL Analytical, Inc San Leandro 2235 Polvorosa Ave , Suite 230, San Leandro CA NVLAP Lab Code 101048-3, MA AA000201, WA C2007

THIS IS THE LAST PAGE OF THE REPORT.

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 90905209

EMSL ANALYTICAL, INC.
LABORATORY · PRODUCTS · TRAINING

EMSL ANALYTICAL, INC
2235 POLVOROSA AVE, STE 230
SAN LEANDRO, CA 94578
PHONE: (510) 895-3675
FAX: (510) 895-3680

Company : GEOCON		**EMSL-Bill to:** ☐ Same ☐ Different If Bill to is Different note instructions in Comments**	
Street: 6671 BRISA ST		*Third Party Billing requires written authorization from third party*	
City: LIVERMORE, CA	**State/Province:** 94550	**Zip/Postal Code:** 94550	**Country:** USA
Report To (Name): D. WATTS		**Fax #:**	
Telephone #: 925-371-5900		**Email Address:**	
Project Name/Number: HWY 101 E8469-06-01			
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order:**	**U.S. State Samples Taken:**	

Turnaround Time (TAT) Options* -- Please Check

☐ 3 Hours ☐ 6 Hours ☐ 24 Hrs ☐ 48 Hrs ☐ 3 Days ☐ 4 Days ☒ 5 Days ☐ 10 Days

**For TEM Air 3 hours/6 hours, please call ahead to schedule. †There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM - Air
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: **Samplers Signature:**

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
0115-1A	JOINT FILL MATERIAL (1/4")	NA	7/1/2009 0811
-1B	↓	↓	0814
-2A	JOINT FILL MATERIAL (1/2")	↓	0824
-2B	↓	↓	0831

Client Sample # (s): 0115-1A, 1B, 2A, 2B **Total # of Samples:** 4

Relinquished (Client): [signature] **Date:** 7/1/2009 **Time:** 1600

Received (Lab): Fed-Ex **Date:** 7/1/2009 7/2/09 **Time:** 1600 9:00 AM

Comments/Special Instructions:

f/l

11. “Preliminary Site Investigation Report, US 101 Marin-Sonoma Narrows Segment B1 – Southerly Interchange, Marin County, California.” - January 2010

PRELIMINARY
SITE INVESTIGATION REPORT

US 101 MARIN-SONOMA NARROWS SEGMENT
B1 – SOUTHERLY INTERCHANGE
MARIN COUNTY, CALIFORNIA

PREPARED FOR:
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CALIFORNIA

PREPARED BY:
GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA

GEOCON

GEOCON PROJECT No. E8469-06-01A/B/C

JANUARY 2010

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. E8469-06-01
January 22, 2010

Natalina Bernardi
BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, California 94588

Subject: PRELIMINARY SITE INVESTIGATION REPORT
US HIGHWAY 101, MARIN-SONOMA NARROWS
SEGMENT B1 – SOUTHERLY INTERCHANGE
MARIN COUNTY, CALIFORNIA

Dear Ms. Bernardi:

Geocon has performed environmental engineering services at the subject site in general accordance with the scope of work outlined in our workplan dated May 12, 2009 (revised June 2, 2009). The site investigation was performed along the northbound and southbound shoulders, median, and interchange within the project limits of United States Highway 101, Marin-Sonoma Narrows, Segment B1, in Marin County, California.

The accompanying report summarizes the services performed including limited soil sample collection from borings advanced using hand-auger and direct-push drilling equipment, and laboratory testing.

The contents of this report reflect the views of Geocon Consultants, Inc., who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

If there are any questions concerning the contents of this report, or if Geocon may be of further service, please contact the undersigned at your convenience.

Sincerely,

GEOCON CONSULTANTS, INC.

Lauren Vigliotti
Senior Staff Geologist

Richard Day, CEG, CHG
Vice President

PROFESSIONAL GEOLOGIST
RICHARD W. DAY
No. 5479
Exp. 09-30-11
STATE OF CALIFORNIA

LJV:RWD

(4 + CD) Addressee
(1) Chris Wilson, Caltrans District 4

TABLE OF CONTENTS

PRELIMINARY SITE INVESTIGATION REPORT Page

1.0 INTRODUCTION 1
1.1 Project Description and Proposed Improvements 1
1.2 Purpose 1

2.0 BACKGROUND 2
2.1 Hazardous Waste Determination Criteria 2
2.2 DTSC Variance 2
2.3 Naturally Occurring Asbestos 4
2.4 Environmental Screening Levels 5

3.0 SCOPE OF SERVICES 5
3.1 Pre-field Activities 5
3.2 Field Activities 5

4.0 INVESTIGATIVE METHODS 6
4.1 Sampling Procedures 6
4.2 Laboratory Analyses 7
4.3 Laboratory QA/QC 7

5.0 INVESTIGATIVE RESULTS 8
5.1 Subsurface Conditions 8
5.2 Laboratory Analytical Results 8
5.2.1 Proposed Bike Lane and Frontage Road and Landfill Access Road Borings (B1 through B37, B76 and B77) 8
5.2.2 ADL Borings (B38 through B75) 9
5.3 Laboratory Quality Assurance/Quality Control 9
5.4 Statistical Evaluation for Lead Detected in Soil Samples 9
5.4.1 Calculating the UCLs for the Arithmetic Mean 10
5.4.2 Correlation of Total and WET Lead 11

6.0 CONCLUSIONS 13
6.1 Predicted WET Lead Results 13
6.1.1 Bike Lane (borings B1-B18, B48-B53, B55, B57, B59, and B61) 13
6.1.2 Frontage Road along NB US 101 (borings B19-B24) 13
6.1.3 NB ramps (borings B38-B47) 14
6.1.4 Median (borings B64-B77) 14
6.1.5 SB ramps (borings B54, B56, B58, B60, B62, and B63) 15
6.1.6 Frontage Road along SB US 101 (borings B25-B37) 16
6.2 CAM 17 Metals 16
6.3 Total Petroleum Hydrocarbons 17
6.4 Pesticides 17
6.5 Naturally Occurring Asbestos 18
6.6 Worker Protection 18

7.0 REPORT LIMITATIONS 19

FIGURES

1. Vicinity Map
2a-d. Site Plan

TABLES

1. Boring Coordinates
2. Summary of Lead and pH Results
3. Summary of CAM 17 Metals Results
4. Summary of Organics Results
5. Summary of Pesticides Results
6. Summary of NOA Results
7a-f. Summary of Lead Statistical Analysis

APPENDICES

A. DTSC Variance
B. Parikh Consultants, Inc. Log of Test Boring A-09-001
C. Laboratory Reports and Chain-of-custody Documentation - CD
D. Lead Regression Analysis, and Metals and TPH Statistics

PRELIMINARY SITE INVESTIGATION REPORT

1.0 INTRODUCTION

This Preliminary Site Investigation Report for the United States Highway (US) 101 Marin-Sonoma Narrows (MSN) - Segment B1 – Southerly Interchange project, was prepared by Geocon Consultants, Inc. at the request of BKF Engineers (BKF), and in accordance with our workplan dated May 12, 2009 (revised June 2, 2009).

1.1 Project Description and Proposed Improvements

The site area consists of the Segment B1 – Southerly Interchange portion of the MSN Project. The project extends approximately four miles from 2,000 feet south of Airport Road north to San Antonio Road (the Site).

The US 101 MSN Project – Segment B1 is proposed to include the following:

- Construction of a bike lane along southbound (SB) US 101 within existing California Department of Transportation (Caltrans) right-of-way (ROW), from approximate Station 226+00 to 335+00.
- Construction of a frontage road adjacent to SB US 101, from approximate Station 335+00 (proposed Redwood Landfill interchange) to 412+00.
- Median widening of US 101 in the area of the Redwood Landfill interchange, approximately between Stations 315+00 to 353+00.
- Reconstruction of the Redwood Landfill interchange, which will include acquisition of private properties located adjacent to existing ROW.
- Construction of a frontage road adjacent to northbound (NB) US 101, approximately between Stations 229+50 and 335+00.
- Removal of the at-grade intersection at San Antonio Road and construction of new shoulders at approximate Station 410+00.

The proposed construction activities will be conducted within existing Caltrans ROW and at adjacent private properties proposed for partial acquisition. Specifically, sampling was conducted on the northbound and southbound shoulders, median, and one interchange within the project limits of US 101 in Marin County, California, which includes Post Miles (PM) Mrn-101 PM R23.2/27.1. The site location is depicted on the Vicinity Map, Figure 1.

1.2 Purpose

The purpose of the proposed scope of services was to evaluate whether impacts due to ADL exist in the surface and near surface soil and determine if other constituents of concern have impacted soil and groundwater at select areas at the Site. As discussed in Section 3.2, groundwater was not encountered

during the investigation. Accordingly, the information obtained from this investigation will be used by BKF to evaluate soil reuse/disposal options.

The project also included a survey of the Redwood Landfill Access Road bridge structure to assess the potential presence and quantity of asbestos and potential presence of lead paint prior to planned renovation activities. The results of the survey are provided in our report entitled *Asbestos and Lead-Containing Paint Survey, Marin-Sonoma Narrows Segment B1, Marin County, California*, dated December, 2009.

2.0 BACKGROUND

2.1 Hazardous Waste Determination Criteria

Regulatory criteria to classify a waste as California hazardous for handling and disposal purposes are contained in the CCR, Title 22, Division 4.5, Chapter 11, Article 3, §66261.24. Criteria to classify a waste as Resource, Conservation, and Recovery Act (RCRA) hazardous are contained in Chapter 40 of the Code of Federal Regulations (40 CFR), Section 261.

For waste containing metals, the waste is classified as California hazardous when: 1) the total metal content exceeds the respective Total Threshold Limit Concentration (TTLC); or 2) the soluble metal content exceeds the respective Soluble Threshold Limit Concentration (STLC) based on the standard Waste Extraction Test WET. A waste has the potential of exceeding the STLC when the waste's total metal content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when a total metal is detected at a concentration greater than or equal to ten times the respective STLC, and assuming that 100 percent of the total metals are soluble, soluble metal analysis is required. A material is classified as RCRA hazardous, or Federal hazardous, when the soluble metal content exceeds the Federal regulatory level based on the Toxicity Characteristic Leaching Procedure (TCLP).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability and corrosivity; however, for the purposes of this investigation, toxicity (i.e., lead concentrations) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified as either California hazardous or RCRA hazardous requires management as a hazardous waste.

2.2 DTSC Variance

The DTSC issued a statewide Variance effective July 1, 2009, regarding the reuse of ADL-impacted soils within Caltrans right-of-way. Under the Variance, soil that is classified as a non-RCRA hazardous

waste, based primarily on ADL content, may be suitable for reuse within Caltrans right-of-way. ADL soil that is classified as a RCRA hazardous waste is not eligible for reuse under the Variance and must be disposed of as a RCRA hazardous waste (Caltrans Type Z3).

ADL soil reused under the Variance must always be at least 5 feet above the highest groundwater elevation and, depending on lead concentrations, must be covered with at least one foot of non-hazardous soil or a pavement structure. The ADL soil may not be placed in areas where it might contact groundwater or surface water (such as streams and rivers), and must be buried in locations that are protected from erosion that may result from storm water run-on and run-off.

Review of the statewide Variance indicates the following conditions regarding the reuse and management of ADL-impacted soil as fill material for construction and maintenance operations. If ADL soil meets the Variance criteria but is not intended to be reused within Caltrans right-of-way, then the excavated soil must be disposed of as a California hazardous waste (Caltrans Type Z2). A copy of the Variance is presented as Appendix A.

Caltrans Type Y1

ADL soil exhibiting a total lead concentration less than or equal to 1,411 milligrams per kilogram (mg/kg), a DI-WET (WET using deionized water as extractant) soluble lead concentration less than or equal to 1.5 milligrams per liter (mg/l), and a pH value greater than or equal to 5.5 may be reused within the same Caltrans corridor and must be covered with at least one foot of non-hazardous soil.

Caltrans Type Y2

ADL soil exhibiting a total lead concentration less than or equal to 1,411 mg/kg, a DI-WET lead concentration less than or equal to 1.5 mg/l, and a pH value greater than 5 and less than 5.5 may be reused within the same Caltrans corridor and must be covered and protected from infiltration by a pavement structure.

ADL soil exhibiting a total lead concentration less than or equal to 1,411 mg/kg, a DI-WET lead concentration greater than 1.5 mg/l and less than or equal to 150 mg/l, and a pH value greater than 5 may be reused within the same Caltrans corridor and must be covered and protected from infiltration by a pavement structure.

ADL soil exhibiting a total lead concentration greater than 1,411 mg/kg and less than or equal to 3,397 mg/kg, a DI-WET lead concentration less than or equal to 150 mg/l, and a pH value greater than 5 may be reused within the same Caltrans corridor and must be covered and protected from infiltration by a pavement structure.

Caltrans Type Z2

ADL soil exhibiting a total lead concentration greater than 3,397 mg/kg, a DI-WET lead concentration greater than 150 mg/l, or a pH value less than or equal to 5 is not eligible for reuse under the Variance and must be disposed of as a California hazardous waste.

Caltrans Type Z3

ADL soil exhibiting a TCLP lead concentration greater than or equal to 5 mg/l is not eligible for reuse under the Variance and must be disposed of as a RCRA hazardous waste.

2.3 Naturally Occurring Asbestos

As defined in current California Air Resources Board (CARB) rules, serpentine material refers to any material that contains at least 10% serpentine, and asbestos-containing serpentine refers to serpentine materials with an asbestos content greater than 5% as determined by CARB Test Method 435 (CARB 435). The use of serpentine material for road surfacing is prohibited in California by Title 17 of the California Code of Regulations (CCR) Section 93106, Asbestos Airborne Toxic Control Measure (ATCM) for Surfacing Application (ATCM 93106), unless the material has been tested and determined to have an asbestos content of less than 0.25%. Materials found to contain asbestos of 0.25% or more are considered to be designated waste if transported offsite, requiring disposal at a landfill facility designated to accept asbestos waste. Alternatively, asbestos-containing materials may be reused onsite if buried beneath a minimum 6 inches of soil.

The CARB specifies mitigation practices for construction, grading, quarrying, and surface mining operations that contain natural occurrences of asbestos outlined in Title 17, Section 93105, Asbestos ATCM for Construction, Grading, Quarrying, and Surface Mining Operations (ATCM 93105). Based on Part (e) Subpart (2) of ATCM 93105 an asbestos dust mitigation plan is required and must be implemented for a project if NOA is disturbed after the start of construction. Additionally, ATCM 93105 specifies that the air pollution control district (APCD) must be notified and an asbestos dust mitigation plan submitted to the APCD. The ATCM states that air monitoring may be required on the property. NOA potentially posses a health hazard when it becomes an airborne particulate.

The construction/maintenance activities mentioned above could disturb NOA-laden debris and soil, thereby potentially creating an airborne hazard. Mitigation practices can reduce the risk of exposure to airborne NOA containing dust. Dust suppression practices include wetting the materials being disturbed and wearing approved respirators with high-efficiency particulate air (HEPA) filters during construction activities.

2.4 Environmental Screening Levels

The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) has prepared a technical report entitled *Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater, Interim Final* (May 2008), which presents Environmental Screening Levels (ESLs) for soil, groundwater, soil gas, and surface water, to assist in evaluating sites impacted by releases of hazardous chemicals. The ESLs are conservative values for more than 100 commonly detected contaminants, which may be used to compare with environmental data collected at a site. ESLs are strictly risk assessment tools and "not regulatory clean up standards." The presence of a chemical at concentrations in excess of an ESL does not necessarily indicate that adverse impacts to human health or the environment are occurring; this simply indicates that a potential for adverse risk may exist and that additional evaluation is or "may be" warranted (SFRWQCB, 2008).

The most conservative ESL table was used for this characterization: Table A – Shallow Soil (≤3 meters below ground surface; bgs) – Groundwater is a Current or Potential Source of Drinking Water. The respective ESLs are listed at the end of Tables 3 through 5, 7 and 8 for comparative purposes.

3.0 SCOPE OF SERVICES

We performed the following scope of services:

3.1 Pre-field Activities

- Prepared a *Workplan* dated May 12, 2009 (revised June 2, 2009), that describes the requested scope of services and quality assurance/quality control (QA/QC) sampling and laboratory procedures. The *Workplan* was approved by BKF and concurrence was obtained from Caltrans via email dated June 9, 2009.
- Prepared a site-specific health and safety plan to provide guidelines on the use of personal protective equipment and the health and safety procedures implemented during the field activities.
- Retained the services of Advanced Technology Laboratories (ATL) and EMSL Analytical (EMSL) to perform the sample analyses.
- Notified Underground Service Alert (USA) at least 48 hours prior to fieldwork.

3.2 Field Activities

Geocon performed the site investigation between June 29 and July 1, 2009, which consisted of the following field activities:

- Advanced 75 soil borings (B1 through B75) in the vicinity of the proposed bike lane, frontage roads, and along the ramps and median of US -101 using hand-auger techniques. Soil borings B1 to B37 were advanced to a maximum depth of 2 feet and soil borings B38 to B75 were advanced to a maximum depth of 2.5 feet.

- Advanced two soil borings (B76 and B77) at the Landfill Access Road overcrossing structure to a maximum depth of 10 feet using hand-auger techniques.
- Collected a total of 189 soil samples for analysis of CAM 17 metals, petroleum hydrocarbon compounds, pesticides, NOA, and pH.
- Transported samples to ATL and EMSL for analysis under standard chain-of-custody (COC) documentation.

While groundwater sampling was designated in the workplan, Geocon could not collect groundwater samples during this investigation as groundwater was not encountered during the advancement of our soil borings. Likewise, Parikh Consultants, Inc advanced geotechnical boring A-09-001 to a depth of approximately 50 feet and groundwater was not encountered. The geotechnical boring was advanced adjacent to the proposed Redwood Landfill Access Road overcrossing structure (Station 335+85). According to the log of test boring (LOTB), silty sand and sandy clay are present from the ground surface to a depth of approximately 5 feet bgs and are underlain by metaclaystone and metasandstone to at least 50 feet bgs. A copy of the LOTB in included as Appendix B.

4.0 INVESTIGATIVE METHODS

4.1 Sampling Procedures

Soil samples were collected from a total of 77 boring locations, which are shown on the Site Plan, Figures 2a through 2d. The boring locations were surveyed using Differential Global Positioning System (DGPS) equipment, and coordinates are presented on Table 1.

Soil samples were collected into new glass jars secured with Teflon-lined screw caps or stainless steel tubes secured with Teflon tape and plastic end caps for CAM 17 metals, petroleum hydrocarbon compounds, and pesticides analyses. Soil samples for total lead and NOA analyses were collected into new re-sealable plastic bags.

Sample containers were labeled, placed into a chilled cooler, and transported to ATL and EMSL using standard COC documentation. Soil borings were backfilled to surface with soil cuttings.

Geocon provided QA/QC procedures during the field activities. These procedures included washing the sampling equipment with a Liqui-Nox® solution followed by a double rinse with deionized water. Decontamination water was disposed to the ground surface within Caltrans right-of-way in a manner not to create runoff, away from drain inlets or potential water bodies.

4.2 Laboratory Analyses

Laboratory analyses performed by ATL and EMSL were under standard seven-day and ten-day turn-around-times, respectively. Reproductions of the laboratory reports and COC documentation are presented as Appendix C.

The soil samples were analyzed as follows:

- 145 samples for total lead using Environmental Protection Agency (EPA) Method 6010 ICAP.
- 44 samples for CAM 17 metals according to Title 22 CCR, EPA Test Methods 6010 ICAP and 7471A.
- 28 samples with total lead concentrations greater than 50 mg/kg (i.e., greater than ten times the STLC of 5.0 mg/l) were further analyzed for WET lead.
- 17 samples with WET lead concentrations greater than 5.0 mg/l were further analyzed for DI-WET lead.
- 15 samples with total lead concentrations exceeding 100 mg/kg and WET lead concentrations exceeding 5 mg/l were analyzed for TCLP lead using EPA Method 1311/7420.
- 19 samples with total chromium concentrations exceeding ten times the STLC of 5.0 mg/l for hexavalent chromium were further analyzed for WET chromium.
- 39 samples for TPH as gasoline (TPHg), benzene, toluene, ethylbenzene, xylenes (BTEX), and methyl-tert-butyl ether (MTBE) using EPA Test Method 8021B.
- 39 samples for TPH as diesel (TPHd) and as motor oil (TPHmo) using EPA Test Method 8015M.
- 39 samples for chlorinated pesticides using EPA Test Method 8081.
- 18 samples for NOA using CARB Test Method 435.
- 21 samples for pH using EPA Method 9045.

4.3 Laboratory QA/QC

QA/QC procedures were performed for each method of analysis with specificity for each analyte listed in the test method's QA/QC. The laboratory QA/QC procedures included the following:

- One method blank for every ten samples, batch of samples or type of matrix, whichever was more frequent.
- One sample analyzed in duplicate for every ten samples, batch of samples or type of matrix, whichever was more frequent.
- One spiked sample for every ten samples, batch of samples or type of matrix; whichever was more frequent, with spike made at ten times the detection limit or at the analyte level.

Prior to submitting the samples to the laboratories, the COC documentation was reviewed for accuracy and completeness (Appendix C).

5.0 INVESTIGATIVE RESULTS

5.1 Subsurface Conditions

Observations during field activities indicated that surface soil at the project location generally consist of gray and brown, sandy silt and silty clay. Groundwater was not encountered during the advancement of the soil borings. A geotechnical boring advanced to a depth of 50 feet in the vicinity of the Landfill Access Road bridge structure did not encounter groundwater (see LOTB, Appendix B).

5.2 Laboratory Analytical Results

A summary of the analytical results are presented in Tables 2 through 6. Reproductions of the laboratory reports and chain-of-custody documentation are presented as Appendix C.

5.2.1 Proposed Bike Lane and Frontage Road and Landfill Access Road Borings (B1 through B37, B76 and B77)

- Total lead was reported at concentrations ranging from 4.7 mg/kg to 130 mg/kg, with four samples exceeding 50 mg/kg (i.e., exceeding ten times the STLC of 5 mg/l).
- WET lead was reported in the samples at concentrations ranging from 2.2 to 4.7 mg/l.
- Total chromium was reported in the samples at concentrations ranging from 19 to 110 mg/kg.
- WET chromium was reported in the samples at concentrations ranging from 0.064 to 0.84 mg/l.
- The following metals were not detected above their respective laboratory reporting limits: antimony, beryllium, molybdenum, selenium, silver, and thallium. Remaining CAM 17 metals were reported at concentrations less than ten times their respective STLCs.
- TPHg, BTEX, and MTBE were not detected above their respective laboratory reporting limits.
- TPHd was reported at concentrations ranging from less than (<) the laboratory reporting limit of 1.0 to 470 mg/kg.
- TPHmo was reported at concentrations ranging from 5.2 to 3,200 mg/kg.
- Pesticides were detected above their respective laboratory reporting limits as follows:
  - 4,4'-DDD in sample B15-0 at a concentration of 26 micrograms per kilogram (µg/kg)
  - Sample B9-0 contained alpha-chlordane, chlordane, and gamma-chlordane at concentrations of 1.4 µg/kg, 12 µg/kg, and 1.6 µg/kg, respectively.
  - 4,4'-DDE in five samples at concentrations ranging from 2.0 to 320 µg/kg
  - 4,4'-DDT in three samples at concentrations ranging from 3.5 to 17 µg/kg
  - Sample B7-0 contained chlordane at a concentration of 8.8 µg/kg.
- NOA was not detected above the analytical sensitivity level of 0.25% dry weight.

5.2.2 ADL Borings (B38 through B75)

- Total lead was reported at concentrations ranging from <5.0 mg/kg to 580 mg/kg, with 22 samples exceeding 50 mg/kg (i.e., exceeding ten times the STLC of 5 mg/l).
- WET lead was reported at concentrations ranging from 0.77 to 37 mg/l.
- DI-WET lead was reported in the samples at concentrations ranging from <0.25 to 2.2 mg/l.
- TCLP lead was reported at concentrations ranging from <0.25 to 1.0 mg/l.
- Total chromium was reported at concentrations ranging from 5.9 to 280 mg/kg.
- WET chromium was reported at concentrations ranging from 0.062 to 0.38 mg/l.
- The following metals were not detected above their respective laboratory reporting limits: antimony, beryllium, molybdenum, selenium, silver and thallium. Remaining CAM 17 metals were reported at concentrations less than ten times their respective STLCs.
- NOA was not detected above the analytical sensitivity level of 0.25% dry weight.
- Soil pH values ranged from 5.8 to 8.3.

5.3 Laboratory Quality Assurance/Quality Control

We reviewed the QA/QC results provided with the laboratory analytical reports. The data indicate non-detect results for the method blanks.

Surrogate recovery was diluted out of a number of samples. The relative percent differences (RPDs) of the duplicate samples for several of the analyses were outside criteria. The RPDs for several of the matrix spike duplicate samples for the analyses were outside criteria. The Case Narratives in the laboratory reports state that each analytical batch was validated by the laboratory control sample (LCS). The data showed acceptable recoveries and RPDs for the remainder of the duplicates and matrix spikes. Dilution was necessary for several analyses due to sample matrix.

Based on this limited data review, no additional qualifications of the soil data are necessary, and the data are of sufficient quality for the purposes of this report.

5.4 Statistical Evaluation for Lead Detected in Soil Samples

The lead data for the Site were treated as six sample populations for statistical evaluation that consisted of the following:

A) Bike Lane - borings B1-B18, B48-B53, B55, B57, B59, and B61

B) Frontage Road along NB US 101 - borings B19-B24

C) NB Ramps – borings B38-B47

D) US 101 Median – borings B64-B77

E) SB ramps – borings B54, B56, B58, B60, B62, and B63

F) Frontage Road along SB US 101 – borings B25-B37

Statistical methods were applied to the total lead data to evaluate: 1) the upper confidence limits (UCLs) of the arithmetic means of the total lead concentrations for each sampling depth; and 2) if an acceptable correlation between total and WET lead concentrations exists that would allow the prediction of WET lead concentrations based on calculated UCLs. The statistical methods used are discussed in a book entitled *Statistical Methods for Environmental Pollution Monitoring,* by Richard Gilbert; in an EPA *Technology Support Center Issue* document entitled, *The Lognormal Distribution in Environmental Applications,* by Ashok Singh et. al., dated December 1997; and in a book entitled *An Introduction to the Bootstrap,* by Bradley Efron and Robert J. Tibshirani.

5.4.1 Calculating the UCLs for the Arithmetic Mean

The upper one-sided 90% and 95% UCLs of the arithmetic mean are defined as the values that, when calculated repeatedly for randomly drawn subsets of site data, equal or exceed the true mean 90% and 95% of the time, respectively. Statistical confidence limits are the classical tool for addressing uncertainties of a distribution mean. The UCLs of the arithmetic mean concentration are used as the mean concentrations because it is not possible to know the true mean due to the essentially infinite number of soil samples that could be collected from a site. The UCLs therefore account for uncertainties due to limited sampling data. As data become less limited at a site, uncertainties decrease, and the UCLs move closer to the true mean.

Non-parametric bootstrap techniques used to calculate the UCLs are discussed in the previously referenced EPA document and in *An Introduction to the Bootstrap.* For those samples in which total lead was not detected at concentrations exceeding the laboratory reporting limit, a value equal to one-half of the detection limit was used in the UCL calculation. The bootstrap test results are included in Appendix D. The following tables present the calculated UCLs and statistics for each data set.

Bike Lane (B1-B18, B48-B53, B55, B57, B59, and B61)

SAMPLE INTERVAL (feet)	90% TOTAL LEAD UCL (mg/kg)	95% TOTAL LEAD UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	MINIMUM VALUE (mg/kg)	MAXIMUM VALUE (mg/kg)
0.0 to 0.5	37.1	39.2	30.5	2.5	130
1.0 to 1.5	25.2	27.5	17.4	2.5	60
1.5 to 2.0	10.2	10.8	8.4	2.5	30
2.0 to 2.5	10.7	11.4	8.1	2.5	25

Frontage Road along NB US 101 (B19-B24)

SAMPLE INTERVAL (feet)	90% TOTAL LEAD UCL (mg/kg)	95% TOTAL LEAD UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	MINIMUM VALUE (mg/kg)	MAXIMUM VALUE (mg/kg)
0.0 to 0.5	58.0	62.4	40.3	7.0	92
1.5 to 2.0	5.7	6.0	4.8	2.5	7.0

NB Ramps (B38-B47)

SAMPLE INTERVAL (feet)	90% TOTAL LEAD UCL (mg/kg)	95% TOTAL LEAD UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	MINIMUM VALUE (mg/kg)	MAXIMUM VALUE (mg/kg)
0.0 to 0.5	38.9	42.4	27.2	2.5	110
1.0 to 1.5	11.7	12.4	9.4	2.5	21
2.0 to 2.5	8.4	8.9	6.6	2.5	18

Median (B64-B77)

SAMPLE INTERVAL (feet)	90% TOTAL LEAD UCL (mg/kg)	95% TOTAL LEAD UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	MINIMUM VALUE (mg/kg)	MAXIMUM VALUE (mg/kg)
0.0 to 0.5	274	288	212.2	15	580
1.0 to 1.5	102	110	73.4	6.0	300
2.0 to 2.5	45.0	49.1	31.9	2.5	88

SB ramps (B54, B56, B58, B60, B62, and B63)

SAMPLE INTERVAL (feet)	90% TOTAL LEAD UCL (mg/kg)	95% TOTAL LEAD UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	MINIMUM VALUE (mg/kg)	MAXIMUM VALUE (mg/kg)
0.0 to 0.5	11.0	11.5	9.6	5.6	13
1.0 to 1.5	12.1	13.1	8.8	2.5	22
2.0 to 2.5	8.7	9.3	6.9	2.5	12

Frontage Road along SB US 101 (B25-B37)

SAMPLE INTERVAL (feet)	90% TOTAL LEAD UCL (mg/kg)	95% TOTAL LEAD UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	MINIMUM VALUE (mg/kg)	MAXIMUM VALUE (mg/kg)
0.0 to 0.5	27.2	28.3	23.1	2.5	40
1.5 to 2.0	5.7	5.8	5.0	2.5	7.9

5.4.2 Correlation of Total and WET Lead

Total and corresponding WET lead concentrations are bivariate data with a linear structure. This linear structure should allow for the prediction of WET lead concentrations based on the UCLs calculated above in Section 5.4.1.

To estimate the degree of interrelation between total and corresponding WET lead values (*x* and *y*, respectively), the *correlation coefficient [r]* is used. The correlation coefficient is a ratio that ranges from +1 to –1. A *correlation coefficient* of +1 indicates a perfect direct relationship between two variables; a *correlation coefficient* of –1 indicates that one variable changes inversely with relation to the other. Between the two extremes is a spectrum of less-than-perfect relationships, including zero, which indicates the lack of any sort of linear relationship at all. The *correlation coefficient* was calculated for the 27 (*x, y*) data points (i.e., soil samples analyzed for both total lead [*x*] and WET lead [*y*]) that were collected at the Site. The resulting *coefficient of determination* (r^2) equaled 0.9257, which yields a corresponding *correlation coefficient* (*r*) of 0.962.

For the *correlation coefficient* that indicates a linear relationship between total and WET lead concentrations, it is possible to compute the line of dependence or a best-fit line between the two variables. A least squares method was used to find the equation of a best-fit line (regression line) by forcing the y-intercept equal to zero since that is a known point. The equation of the regression line was determined to be $y = 0.0611(x)$, where *x* represents total lead concentrations and *y* represents predicted WET lead concentrations.

This equation was used to estimate the expected WET lead concentrations for the UCLs calculated in for samples collected from the Site (see Section 5.4.1). Regression analysis results and a scatter plot depicting the (*x, y*) data points along with the regression line are included in Appendix D. The predicted WET lead concentrations are summarized in Tables 7a through 7f.

6.0 CONCLUSIONS

Waste classifications are evaluated based on the 90% UCL of the lead content for the relevant excavation depths; this has historically been considered sufficient to satisfy a good faith effort by the EPA as discussed in SW-846. Risk assessment characterization is based on the 95% UCL of the lead content in the waste for the relevant depths; this is in accordance with the Risk Assessment Guidance for Superfund (RAGS) Volume 1 Documentation for Exposure Assessment. Per Caltrans, the 90% UCLs are to be used to evaluate onsite reuse and the 95% UCLs are to be used to evaluate offsite disposal.

6.1 Predicted WET Lead Results

6.1.1 Bike Lane (borings B1-B18, B48-B53, B55, B57, B59, and B61)

The following table summarizes the predicted waste classification for excavated soil based on the calculated weighted averages of the total lead UCLs for data collected from this portion of the Site. Weighted averages are calculated by using the total lead UCL concentration for each 0.5-foot depth interval as the value for the underlying 0.5-foot depth interval (unless a sample was collected from the underlying depth interval). The total and WET lead calculations are summarized in Table 7a.

Excavation Depth	90% UCL Total Lead (mg/kg)	90% UCL Predicted WET Lead (mg/l)	95% UCL Total Lead (mg/kg)	Waste Classification
0 to 1.0 foot	25	1.5	28	Non-Hazardous
Underlying soil (1.0 to 2.5 feet)	*15*	*0.9*	*17*	*Non-Hazardous*
0 to 2.5 feet	24	1.5	26	Non-Hazardous

90% UCL applicable for waste classification and onsite reuse; 95% UCL applicable for risk assessment and offsite disposal

Based on the data presented in the above table, excavated soil would not be classified as a California hazardous waste since the 90% UCL-predicted WET lead concentrations are less than the lead STLC of 5.0 mg/l.

6.1.2 Frontage Road along NB US 101 (borings B19-B24)

The following table summarizes the predicted waste classification for excavated soil based on the calculated weighted averages of the total lead UCLs for data collected from this portion of the Site. The total and WET lead calculations are summarized in Table 7b.

Excavation Depth	90% UCL Total Lead (mg/kg)	90% UCL Predicted WET Lead (mg/l)	95% UCL Total Lead (mg/kg)	Waste Classification
0 to 1.0 foot	58	3.5	62	Non-Hazardous
Underlying soil (1.0 to 2.0 feet)	*32*	*1.9*	*34*	*Non-Hazardous*
0 to 2.0 feet	45	2.7	48	Non-Hazardous

90% UCL applicable for waste classification and onsite reuse; 95% UCL applicable for risk assessment and offsite disposal

Based on the data presented in the above table, excavated soil would not be classified as a California hazardous waste since the maximum-predicted WET lead concentrations are less than the lead STLC of 5.0 mg/l.

6.1.3 NB ramps (borings B38-B47)

The following table summarizes the predicted waste classification for excavated soil based on the calculated weighted averages of the total lead UCLs for data collected from this portion of the Site. The total and WET lead calculations are summarized in Table 7c.

Excavation Depth	90% UCL Total Lead (mg/kg)	90% UCL Predicted WET Lead (mg/l)	95% UCL Total Lead (mg/kg)	Waste Classification
0 to 1.0 foot	39	2.4	42	Non-Hazardous
Underlying soil (1.0 to 2.5 feet)	*11*	*0.6*	*11*	*Non-Hazardous*
0 to 2.5 feet	22	1.3	25	Non-Hazardous

90% UCL applicable for waste classification and onsite reuse; 95% UCL applicable for risk assessment and offsite disposal

Based on the data presented in the above table, excavated soil would not be classified as a California hazardous waste since the maximum-predicted WET lead concentrations are less than the lead STLC of 5.0 mg/l.

6.1.4 Median (borings B64-B77)

The following table summarizes the predicted waste classification for excavated soil based on the calculated weighted averages of the total lead UCLs for data collected from this portion of the Site. The total and WET lead calculations are summarized in Table 7d.

Excavation Depth	90% UCL Total Lead (mg/kg)	90% UCL Predicted WET Lead (mg/l)	95% UCL Total Lead (mg/kg)	Waste Classification
0 to 1.0 foot	274	**17**	288	**Hazardous**
Underlying soil (1.0 to 2.5 feet)	*83*	***5.1***	*89*	***Hazardous***
0 to 2.0 feet	188	**11**	199	**Hazardous**
Underlying Soil (2.0 to 2.5 feet)	*45*	*2.8*	*49*	*Non-Hazardous*
0 to 2.5 feet	159	***9.7***	175	**Hazardous**

90% UCL applicable for waste classification and onsite reuse; 95% UCL applicable for risk assessment and offsite disposal

Based on the data presented in the above table, soil excavated to a depth of 2 feet would be classified as a California hazardous waste since the 90% UCL-predicted WET lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the TCLP lead results, excavated soil would not be classified as a RCRA hazardous waste. Underlying soil below a depth of 2.0 feet would be classified as non-hazardous.

Based on the reported DI-WET results, soil excavated from the surface to a depth of 2 feet may be reused onsite (as Caltrans Type Y1) in accordance with the DTSC Variance by placing the excavated soil under clean fill or pavement.

6.1.5 SB ramps (borings B54, B56, B58, B60, B62, and B63)

The following table summarizes the predicted waste classification for excavated soil based on the calculated weighted averages of the total lead UCLs for data collected from this portion of the Site. The total and WET lead calculations are summarized in Table 7e.

Excavation Depth	90% UCL Total Lead (mg/kg)	90% UCL Predicted WET Lead (mg/l)	95% UCL Total Lead (mg/kg)	Waste Classification
0 to 1.0 foot	11	0.7	11	Non-Hazardous
Underlying soil (1.0 to 2.5 feet)	*11*	*0.7*	*12*	*Non-Hazardous*
0 to 2.5 feet	11	*0.7*	13	Non-Hazardous

90% UCL applicable for waste classification and onsite reuse; 95% UCL applicable for risk assessment and offsite disposal

Based on the data presented in the above table, excavated soil would not be classified as a California hazardous waste since the maximum-predicted WET lead concentrations are less than the lead STLC of 5.0 mg/l.

6.1.6 Frontage Road along SB US 101 (borings B25-B37)

The following table summarizes the predicted waste classification for excavated soil based on the calculated weighted averages of the total lead UCLs for data collected from this portion of the Site. The total and WET lead calculations are summarized in Table 7f.

Excavation Depth	90% UCL Total Lead (mg/kg)	90% UCL Predicted WET Lead (mg/l)	95% UCL Total Lead (mg/kg)	Waste Classification
0 to 1.0 foot	27	1.7	28	Non-Hazardous
Underlying soil (1.0 to 2.0 feet)	*16*	*1.0*	*17*	*Non-Hazardous*
0 to 2.0 feet	22	1.3	23	Non-Hazardous

90% UCL applicable for waste classification and onsite reuse; 95% UCL applicable for risk assessment and offsite disposal

Based on the data presented in the above table, excavated soil would not be classified as a California hazardous waste since the maximum-predicted WET lead concentrations are less than the lead STLC of 5.0 mg/l.

6.2 CAM 17 Metals

Based on the reported WET chromium results, soil would not be classified as hazardous waste.

The CAM 17 metals concentrations in site soil were compared to ESLs (Table A, SFRWQCB, May 2008). Arsenic and vanadium were the only metals with reported concentrations greater than their respective ESL values in the soil samples collected at the site. Arsenic was detected at concentrations between 1.1 and 11 mg/kg, exceeding the residential land use ESL of 0.39 mg/kg and the commercial/industrial land use ESL of 1.6 mg/kg for shallow soil (≤3 meters; SFRWQCB, Table A). Vanadium was reported in the soil samples at concentrations between 17 mg/kg and 97 mg/kg, exceeding the residential land use ESL of 16 mg/kg for shallow soil.

Upper one-sided 95% UCLs were calculated for the full set of arsenic and vanadium data collected at the Site. The UCLs were compared with the residential and commercial/industrial land use ESLs and with published background levels typically present in California soils as presented in *Background Concentrations of Trace and Major Elements in California Soils* (Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996). The bootstrap results are included in Appendix D. The calculated standard bootstrap UCLs, ESLs and published background concentrations are summarized in the table below:

Metal	95% UCL	RESIDENTIAL ESL	COMMERCIAL/ INDUSTRIAL ESL	PUBLISHED BACKGROUND MEAN[1]	PUBLISHED BACKGROUND RANGE [1]
Arsenic	1.8	0.39	1.6	3.5	0.6 to 11.0
Vanadium	39.4	16	200	112	39 to 288

Concentrations reported in milligrams per kilogram (mg/kg)

[1] Kearney Foundation of Soil Science, March 1996

The 95% UCL arsenic value for soil samples collected at the Site is greater than the residential and land use ESL; however, it is less than the commercial/industrial land use ESL and within the published background range. The SFRWQCB *November 2007 Update to Environmental Screening Levels (ESLs) Technical Document* states that ambient background concentrations of arsenic typically exceed risk-based screening levels. In such instances, it may be more appropriate to compare site data to regionally specific established background levels.

The 95% UCL vanadium concentration for soil samples collected at the Site is greater than the residential land use ESL; however, it is less than the commercial/industrial land use ESL and within the published background range.

Offsite reuse or disposal of excavated soil may be restricted based on metals content.

6.3 Total Petroleum Hydrocarbons

TPHd was reported at concentrations ranging from <1.0 to 470 mg/kg, with 5 of the 39 samples analyzed exceeding the residential and commercial/industrial land use ESLs of 83 mg/kg. The calculated 95% UCL for the TPHd results is 60.4 mg/kg and is less than the residential and commercial/industrial land use ESLs.

TPHmo was reported at concentrations ranging from 5.2 to 3,200 mg/kg, with 6 of the 39 samples analyzed exceeding the residential land use ESL of 370 mg/kg. One sample (B8-0) had a reported concentration that exceeded the commercial/industrial land use ESL of 2,500 mg/kg. The calculated 95% UCL for TPHmo is 439 mg/kg exceeding the residential land use ESL.

Offsite reuse or disposal of excavated soil may be restricted based on TPHd and TPHmo content.

6.4 Pesticides

Pesticides were not detected above their respective ESLs.

6.5 Naturally Occurring Asbestos

The mapped geology of the general area of the Site is indicative of a metamorphic regime where NOA minerals are likely to occur. However, the soil sample results indicate that NOA is not present at the Site at concentrations exceeding the CARB regulatory limit of 0.25%.

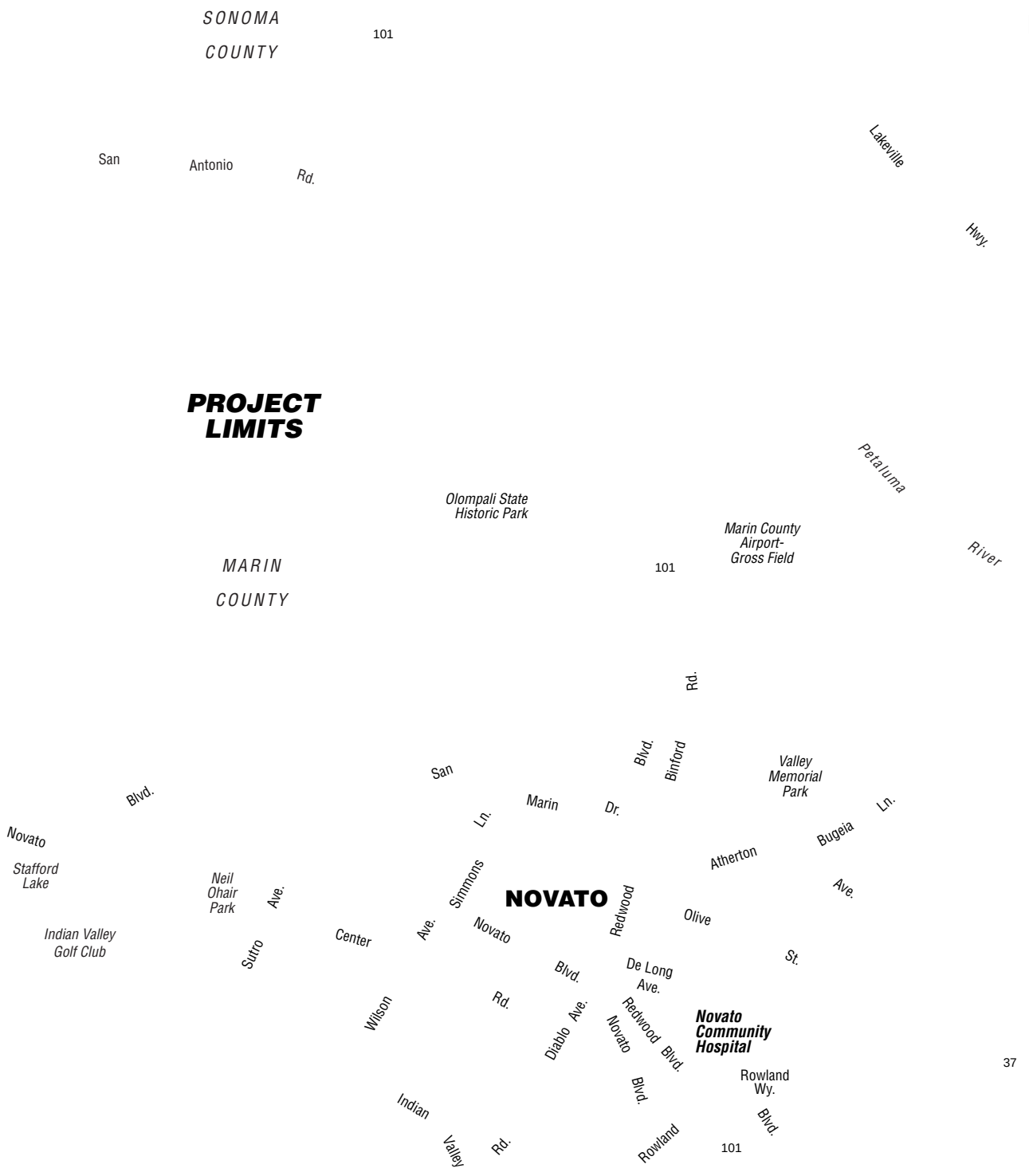
6.6 Worker Protection

Per Caltrans' requirements, the contractor(s) should prepare a project-specific health and safety plan to prevent or minimize worker exposure to impacted soil. The plan should include protocols for environmental and personnel monitoring, requirements for personal protective equipment, and other health and safety protocols and procedures for the handling of impacted soil.

7.0 REPORT LIMITATIONS

This report has been prepared exclusively for BKF Engineers. The information contained herein is only valid as of the date of the field sampling and will require an update to reflect additional information obtained.

This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty, express or implied, with respect to the content of this report or any subsequent reports, correspondence or consultation. Geocon strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.



GEOCON
CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

0 1/2
Scale in Miles

US 101 Marin Sonoma Narrows – Segment B1

Marin County,
California

VICINITY MAP

E8469-06-01A/B/C January 2010 Figure 1

Matchline

Matchline

6" BLOW OFF VALVE

2" AIR RELEASE VALVE

1" AIR RELEASE VALVE

6" BLOWOFF
8' OUTSIDE OF R/W FENCE

12" OUTLET
ETS FOR DUMP BORE & AQUEDUCT
8' OUTSIDE OF R/W FENCE

CSS IN BOX

SONOMA-MARIN 4" TRANSMISSION PIPELINE PROJECT PROPOSED

1" AIR RELEASE VALVE
8' OUTSIDE OF R/W FENCE

8" OUTLET
6" GATE VALVE
8' OUTSIDE OF R/W FENCE

2" AIR RELEASE VALVE
8' OUTSIDE OF R/W FENCE

24" GATE VALVE
AND BLOW OFF ASSEMBLY
8' OUTSIDE OF R/W FENCE

FIRE HYDRANT #447
8' OUTSIDE OF R/W FENCE

SILVEIRA CATTLE CROSSING
CONCRETE ENCASEMENT

SILVEIRA ANTHONY F & LORRAINE F
125-160-15

SILVEIRA ANTHONY F & LORRAINE F
125-160-20

SILVEIRA ANTHONY F & LORRAINE F
125-160-20

SILVEIRA ANTHONY F & LORRAINE F
125-160-18

SILVEIRA ANTHONY F & LORRAINE F
125-160-19

LANDFILL ACCESS ROAD

B14 B64 B15 B48 B16 B17 B51 B69 B52 B70 B18 B71 B76 B54 B53 B25 B56 B58 B59 B57 B60 B26 B62 B61 B63 B27 B28 B29 B30 B20 B65 B21 B66 B50 B49 B67 B22 B68 B38 B39 B40 B41 B23 B24 B55 B72 B43 B42 B77 B44 B45 B73 B46 B47

LEGEND:

Boring Location

N

0 200 400

SCALE: feet

GEOCON
CONSULTANTS INC.
6671 BRISA STREET, LIVERMORE, CA 94550
PHONE 925 371-5900 - FAX 925 371-5915

US 101 Marin Sonoma Narrows - Segment B1

Marin County, California

SITE PLAN

GEOCON Proj No E8469-06-01C

EA No.

January 2010

Figure 2c

B1_SITE1009

LEGEND:

Boring Location

N

0 200 400

SCALE: feet

Matchline

Matchline

STATE OF CALIFORNIA
OLOMPALI STATE HISTORIC PARK
125-160-01

STATE OF CALIFORNIA
125-180-05

SONOMA-MARIN 42" TRANSMISSION PIPELINE PROJECT (PROPOSED)

24" GATE VALVE & BLOWOFF ASSEMBLY 25G

2" AIR RELEASE VALVE

SONOMA-MARIN 42" TRANSMISSION PIPELINE

6" BLOW OFF VALVE

1" AIR RELEASE VALVE

12" OUTLET FLS FOR DUMP BORE & AL OUTSIDE OF R/W FENCE

CSS IN BOX

6" BLOWOFF OUTSIDE OF R/W FENCE

SONOMA-MARIN 42" TRANSMISSION PIPELINE

B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20 B21 B22 B48 B49 B50 B51 B64 B65 B66 B67 B68 B69

SILVEIRA ANTHONY F & LORRAINE F
125-160-06

SILVEIRA ANTHONY F & LORRAINE F
125-160-12

SILVEIRA ANTHONY F & LORRAINE F
125-160-20

SILVEIRA ANTHONY F & LORRAINE F
125-160-18

SMART
RR 125-160-09

RR 125-160-08

SONOMA-MARIN RAIL TRANSIT DISTRICT
RR 125-190-02

CALIFORNIA STATE OF/
DEPT OF FISH & GAME
125-190-73

BORTOLUSSI PHILLIP & PEGGY
125-190-01

TO MARINA

GEOCON
CONSULTANTS INC.
6671 BRISA STREET, LIVERMORE, CA 94550
PHONE 925 371-5900 - FAX 925 371-5915

US 101 Marin Sonoma Narrows - Segment B1

Marin County, California

SITE PLAN

GEOCON Proj No E8469-06-01C

EA No.

January 2010

Figure 2b

B1_SITE1009

LEGEND:

Boring Location

CITY OF NOVATO

MARIN COUNTY
CITY OF NOVATO

MARIN COUNTY
OPEN SPACE DISTRI
125-180-068

STATE OF CALIFORNIA
125-180-074

NOVATO MOTEL
125-180-80

COUNTY OF MARIN
125-180-75

BIRKENSTOCK WAREHOUSE

NOVATO REDWOOD PROPERTIES INC
125-180-45

CCS IN BURIED BOX

CCS IN BOX W/ETS

SAMPLING STATION

B1

B2

B3

B4

B5

B6

B7

SONOMA-MARIN RAIL TRANSIT DISTRICT
RR 125-190-10

RR 125-190-62

RR 125-190-55

J CASHEW CORP
125-190-61

J CASHEW CORP
125-190-64

JHW FAMILY LTD PTNRS
125-190-56

JHW FAMILY LTD PTNRS
125-190-29

JHW FAMILY LTD PTNRS
125-190-41

AVELLA JOSEPH A/
AVELLA LAVERNE
125-201-001

CHIANG PETER/WONG GRACE
125-540-02

LAND RUSH PARTNERS
125-560-001

CERVANTES FAMILY TRUST
125-540-01

BINFORD ROAD LLC
125-190-60

125-190-35

BUREDELL AIR PARTNERS LLC
125-190-74

AIRPORT RD

REDWOOD BLVD

Matchline

N

0 200 400
SCALE: feet

GEOCON
CONSULTANTS INC.
6671 BRISA STREET, LIVERMORE, CA 94550
PHONE 925 371-5900 - FAX 925 371-5915

US 101 Marin Sonoma Narrows - Segment B1

Marin County, California

SITE PLAN

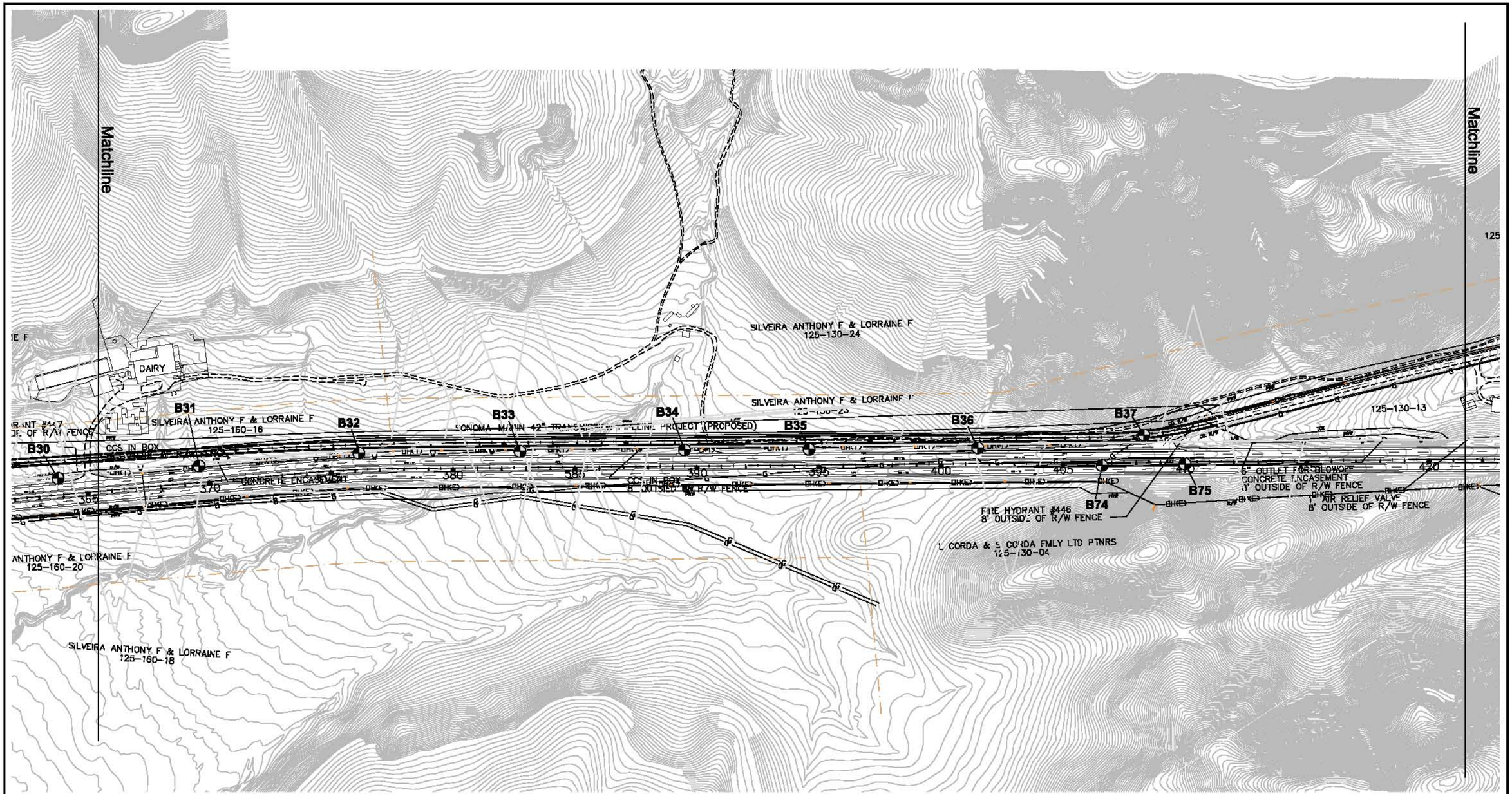
GEOCON Proj No E8469-06-01C

EA No.

January 2010

Figure 2a

B1_SITE1009



LEGEND:

⊕ Boring Location

N

0 200 400

SCALE: feet

GEOCON
CONSULTANTS INC.
6671 BRISA STREET, LIVERMORE, CA 94550
PHONE 925 371-5900 - FAX 925 371-5915

US 101 Marin Sonoma Narrows - Segment B1

Marin County, California

SITE PLAN

GEOCON Proj No E8469-06-01C

EA No.

January 2010

Figure 2d

B1_SITE1009

TABLE 1
Boring Coordinates
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Boring	Northing	Easting
B1	2,242,230.909	5,968,057.593
B2	2,242,860.212	5,968,053.319
B3	2,243,509.633	5,968,033.172
B4	2,244,040.954	5,968,011.615
B5	2,244,747.507	5,967,988.675
B6	2,245,435.855	5,967,957.597
B7	2,246,109.866	5,967,862.289
B8	2,246,770.424	5,967,696.836
B9	2,247,382.449	5,967,531.558
B10	2,248,050.149	5,967,343.553
B11	2,248,611.112	5,967,199.030
B12	2,249,226.540	5,967,047.526
B13	2,249,797.669	5,966,887.940
B14	2,250,337.180	5,966,756.239
B15	2,250,753.704	5,966,614.439
B16	2,251,254.637	5,966,294.446
B17	2,251,671.774	5,965,877.796
B18	2,252,193.474	5,965,365.366
B19	2,249,936.350	5,967,088.012
B20	2,250,489.501	5,966,934.532
B21	2,251,033.396	5,966,647.422
B22	2,251,561.026	5,966,303.314
B23	2,252,042.279	5,965,939.299
B24	2,252,471.672	5,965,548.482
B25	2,252,373.065	5,964,694.640
B26	2,252,858.103	5,964,409.261
B27	2,253,454.169	5,964,152.640
B28	2,253,894.681	5,963,685.738
B29	2,254,179.135	5,963,347.586
B30	2,254,497.444	5,962,968.648
B31	2,254,870.675	5,962,524.580
B32	2,255,295.849	5,962,024.467
B33	2,255,757.407	5,961,551.899
B34	2,256,229.412	5,961,071.275
B35	2,256,588.617	5,960,708.768
B36	2,257,073.567	5,960,215.507
B37	2,257,518.070	5,959,696.549
B38	2,251,926.629	5,965,879.620
B39	2,252,120.133	5,965,684.102
B40	2,252,235.031	5,965,538.481
B41	2,252,535.024	5,965,420.577
B42	2,252,831.680	5,965,124.919
B43	2,252,908.788	5,964,975.775
B44	2,253,000.935	5,964,813.363
B45	2,253,177.641	5,964,626.221
B46	2,253,292.911	5,964,517.031
B47	2,253,540.199	5,964,299.210
B48	2,251,028.931	5,966,484.741
B49	2,251,283.036	5,966,307.639

TABLE 1
Boring Coordinates
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Boring	Northing	Easting
B50	2,251,518.728	5,966,082.149
B51	2,251,744.871	5,965,835.121
B52	2,251,976.838	5,965,596.665
B53	2,252,211.539	5,965,351.270
B54	2,252,374.277	5,965,075.417
B55	2,252,468.061	5,965,091.166
B56	2,252,397.258	5,964,961.299
B57	2,252,641.193	5,964,903.409
B58	2,252,484.582	5,964,901.174
B59	2,252,762.907	5,964,781.073
B60	2,252,703.634	5,964,736.504
B61	2,252,870.107	5,964,690.422
B62	2,252,888.208	5,964,672.557
B63	2,253,143.935	5,964,435.826
B64	2,250,545.724	5,966,792.048
B65	2,250,809.447	5,966,680.234
B66	2,251,083.423	5,966,513.921
B67	2,251,356.276	5,966,322.604
B68	2,251,580.072	5,966,119.049
B69	2,251,813.090	5,965,874.977
B70	2,252,142.403	5,965,530.782
B71	2,252,510.898	5,965,001.812
B72	2,252,811.315	5,964,855.201
B73	2,253,037.142	5,964,642.016
B74	2,257,484.951	5,959,906.915
B75	2,257,720.634	5,959,661.813
B76	2,252,491.314	5,965,040.514
B77	2,252,658.070	5,965,121.510

Coordinates are shown in feet, NAD 83 (Zone 3)

TABLE 2
Summary of Lead and pH Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B1-0	0	25	---	---	---	6.9
B1-1.5	1.5	8.6	---	---	---	---
B2-0	0	26	---	---	---	---
B2-1.5	1.5	7.8	---	---	---	---
B3-0	0	20	---	---	---	---
B3-1.5	1.5	6.2	---	---	---	---
B4-0	0	39	---	---	---	---
B4-1.5	1.5	15	---	---	---	---
B5-0	0	22	---	---	---	---
B5-1.5	1.5	6.8	---	---	---	7.9
B6-0	0	6.0	---	---	---	---
B6-1.5	1.5	5.0	---	---	---	---
B7-0	0	62	3.1	---	---	---
B7-1.5	1.5	4.7	---	---	---	---
B8-0	0	28	---	---	---	---
B8-1.5	1.5	30	---	---	---	---
B9-0	0	130	4.7	---	---	---
B9-1.5	1.5	11	---	---	---	---
B10-0	0	28	---	---	---	6.2
B10-1.5	1.5	13	---	---	---	---
B11-0	0	31	---	---	---	---
B11-1.5	1.5	<5.0	---	---	---	---
B12-0	0	11	---	---	---	---
B12-1.5	1.5	8.5	---	---	---	---
B13-0	0	32	---	---	---	---
B13-1.5	1.5	5.9	---	---	---	---
B14-0	0	22	---	---	---	---
B14-1.5	1.5	5.7	---	---	---	7.5
B15-0	0	69	2.4	---	---	---
B15-1.5	1.5	6.1	---	---	---	---
B16-0	0	68	2.2	---	---	---
B16-1.5	1.5	<5.0	---	---	---	---

TABLE 2
Summary of Lead and pH Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B17-0	0	40	---	---	---	---
B17-1.5	1.5	5.9	---	---	---	---
B18-0	0	23	---	---	---	---
B18-1.5	1.5	5.2	---	---	---	---
B19-0	0	34	---	---	---	5.9
B19-1.5	1.5	4.8	---	---	---	---
B20-0	0	21	---	---	---	---
B20-1.5	1.5	<5.0	---	---	---	---
B21-0	0	78	3.0	---	---	---
B21-1.5	1.5	<5.0	---	---	---	---
B22-0	0	92	4.7	---	---	---
B22-1.5	1.5	5.3	---	---	---	---
B23-0	0	10	---	---	---	---
B23-1.5	1.5	6.6	---	---	---	---
B24-0	0	7.0	---	---	---	---
B24-1.5	1.5	7.0	---	---	---	---
B25-0	0	12	---	---	---	---
B25-1.5	1.5	<5.0	---	---	---	---
B26-0	0	15	---	---	---	---
B26-1.5	1.5	5.0	---	---	---	---
B27-0	0	17	---	---	---	---
B27-1.5	1.5	6.6	---	---	---	---
B28-0	0	17	---	---	---	5.8
B28-1.5	1.5	7.9	---	---	---	---
B29-0	0	12	---	---	---	---
B29-1.5	1.5	<5.0	---	---	---	---
B30-0	0	36	---	---	---	---
B30-1.5	1.5	5.3	---	---	---	---
B31-0	0	<5.0	---	---	---	---
B31-1.5	1.5	6.6	---	---	---	---
B32-0	0	22	---	---	---	---
B32-1.5	1.5	6.0	---	---	---	6.9

TABLE 2
Summary of Lead and pH Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B33-0	0	40	---	---	---	---
B33-1.5	1.5	<5.0	---	---	---	---
B34-0	0	36	---	---	---	---
B34-1.5	1.5	<5.0	---	---	---	---
B35-0	0	23	---	---	---	---
B35-1.5	1.5	5.8	---	---	---	---
B36-0	0	34	---	---	---	---
B36-1.5	1.5	5.3	---	---	---	---
B37-0	0	34	---	---	---	6.6
B37-1.5	1.5	6.7	---	---	---	---
B38-0	0	<5.0	---	---	---	---
B38-1	1	<5.0	---	---	---	---
B38-2	2	<5.0	---	---	---	---
B39-0	0	8.4	---	---	---	---
B39-1	1	6.5	---	---	---	---
B39-2	2	<5.0	---	---	---	---
B40-0	0	12	---	---	---	---
B40-1	1	6.6	---	---	---	---
B40-2	2	5.5	---	---	---	---
B41-0	0	24	---	---	---	---
B41-1	1	21	---	---	---	7.2
B41-2	2	18	---	---	---	---
B42-0	0	11	---	---	---	---
B42-1	1	5.8	---	---	---	---
B42-2	2	9.7	---	---	---	---
B43-0	0	24	---	---	---	---
B43-1	1	19	---	---	---	7.3
B43-2	2	<5.0	---	---	---	---
B44-0	0	34	---	---	---	---
B44-1	1	12	---	---	---	---
B44-2	2	5.1	---	---	---	---
B45-0	0	17	---	---	---	---
B45-1	1	7.5	---	---	---	---
B45-2	2	5.9	---	---	---	---

TABLE 2
Summary of Lead and pH Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B46-0	0	110	4.6	---	---	6.6
B46-1	1	5.6	---	---	---	---
B46-2	2	8.9	---	---	---	---
B47-0	0	29	---	---	---	---
B47-1	1	7.7	---	---	---	---
B47-2	2	5.1	---	---	---	---
B48-0	0	39	---	---	---	---
B48-1	1	60	3.6	---	---	---
B48-2	2	13	---	---	---	---
B49-0	0	<5.0	---	---	---	---
B49-1	1	52	0.77	---	---	---
B49-2	2	8.0	---	---	---	---
B50-0	0	48	---	---	---	---
B50-1	1	16	---	---	---	6.1
B50-2	2	<5.0	---	---	---	---
B51-0	0	8.4	---	---	---	---
B51-1	1	7.8	---	---	---	---
B51-2	2	<5.0	---	---	---	---
B52-0	0	8.7	---	---	---	---
B52-1	1	<5.0	---	---	---	---
B52-2	2	10	---	---	---	---
B53-0	0	33	---	---	---	---
B53-1	1	5.0	---	---	---	---
B53-2	2	5.8	---	---	---	6.8
B54-0	0	11	---	---	---	---
B54-1	1	7.6	---	---	---	---
B54-2	2	8.8	---	---	---	---
B55-0	0	<5.0	---	---	---	6.4
B55-1	1	6.5	---	---	---	---
B55-2	2	<5.0	---	---	---	---
B56-0	0	5.6	---	---	---	---
B56-1	1	<5.0	---	---	---	---
B56-2	2	<5.0	---	---	---	---
B57-0	0	8.4	---	---	---	---
B57-1	1	5.3	---	---	---	---

TABLE 2
Summary of Lead and pH Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B57-2	2	5.3	---	---	---	---
B58-0	0	11	---	---	---	---
B58-1	1	6.7	---	---	---	---
B58-2	2	<5.0	---	---	---	---
B59-0	0	8.3	---	---	---	7.3
B59-1	1	11	---	---	---	---
B59-2	2	6.3	---	---	---	---
B60-0	0	11	---	---	---	---
B60-1	1	8.8	---	---	---	---
B60-2	2	6.7	---	---	---	---
B61-0	0	8.3	---	---	---	---
B61-1	1	7.4	---	---	---	---
B62-0	0	13	---	---	---	---
B62-1	1	22	---	---	---	---
B62-2	2	12	---	---	---	---
B63-0	0	5.9	---	---	---	---
B63-1	1	5.1	---	---	---	---
B63-2	2	8.9	---	---	---	8.0
B64-0	0	130	7.0	<0.25	<0.25	
B64-1	1	13	---	---	---	7.1
B64-2	2	5.3	---	---	---	---
B65-0	0	300	19	0.26	0.43	---
B65-1	1	120	6.4	<0.25	<0.25	---
B66-0	0	280	14	<0.25	0.55	6.4
B66-1	1	73	6.6	<0.25	---	---
B66-2	2	86	3.2	---	---	---
B67-0	0	310	13	0.47	<0.25	---
B67-1	1	110	7.0	<0.25	<0.25	---
B68-0	0	130	8.1	<0.25	<0.25	---
B68-1	1	110	4.7	---	---	---
B69-0	0	110	5.9	<0.25	<0.25	---
B69-1	1	77	5.1	<0.25	---	---
B69-2	2	88	3.6	---	---	8.3

TABLE 2
Summary of Lead and pH Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B70-0	0	100	7.4	<0.25	0.27	---
B70-1	1	300	22	2.2	0.58	---
B70-2	2	40	---	---	---	---
B71-0	0	150	7.3	0.35	0.43	---
B71-1	1	6.9	---	---	---	---
B71-2	2	<5.0	---	---	---	---
B72-0	0	15	---	---	---	---
B72-1	1	6.0	---	---	---	---
B72-2	2	9.8	---	---	---	---
B73-0	0	580	37	1.4	1.0	---
B73-1	1	29	---	---	---	---
B73-2	2	22	---	---	---	---
B74-0	0	420	31	1.6	0.45	---
B74-1	1	7.1	---	---	---	---
B74-2	2	6.3	---	---	---	7.0
B75-0	0	21	---	---	---	---
B75-1	1	160	12	<0.25	0.40	---
B75-2	2	27	---	---	---	---
B76-1	1	8.1	---	---	---	---
B76-4	4	6.2	---	---	---	---
B77-1	1	7.4	---	---	---	7.9
B77-4	4	6.5	---	---	---	---

Notes:

mg/kg = Milligrams per kilogram
mg/l = Milligrams per liter
WET = Waste Extraction Test using citric acid as the extraction fluid
DI-WET = WET using deionized water as the extraction fluid
TCLP = Toxicity Characteristic Leaching Procedure
--- = Not analyzed
<5.0 = Analyte was not detected above the laboratory reporting limit

TABLE 3
Summary of CAM17 Metals Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
B1-0	0	<2.0	<1.0	180	<1.0	<1.0	42	19	28	25	<1.0	57	<1.0	<1.0	<1.0	34	93	0.11
B2-1.5	1.5	<2.0	3.4	110	<1.0	<1.0	66 *0.13*	16	20	7.8	<1.0	93	<1.0	<1.0	<1.0	44	41	0.26
B5-0	0	<2.0	3.1	160	<1.0	<1.0	36	11	29	22	<1.0	38	<1.0	<1.0	<1.0	40	77	<0.10
B7-1.5	1.5	<2.0	1.3	78	<1.0	<1.0	19	3.2	9.0	4.7	<1.0	14	<1.0	<1.0	<1.0	19	19	<0.10
B9-0	0	<2.0	<1.0	170	<1.0	1.2	84 *0.17*	13	40	130	<1.0	89	<1.0	<1.0	<1.0	44	170	0.26
B13-0	0	<2.0	<1.0	110	<1.0	<1.0	21	5.8	10	32	<1.0	13	<1.0	<1.0	<1.0	22	43	<0.10
B15-1.5	1.5	<2.0	<1.0	99	<1.0	<1.0	90 *0.18*	16	9.2	6.1	<1.0	80	<1.0	<1.0	<1.0	19	17	<0.10
B17-0	0	<2.0	5.1	180	<1.0	<1.0	23	6.3	11	40	<1.0	28	<1.0	<1.0	<1.0	19	39	0.27
B19-1.5	1.5	<2.0	<1.0	130	<1.0	<1.0	23	18	7.3	4.8	<1.0	14	<1.0	<1.0	<1.0	28	19	<0.10
B21-0	0	<2.0	<1.0	140	<1.0	<1.0	110 *0.84*	15	22	78	<1.0	87	<1.0	<1.0	<1.0	30	94	<0.10
B23-1.5	1.5	<2.0	1.6	130	<1.0	<1.0	61 *0.14*	25	10	6.6	<1.0	56	<1.0	<1.0	<1.0	42	20	<0.10
B25-0	0	<2.0	<1.0	110	<1.0	<1.0	37	8.5	17	12	<1.0	43	<1.0	<1.0	<1.0	43	38	<0.10
B27-1.5	1.5	<2.0	3.7	91	<1.0	<1.0	53 *0.11*	2.4	9.0	6.6	<1.0	27	<1.0	<1.0	<1.0	36	17	<0.10

TABLE 3
Summary of CAM17 Metals Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
B29-0	0.0	<2.0	<1.0	150	<1.0	<1.0	59 *0.61*	15	29	12	<1.0	61	<1.0	<1.0	<1.0	31	82	<0.10
B33-0	0	<2.0	<1.0	140	<1.0	<1.0	90 *0.29*	20	23	40	<1.0	64	<1.0	<1.0	<1.0	46	270	0.11
B35-1.5	1.5	<2.0	<1.0	160	<1.0	<1.0	58 *0.075*	15	14	5.8	<1.0	36	<1.0	<1.0	<1.0	38	26	0.31
B37-0	0	<2.0	<1.0	210	<1.0	<1.0	37	11	24	34	<1.0	53	<1.0	<1.0	<1.0	28	68	<0.10
B39-1	1	<2.0	1.6	110	<1.0	<1.0	47	8.8	17	6.5	<1.0	50	<1.0	<1.0	<1.0	24	35	0.12
B41-0	0	<2.0	<1.0	260	<1.0	<1.0	73 *0.15*	13	33	24	<1.0	89	<1.0	<1.0	<1.0	35	49	0.11
B42-2	2	<2.0	1.6	33	<1.0	<1.0	5.9	2.7	46	10	<1.0	11	<1.0	<1.0	<1.0	17	15	<0.10
B43-1	1	<2.0	1.9	240	<1.0	<1.0	22	16	41	19	<1.0	43	<1.0	<1.0	<1.0	18	51	<0.10
B45-1	1	<2.0	1.1	110	<1.0	<1.0	50 *0.10*	12	7.2	7.5	<1.0	41	<1.0	<1.0	<1.0	25	25	<0.10
B47-0	0	<2.0	<1.0	89	<1.0	<1.0	34	11	20	29	<1.0	42	<1.0	<1.0	<1.0	29	73	<0.10
B49-2	2	<2.0	<1.0	82	<1.0	<1.0	280 *0.18*	19	21	8.0	<1.0	260	<1.0	<1.0	<1.0	25	36	<0.10
B51-1	1	<2.0	3.0	140	<1.0	<1.0	28	8.7	8.5	7.8	<1.0	28	<1.0	<1.0	<1.0	19	20	<0.10
B52-2	2	<2.0	1.5	130	<1.0	<1.0	83 *0.062*	24	12	10	<1.0	57	<1.0	<1.0	<1.0	66	20	<0.10
B53-0	0	<2.0	11	120	<1.0	<1.0	45	10	10	33	<1.0	46	<1.0	<1.0	<1.0	28	36	<0.10

TABLE 3
Summary of CAM17 Metals Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
B54-2	2	<2.0	1.5	110	<1.0	<1.0	40	9.3	8.7	8.8	<1.0	41	<1.0	<1.0	<1.0	26	24	<0.10
B55-1	1	<2.0	<1.0	140	<1.0	<1.0	47	11	11	6.5	<1.0	49	<1.0	<1.0	<1.0	34	24	<0.10
B57-0	0	<2.0	1.2	120	<1.0	<1.0	47	10	10	8.4	<1.0	47	<1.0	<1.0	<1.0	28	32	0.39
B59-1	1	<2.0	<1.0	110	<1.0	<1.0	47	16	14	11	<1.0	52	<1.0	<1.0	<1.0	42	32	0.17
B60-1	1	<2.0	1.9	190	<1.0	<1.0	45	8.9	9.4	8.8	<1.0	41	<1.0	<1.0	<1.0	30	33	<0.10
B63-2	2	<2.0	<1.0	94	<1.0	<1.0	48	23	6.8	8.9	<1.0	52	<1.0	<1.0	<1.0	27	32	<0.10
B64-1	1	<2.0	<1.0	100	<1.0	<1.0	160 *0.13*	38	24	13	<1.0	170	<1.0	<1.0	<1.0	97	38	0.23
B66-2	2	<2.0	<1.0	130	<1.0	<1.0	89 *0.20*	24	24	86	<1.0	75	<1.0	<1.0	<1.0	63	100	0.24
B68-1	1	<2.0	<1.0	100	<1.0	1.1	94 *0.27*	22	31	110	<1.0	90	<1.0	<1.0	<1.0	72	120	0.39
B69-0	0	<2.0	<1.0	150	<1.0	<1.0	65 *0.38*	13	34	110	<1.0	80	<1.0	<1.0	<1.0	45	230	0.16
B71-1	1	<2.0	<1.0	130	<1.0	<1.0	40	10	9.8	6.9	<1.0	41	<1.0	<1.0	<1.0	28	28	<0.10
B73-2	2	<2.0	<1.0	170	<1.0	<1.0	26	10	21	22	<1.0	29	<1.0	<1.0	<1.0	42	54	<0.10
B75-0	0	<2.0	<1.0	95	<1.0	<1.0	42	12	23	21	<1.0	68	<1.0	<1.0	<1.0	43	110	0.34
B76-1	1	<2.0	<1.0	130	<1.0	<1.0	55 *0.074*	12	14	8.1	<1.0	44	<1.0	<1.0	<1.0	44	32	<0.10

TABLE 3
Summary of CAM17 Metals Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
B76-4	4	<2.0	<1.0	120	<1.0	<1.0	40	10	9.5	6.2	<1.0	36	<1.0	<1.0	<1.0	32	26	<0.10
B77-1	1	<2.0	<1.0	170	<1.0	<1.0	59	13	23	7.4	<1.0	85	<1.0	<1.0	<1.0	39	44	<0.10
							0.064											
B77-4	4	<2.0	1.4	310	<1.0	<1.0	35	11	28	6.5	<1.0	57	<1.0	<1.0	<1.0	25	30	<0.10
ESLs																		
Residential Land Use		6.3	0.39	750	4.0	1.7	750	40	230	200	40	150	10	20	1.3	16	600	1.3
Comm/Ind Land Use		40	16	1500	8.0	7.4	750	80	230	750	40	150	10	40	16	200	600	10
Construction Exposure		310	15	2,600	98	39	1,200,000	94	310,000	750	78	260	3,900	3,900	62	770	230,000	58

Notes:

Results are shown in milligrams per kilogram (mg/kg).

Values listed for chromium are for Chromium III, as there is no standard for total chromium.

Italics = Values listed in italics are results for chromium using the waste extraction test (WET)

< = Analyte was not detected above the laboratory reporting limit.

ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, Revised May 2008.

TABLE 4
Summary of Organics Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (µg/kg)	MTBE (µg/kg)
B1-0	0	<1.0	47	250	ND	<5.0
B2-0	0	<1.0	100	1,000	ND	<5.0
B3-0	0	<1.0	31	230	ND	<5.0
B4-0	0	<1.0	160	1,200	ND	<5.0
B5-0	0	<1.0	82	720	ND	<5.0
B6-0	0	<1.0	2.3	22	ND	<5.0
B7-0	0	<1.0	26	340	ND	<5.0
B8-0	0	<1.0	470	3,200	ND	<5.0
B9-0	0	<1.0	160	1,200	ND	<5.0
B10-0	0	<1.0	13	91	ND	<5.0
B11-0	0	<1.0	4.6	42	ND	<5.0
B12-0	0	<1.0	9.3	44	ND	<5.0
B13-0	0	<1.0	7.7	69	ND	<5.0
B14-0	0	<1.0	4.3	28	ND	<5.0
B15-0	0	<1.0	19	100	ND	<5.0
B16-0	0	<1.0	15	74	ND	<5.0
B17-0	0	<1.0	10	58	ND	<5.0
B18-0	0	<1.0	11	59	ND	<5.0
B19-0	0	<1.0	6.2	42	ND	<5.0
B20-0	0	<1.0	6.8	40	ND	<5.0
B21-0	0	<1.0	23	98	ND	<5.0
B22-0	0	<1.0	27	110	ND	<5.0
B23-0	0	<1.0	4.3	21	ND	<5.0
B24-0	0	<1.0	160	1,300	ND	<5.0
B25-0	0	<1.0	6.4	38	ND	<5.0
B26-0	0	<1.0	6.6	32	ND	<5.0
B27-0	0	<1.0	2.7	26	ND	<5.0
B28-0	0	<1.0	8.9	74	ND	<5.0
B29-0	0	<1.0	16	350	ND	<5.0
B30-0	0	<1.0	6.2	46	ND	<5.0
B31-0	0	<1.0	8.7	50	ND	<5.0
B32-0	0	<1.0	8.8	65	ND	<5.0
B33-0	0	<1.0	2.9	41	ND	<5.0
B34-0	0	<1.0	5.8	42	ND	<5.0
B35-0	0	<1.0	3.2	20	ND	<5.0
B36-0	0	<1.0	13	48	ND	<5.0
B37-0	0	<1.0	7.7	42	ND	<5.0

TABLE 4
Summary of Organics Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (µg/kg)	MTBE (µg/kg)
B76-1	1	<1.0	<1.0	5.2	ND	<5.0
B77-1	1	<1.0	2.4	5.2	ND	<5.0
	ESLs					
	Residential	83	83	370	---	23
	Commercial/Industrial	83	83	2,500	---	23
	Construction Exposure	4,200	4,200	12,000	---	2.8E+06

Notes:

mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
ND = Not detected above laboratory reporting limit
BTEX = Benzene, toluene, ethylbenzene, and xylenes
MTBE = Methyl-tert-butyl ether
TPHg = Total Petroleum Hydrocarbons (TPH) as gasoline
TPHd = TPH as diesel
TPHmo = TPH as motor oil
--- = Not Analyzed or Not Applicable
< = Not detected above the stated laboratory reporting limit
ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, May 2008.

TABLE 5
Summary of Pesticides Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (ft)	4,4'-DDD	4,4'-DDE	4,4'-DDT	alpha-Chlordane	Chlordane	gamma-Chlordane	Other Pesticides
B1-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B2-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B3-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B4-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B5-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B6-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B7-0	0	<2.0	<2.0	<2.0	<1.0	8.8	<1.0	ND
B8-0	0	<2.0	<2.0	<2.0	<2.0	<8.5	<2.0	ND
B9-0	0	<2.0	<2.0	4.0	1.4	12	1.6	ND
B10-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B11-0	0	<2.0	11	3.5	<1.0	<8.5	<1.0	ND
B12-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B13-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B14-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B15-0	0	26	320	17	<1.0	<8.5	<1.0	ND
B16-0	0	<2.0	59	<2.0	<1.0	<8.5	<1.0	ND
B17-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B18-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B19-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B20-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B21-0	0	<2.0	2.0	<2.0	<1.0	<8.5	<1.0	ND
B22-0	0	<2.0	7.3	<2.0	<1.0	<8.5	<1.0	ND
B23-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B24-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B25-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B26-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B27-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B28-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B29-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B30-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B31-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B32-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B33-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B34-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B35-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B36-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B37-0	0	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B76-1	1	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
B77-1	1	<2.0	<2.0	<2.0	<1.0	<8.5	<1.0	ND
ESLs								
Residential		2,400	1,700	1,700	---	440	---	---
Commercial/Industrial		10,000	4,000	4,000	---	1,700	---	---
Construction Exposure		120,000	87,000	87,000	---	21,000	---	---

Notes:

µg/kg Data are shown in units of micrograms per kilogram (µg/kg)

ND = Not detected above laboratory reporting limit

--- = Not Analyzed or Not Applicable

< = Not detected above the stated laboratory reporting limit

ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, May 2008.

TABLE 6
Summary of NOA Results
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Sample ID	Sample Depth (feet)	Asbestos Content (% dry weight)
B2-1.5	1.5	None Detected
B7-1.5	1.5	None Detected
B15-1.5	1.5	None Detected
B19-1.5	1.5	None Detected
B23-1.5	1.5	None Detected
B27-1.5	1.5	None Detected
B31-1.5	1.5	None Detected
B35-1.5	1.5	None Detected
B39-1	1.0	None Detected
B43-1	1.0	None Detected
B49-2	2.0	None Detected
B52-2	2.0	None Detected
B55-1	1.0	None Detected
B63-2	2.0	None Detected
B64-1	1.0	None Detected
B68-1	1.0	None Detected
B71-1	1.0	None Detected
B77-1	1.0	None Detected

TABLE 7a
Summary of Lead Statistical Analysis
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Bike Lane (borings B1-B18, B48-B53, B55, B57, B59, and B61)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	37.1	39.2
1.0 to 1.5 feet	25.2	27.5
1.5 to 2.0 feet	10.2	10.8
2.0 to 2.5 feet	10.7	11.4

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	25	1.5	28
Underlying Soil (1.0 to 2.5 feet)	*15*	*0.9*	*17*
0 to 2.0 feet	27	1.7	29
Underlying Soil (2.0 to 2.5 feet)	*11*	*0.7*	*11*
0 to 2.5 feet	24	1.5	26

Notes:

Weighted average values are based upon calculated UCLs for each depth interval.

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y =$ 0.0611 x

TABLE 7b
Summary of Lead Statistical Analysis
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Frontage Road along Northbound SR-101 (borings B19-B24)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	58.0	62.4
1.5 to 2.0 foot	5.7	6.0

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	58	3.5	62
Underlying Soil (1.0 to 2.0 feet)	*32*	*1.9*	*34*
0 to 2.0 feet	45	2.7	48

Notes:

Weighted average values are based upon calculated UCLs for each depth interval.

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y =$ 0.0611 x

TABLE 7c
Summary of Lead Statistical Analysis
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Northbound ramps (borings B38-B47)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	38.9	42.4
1.0 to 1.5 feet	11.7	12.4
2.0 to 2.5 feet	8.4	8.9

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	39	2.4	42
Underlying Soil (1.0 to 2.5 feet)	*11*	*0.6*	*11*
0 to 2.0 feet	25	1.5	27
Underlying Soil (2.0 to 2.5 feet)	*8.4*	*0.5*	*8.9*
0 to 2.5 feet	22	1.3	25

Notes:
Weighted average values are based upon calculated UCLs for each depth interval.
UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
* = Soluble (WET) lead concentrations are predicted using slope of regression line,
where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y =$ 0.0611 x

TABLE 7d
Summary of Lead Statistical Analysis
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Median (borings B64-B77)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	273.9	287.7
1.0 to 1.5 feet	101.6	109.6
2.0 to 2.5 feet	45.0	49.1

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	274	17	288
Underlying Soil (1.0 to 2.5 feet)	*83*	*5.1*	*89*
0 to 2.0 feet	188	11	199
Underlying Soil (2.0 to 2.5 feet)	*45*	*2.8*	*49*
0 to 2.5 feet	159	9.7	175

Notes:

Weighted average values are based upon calculated UCLs for each depth interval.

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y =$ 0.0611 x

TABLE 7e
Summary of Lead Statistical Analysis
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Southbound ramps (borings B54, B56, B58, B60, B62, and B63)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	11.0	11.5
1.0 to 1.5 feet	12.1	13.1
2.0 to 2.5 feet	8.7	9.3

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	11	0.7	11
Underlying Soil (1.0 to 2.5 feet)	*11*	*0.7*	*12*
0 to 2.0 feet	12	0.7	12
Underlying Soil (2.0 to 2.5 feet)	*8.7*	*0.5*	*9.3*
0 to 2.5 feet	11	0.7	13

Notes:

Weighted average values are based upon calculated UCLs for each depth interval.

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y =$ 0.0611 x

TABLE 7f
Summary of Lead Statistical Analysis
US 101 - Marin Sonoma Narrows Segment B1
Marin County, California

Frontage Road along Southbound SR-101 (borings B25-B37)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	27.2	28.3
1.5 to 2.0 foot	5.7	5.8

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	27	1.7	28
Underlying Soil (1.0 to 2.0 feet)	*16*	*1.0*	*17*
0 to 2.0 feet	22	1.3	23

Notes:

Weighted average values are based upon calculated UCLs for each depth interval.

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y =$ 0.0611 x

APPENDIX A

California Environmental Protection Agency
Department of Toxic Substances Control

VARIANCE

Applicant Names:

State of California
Department of Transportation
(Caltrans)
1120 N Street
Sacramento, California 95814

Variance No. V09HQSCD006

Effective Date: July 1, 2009

Expiration Date: July 1, 2014

Modification History:

Pursuant to California Health and Safety Code, Section 25143, the Department of Toxic Substances Control hereby issues the attached Variance consisting of 9 pages to the Department of Transportation.

Beverly Rikala
Team Leader, Operating Facilities Team
Department of Toxic Substances Control

Date: 6/30/09

1. INTRODUCTION.

a) Pursuant to Health and Safety Code, section 25143, the California Department of Toxic Substances Control (DTSC) grants this variance to the applicant below for waste considered to be hazardous solely because of its lead concentrations and as further specified herein.

b) DTSC hereby grants this variance only from the requirements specified herein and only in accordance with all terms and conditions specified herein.

2. IDENTIFYING INFORMATION.

APPLICANT/OWNER/OPERATOR

State of California
Department of Transportation, (Caltrans)
All Districts

3. TYPE OF VARIANCE.

Generation, Manifest, Transportation, Storage and Disposal.

4. ISSUANCE AND EXPIRATION DATES.

DATE ISSUED: July 1, 2009 EXPIRATION DATE: July 1, 2014

5. APPLICABLE STATUTES AND REGULATIONS. The hazardous waste that is the subject of this variance is fully regulated under Health and Safety Code, section 25100, et seq. and California Code of Regulations, title 22, division 4.5 except as specifically identified in Section 8 of this variance.

6. DEFINITION. For purposes of this variance, "lead-contaminated soil(s)" shall mean soil that meets the criteria for hazardous waste but contains less than 3397 mg/kg total lead and is hazardous primarily because of aerially-deposited lead contamination associated with exhaust emissions from the operation of motor vehicles.

7. FINDINGS/DETERMINATIONS. DTSC has determined that the variance applicant meets the requirements set forth in Health and Safety Code, section 25143 for a variance from specific regulatory requirements as outlined in Section 8 of this variance. The specific determinations and findings made by DTSC are as follows:

a) Caltrans intends to excavate, stockpile, transport, bury and cover large volumes of soil associated with highway construction projects. In the more urbanized highway corridors around the State this soil is contaminated with lead, primarily due to historic emissions from automobile exhausts. In situ sampling and laboratory testing has shown that some of the soil contains concentrations of lead in excess of State regulatory thresholds, and thus any generated waste from disturbance of the soil

would be regulated as hazardous waste. Such soil contains a Total Threshold Limit Concentration (TTLC) of 1000 milligrams per kilogram (mg/kg) or more lead and/or it meets or exceeds the Soluble Threshold Limit Concentration (STLC) for lead of 5 milligrams per liter (mg/l). A Human Health Risk Assessment prepared for this variance concludes that soil contaminated with elevated concentrations of lead can be managed in a way that presents no significant risk to human health.

b) The lead-contaminated soil will be placed only in Caltrans' right-of-way. Depending on concentration levels, the wastes will be covered with a minimum thickness of one (1) foot of non-hazardous soil or asphalt/concrete cover and will always be at least five (5) feet above the highest groundwater elevation. Caltrans will assure that proper health and safety procedures will be followed for workers, including any persons engaged in maintenance work in areas where the waste has been buried and covered.

c) DTSC finds and requires that the lead-contaminated soil excavated, stockpiled, transported, buried and covered pursuant to this variance is a non-RCRA hazardous waste, and that the waste management activity is insignificant as a potential hazard to human health and safety and the environment, when managed in accordance with the conditions, limitations and other requirements specified in this variance.

8. PROVISIONS WAIVED.

Provided Caltrans meets the terms and conditions of this variance, DTSC waives the hazardous waste management requirements of Health and Safety Code, Chapter 6.5 and California Code of Regulations, title 22 for the lead-contaminated soil that Caltrans reuses in projects that would require Caltrans to obtain a permit for a disposal facility and any other generator requirements that concern the transportation, manifesting, storage and land disposal of hazardous waste.

9. SPECIFIC CONDITIONS, LIMITATIONS AND OTHER REQUIREMENTS.

In order for the provisions discussed in section 8 to be waived, lead-contaminated soil must not exceed the contaminant concentrations discussed below and Caltrans management practices must meet all the following conditions:

a) Caltrans implementation of this variance shall comply with all applicable state laws and regulations for water quality control, water quality control plans, waste discharge requirements (including storm water permits), and others issued by the State Water Resources Control Board (SWRCB) and/or a California Regional Water Quality Control Board (RWQCB). Caltrans shall provide written notification to the appropriate RWQCB at least 30 days prior to advertisement for bids of projects that involve invocation of this variance, or as otherwise negotiated with the SWRCB or appropriate RWQCB.

b) The waivers in this variance shall only be applied to lead-contaminated soil that is not a RCRA hazardous waste and is hazardous primarily because of aerially-

deposited lead contamination associated with exhaust emissions from the operation of motor vehicles. The variance is not applicable to any other hazardous waste.

c) Soil containing 1.5 mg/l extractable lead or less (based on a modified waste extraction test using deionized water as the extractant) and 1411 mg/kg or less total lead may be used as fill provided that the lead-contaminated soil is placed a minimum of five (5) feet above the maximum historic water table elevation and covered with at least one (1) foot of nonhazardous soil that will be maintained by Caltrans to prevent future erosion.

d) Soil containing 150 mg/L extractable lead or less (based on a modified waste extraction test using deionized water as the extractant) and 3397 mg/kg or less total lead may be used as fill provided that the lead-contaminated soils are placed a minimum of five (5) feet above the maximum historic water table elevation and protected from infiltration by a pavement structure which will be maintained by Caltrans.

e) Lead-contaminated soil with a pH less than 5.5 but greater than 5.0 shall only be used as fill material under the paved portion of the roadway. Lead-contaminated soil with a pH at or less than 5.0 shall be managed as a hazardous waste.

f) For each project that has the potential to generate waste by disturbing lead-contaminated soil (as defined in 6), Caltrans shall conduct sampling and analysis to adequately characterize the soils containing aerially deposited lead in the areas of planned excavation along the project route. Such sampling and analysis shall include the Toxicity Characteristic Leaching Procedure (TCLP) as prescribed by the United States Environmental Protection Agency to determine whether concentrations of contaminants in soil exceed federal criteria for classification as a hazardous waste.

g) Lead-contaminated soil managed pursuant to this variance shall not be moved outside the designated corridor boundaries (see paragraph t) below. All lead-contaminated soil not buried and covered within the same Caltrans corridor where it originated is not eligible for management under this variance and shall be managed as a hazardous waste.

h) Lead-contaminated soil managed pursuant to this variance shall not be placed in areas where it would become in contact with groundwater or surface water (such as streams and rivers).

i) Lead-contaminated soil managed pursuant to this variance shall be buried and covered only in locations that are protected from erosion that may result from storm water run-on and run-off.

j) The lead-contaminated soil shall be buried and covered in a manner that will prevent accidental or deliberate breach of the asphalt, concrete, and/or cover soil.

k) The presence of lead-contaminated soil shall be incorporated into the projects' as-built drawings. The as-built drawings shall be annotated with the location, representative analytical data, and volume of lead-contaminated soil. The as-built drawings shall also state the depth of the cover. These as-built drawings shall be retained by Caltrans.

l) Caltrans shall ensure that no other hazardous wastes, other than the lead-contaminated hazardous waste soil, are placed in the burial areas.

m) Lead-contaminated soil shall not be buried within ten (10) feet of culverts or locations subject to frequent worker exposure.

n) Excavated lead-contaminated soil not placed into the designated area (fill area, roadbed area) by the end of the working day shall be stockpiled and covered with sheets of polyethylene or at least one foot of non-hazardous soil. The lead-contaminated soil, while stockpiled or under transport, shall be protected from contacting surface water and from being dislodged or transported by wind or storm water. The stockpile covers shall be inspected at least once a week and within 24 hours after rainstorms. If the lead-contaminated soil is stockpiled for more than 4 days from the time of excavation, Caltrans shall restrict public access to the stockpile by using barriers that meet the safety requirements of the construction zone. The lead-contaminated soil shall be stockpiled for no more than 90 days from the time the soil is first excavated. If the contaminated soil is stockpiled beyond the 90 day limit Caltrans shall:

1. notify DTSC in writing of the 90 day exceedance and expected date of removal;
2. perform weekly inspections of the stockpiled material to ensure that there is adequate protection from run-on, runoff, public access, and wind dispersion; and
3. notify DTSC on weekly basis of the stockpile status until the stockpile is removed.

The lead-contaminated soil shall be stockpiled for no more than 180 days from the time the soil is first excavated.

o) Caltrans shall ensure that all stockpiling of lead-contaminated soil remains within the project area of the specified corridor. Stockpiling of lead-contaminated soil within the specified corridor, but outside the project area, is prohibited.

p) Caltrans shall conduct confirmatory sampling of any stockpile area in areas not known or expected to contain lead-contaminated soil after removal of the lead-contaminated soil to ensure that contamination has not been left behind or has not migrated from the stockpiled material to the surrounding soils.

q) Caltrans shall stockpile lead-contaminated soil only on high ground (i.e. no sump areas or low points) so that stockpiled soil will not come in contact with surface

water run-on or run-off.

r) Caltrans shall not stockpile lead-contaminated soil in environmentally and ecologically sensitive areas.

s) Caltrans shall ensure that storm/rain run-off that has come into contact with stockpiled lead-contaminated soil will not flow to storm drains, inlets, or waters of the State.

t) Caltrans may dispose of the lead-contaminated soil only within the operating right-of-way of an existing highway, as defined in Streets and Highways Code, section 23. Caltrans may move lead-contaminated soil from one Caltrans project to another Caltrans project only if the lead-contaminated soil remains within the same designated corridor.

Caltrans shall record any movement of lead-contaminated soil by using a bill of lading. The bill of lading must contain: 1) the US DOT description including shipping name, hazard class and ID number; 2) handling codes; 3) quantity of material; 4) volume of material; 5) date of shipment; 6) origin and destination of shipment; and 7) any specific handling instructions. The bill of lading shall be referenced in and kept on file with the project's as-built drawings. The lead-contaminated soil must be kept covered during transportation.

u) For each specific corridor where this variance is to be implemented, all of the following information shall be submitted in writing to DTSC at least five (5) days before construction of any project begins:

1. plan drawing designating the boundaries of the corridor where lead-contaminated soils will be excavated, stockpiled, buried and covered;

2. a list of the Caltrans projects that the corridor encompasses;

3. a list of Caltrans contractors that will be conducting any phase of work on any project affected by this variance;

4. duration of corridor construction;

5. location where sampling and analytical data used to make lead concentration level determinations are kept (e.g. a particular Caltrans project file);

6. name and phone number (including area code) of project resident engineer and project manager;

7. location where Caltrans and contractor health and safety plan and records are kept;

8. location of project special provisions (including page or section number) for soil excavation, transportation, stockpile, burial and placement of cover material;

9. location of project drawings (including drawing page number) for soil excavation, burial and placement of cover in plan and cross section (for example, "The project plans are located at the resident engineer's office located at 5th and Main Streets, City of Fresno, See pages xxxxx of contract xxxx");

10. updated information if a Caltrans project within the corridor is added, changed or deleted; and

11. type of environmental document prepared for each project, date of adoption, document title, Clearing House number and where the document is available for review. A copy of the Caltrans Categorical Exemption, Categorical Exclusion Form, or if filed, the Notice of Exemption for any project shall be submitted to the DTSC Headquarters Project Manager.

v) Changes in location of lead-contaminated soil placement, quantities or protection measures (field changes) shall be noted in the resident engineer's project log within five (5) days of the field change.

w) Caltrans shall ensure that field changes are in compliance with the requirements of this variance.

x) Operational procedures described in the California Environmental Quality Act (CEQA) Special Initial Study shall be followed by Caltrans for activities conducted under this variance.

y) Caltrans shall implement appropriate health and safety procedures to protect its employees and the public, and to prevent or minimize exposure to potentially hazardous wastes. A project-specific health and safety plan must be prepared and implemented. The monitoring and exposure standards shall be based on construction standards for exposure to lead in California Code of Regulations, title 8, section 1532.1.

z) Caltrans shall provide a district Coordinator for this variance. This Coordinator will be the primary point of contact for information flowing to, or received from, DTSC regarding any matter or submission under this variance. Caltrans shall promptly notify DTSC of the name of Coordinator and any change in the Coordinator.

aa) Caltrans shall conduct regular inspections, consistent with Caltrans' Maintenance Division's current Pavement Inspection and Slope Inspection programs, of the locations where lead-contaminated soil has been buried and/or covered pursuant to this variance. If site inspection reveals deterioration of cover so that conditions in the variance are not met, Caltrans shall repair or replace the cover.

bb) Caltrans shall develop and implement a record keeping mechanisms to record and retain permanent records of all locations where lead-contaminated soil has been buried per this variance. The records shall be made available to DTSC.

cc) If areas subject to the terms of this variance are sold, relinquished or abandoned (including roadways), all future property owners shall be notified in writing in advance by Caltrans of the requirements of this variance, and Caltrans shall provide the owner with a copy of the variance. A copy of such a notice shall be sent to DTSC and contain the corridor location and project. Caltrans shall also disclose to DTSC and the new owner the location of areas where lead-contaminated soil has been buried. Future property owners shall be subject to the same requirements as Caltrans.

dd) For the purposes of informing the public about instances where the variance is implemented, Caltrans shall:

1. maintain current fact sheets at all Caltrans resident engineer offices and the Caltrans District office. Caltrans shall make the fact sheets available to anyone expressing an interest in variance-related work.

2. maintain a binder(s) containing copies of all reports submitted to DTSC at the District office. Caltrans shall ensure that the binders are readily accessible to the public.

3. carry out the following actions when it identifies additional projects:

(A) notify the public via a display advertisement in a newspaper of general circulation in that area.

(B) update and distribute the fact sheet to the mailing list and repository locations.

ee) Lead-contaminated soil may be buried only in areas where access is limited or where lead-contaminated soil is covered and contained by a pavement structure.

ff) Dust containing lead-contaminated soil must be controlled. Water or dust palliative may be applied to control dust. If visible dust migration occurs, all excavation, stockpiling and truck loading and burying must be stopped. The granting of this variance confers no relief on Caltrans from compliance with the laws, regulations and requirements enforced by any local air district or the California Air Resources Board.

gg) Sampling and analysis is required to show the lead-contaminated soil meets the variance criteria. All sampling and analysis must be conducted in accordance with the appropriate methods specified in U.S. EPA SW-846.

hh) DTSC retains the right to require Caltrans or any future owner to remove, and properly dispose of, lead-contaminated soil in the event DTSC determines it is necessary for protection of public health, safety or the environment.

ii) DTSC finds that some projects involving lead-contaminated soil are joint projects between Caltrans and other government entities. In these joint projects, Caltrans may not be the lead agency implementing the project although Caltrans is still involved if the project occurs on its right-of-way.

Caltrans may invoke this variance for joint projects where Caltrans and local government entity are involved provided that 1) the project is within the Caltrans Right-of-Way; 2) Caltrans reviews/ oversees all phases of the project including design, contracting, environmental assessment, construction, operation, and maintenance; and 3) Caltrans oversees the project to verify all variance conditions are complied with. Caltrans will be fully responsible for the variance notification and implementation in these joint projects.

jj) All correspondence shall be directed to the following office:

Hazardous Waste Permitting
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

Attn: Caltrans Lead Variance Notification Unit

10. DISCLAIMER.

a) The issuance of this variance does not relieve Caltrans of the responsibility for compliance with Health and Safety Code, chapter 6.5, or the regulations adopted thereunder, and any other laws and regulations other than those specifically identified in Section 8 of this variance. Caltrans is subject to all terms and conditions herein. The granting of this variance confers no relief from compliance with any federal, State or local requirements other than those specifically provided herein.

b) The issuance of this variance does not release Caltrans from any liability associated with the handling of hazardous waste, except as specifically provided herein and subject to all terms and conditions of this variance.

11. VARIANCE MODIFICATION OR REVOCATION. This variance is subject to review at the discretion of DTSC and may be modified or revoked by DTSC upon change of ownership and at any other time pursuant to Health and Safety Code, section 25143.

12. CEQA DETERMINATION. DTSC adopted a Negative Declaration on June 30, 2009.

Approved:

6/30/09
Date

Beverly Rikala
Operating Facilities Team
Department of Toxic Substances Control

APPENDIX B

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Mrn	101	R23.2/27.1	____	____

GEOTECHNICAL PROFESSIONAL DATE

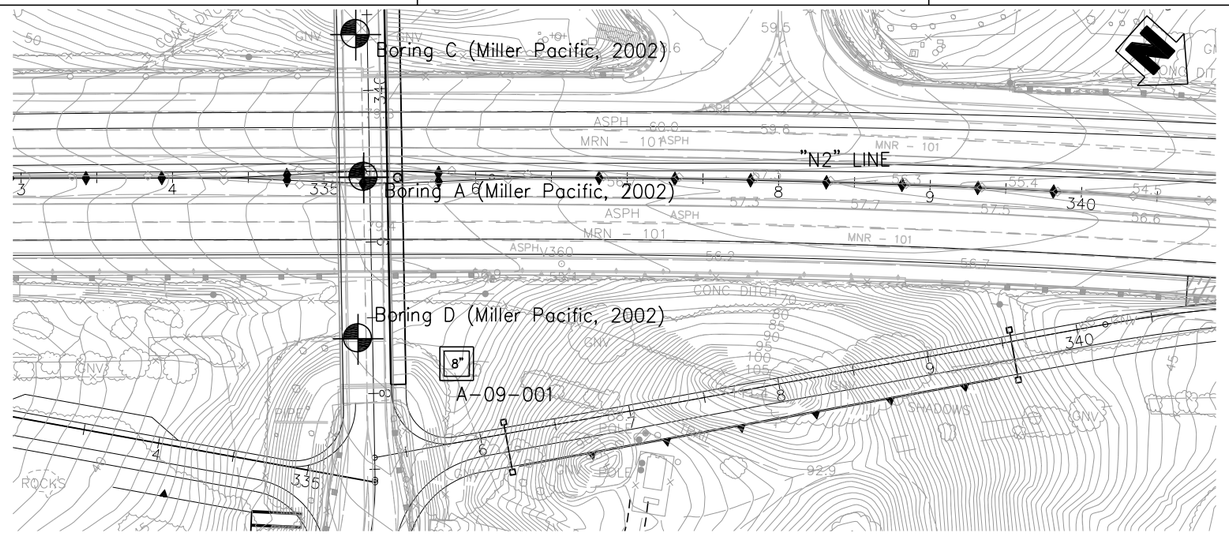
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

DRAFT

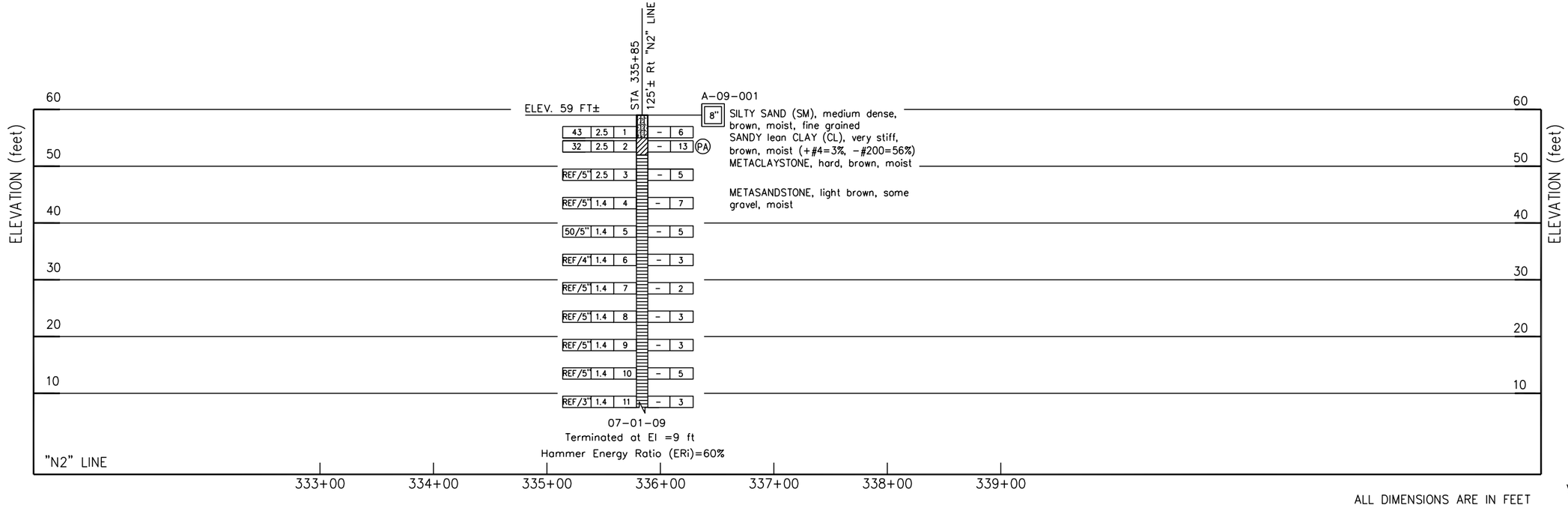


PLAN
1"=50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE SHOWN

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	BRIDGE NO. 27-0115
SIGN OFF DATE	CHECKED BY	P. SIRCAR	DATE: JULY 2009			POST MILES 25.5

REDWOOD LANDFILL OVERCROSSING (WIDEN)
LOG OF TEST BORINGS

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03240
EA 264071

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

USERNAME => $USER
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME
Jan 21, 2010 - 3:02pm S:\ACAD\208140.RLF\LOTB (Foundation Report).dwg
ltron

APPENDIX C

July 13, 2009

Lauren Vigliotti
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
CSDLAC No.: 10196

Workorder No.: 106198

RE: HWY 101- MARIN CO., E8469-06-01

Attention: Lauren Vigliotti

Enclosed are the results for sample(s) received on June 30, 2009 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Project: HWY 101- MARIN CO., E8469-06-01
Lab Order: 106198

CASE NARRATIVE

Analytical Comments for Method 6010

Dilution was necessary for sample 106198-040A, due to sample matrix.

Analytical Comments for Method 8015 (DRO/ORO)

Dilution was necessary for sample 106198-004A, due to sample matrix.

Surrogate recovery was diluted out for samples 106198-004A and 106215-001DMSD.

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 106215-001DMS and 106215-001DMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 106215-001DMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8021

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 106198-027MSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT: Geocon Consultants, Inc.
Project: HWY 101- MARIN CO., E8469-06-01
Project No:
Analyte: Lead

Lab Order: 106198
Date Received 6/30/2009 8:10:00 AM
Matrix: Soil
Analyst: CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106198-002A	B22-0	92	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-003A	B23-0	10	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-004A	B24-0	7.0	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-005A	B21-1.5	ND	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-006A	B22-1.5	5.3	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-008A	B24-1.5	7.0	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-009A	B46-1	5.6	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-010A	B47-1	7.7	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-011A	B42-0	11	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-012A	B43-0	24	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-013A	B44-0	34	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-014A	B45-0	17	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-015A	B46-0	110	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-017A	B42-1	5.8	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-019A	B44-1	12	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-022A	B43-2	ND	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-023A	B44-2	5.1	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-024A	B45-2	5.9	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106198
Project:	HWY 101- MARIN CO., E8469-06-01	**Date Received**	6/30/2009 8:10:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106198-025A	B46-2	8.9	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-026A	B47-2	5.1	mg/Kg	56372	5.0	1	6/29/2009	7/7/2009
106198-029A	B71-2	ND	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-030A	B64-0	130	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-031A	B65-0	300	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-032A	B66-0	280	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-033A	B67-0	310	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-034A	B68-0	130	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-036A	B70-0	100	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-037A	B71-0	150	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-038A	B64-2	5.3	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-041A	B65-1	120	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-042A	B66-1	73	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-043A	B67-1	110	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-045A	B69-1	77	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-046A	B70-1	300	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-048A	B69-2	88	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009
106198-049A	B70-2	40	mg/Kg	56373	5.0	1	6/29/2009	7/7/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

pH
EPA 9045C

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106198
Project:	HWY 101- MARIN CO., E8469-06-01	**Date Received**	6/30/2009 8:10:00 AM
Project No:		**Matrix:**	Soil
Analyte:	pH	**Analyst:**	DDL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106198-015A	B46-0	6.6	pH Units	R110541	0.10	1	6/29/2009	7/7/2009
106198-018A	B43-1	7.3	pH Units	R110541	0.10	1	6/29/2009	7/7/2009
106198-027A	B77-1	7.9	pH Units	R110541	0.10	1	6/29/2009	7/7/2009
106198-032A	B66-0	6.4	pH Units	R110541	0.10	1	6/29/2009	7/7/2009
106198-040A	B64-1	7.1	pH Units	R110541	0.10	1	6/29/2009	7/7/2009
106198-048A	B69-2	8.3	pH Units	R110541	0.10	1	6/29/2009	7/7/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B21-0
Lab Order: 106198 **Collection Date:** 6/29/2009 8:51:00 AM
Project: HWY 101- MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106198-001A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 01:05 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Barium	140	1.0		mg/Kg	1	7/11/2009 01:05 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Chromium	110	1.0		mg/Kg	1	7/11/2009 01:05 PM
Cobalt	15	1.0		mg/Kg	1	7/11/2009 01:05 PM
Copper	22	2.0		mg/Kg	1	7/11/2009 01:05 PM
Lead	78	1.0		mg/Kg	1	7/11/2009 01:05 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Nickel	87	1.0		mg/Kg	1	7/11/2009 01:05 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 01:05 PM
Vanadium	30	1.0		mg/Kg	1	7/11/2009 01:05 PM
Zinc	94	1.0		mg/Kg	1	7/11/2009 01:05 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090706A	QC Batch: 56324			PrepDate: 7/1/2009	Analyst: **CBR**	
DRO	23	1.0		mg/Kg	1	7/6/2009 09:25 PM
ORO	98	1.0		mg/Kg	1	7/6/2009 09:25 PM
Surr: p-Terphenyl	66.1	30-130		%REC	1	7/6/2009 09:25 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
4,4´-DDE	2.0	2.0		µg/Kg	1	7/8/2009 02:39 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 02:39 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-001A

Client Sample ID: B21-0
Collection Date: 6/29/2009 8:51:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate:	7/7/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 02:39 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 02:39 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 02:39 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 02:39 PM
Surr: Decachlorobiphenyl	47.4	20-142		%REC	1	7/8/2009 02:39 PM
Surr: Tetrachloro-m-xylene	42.9	25-115		%REC	1	7/8/2009 02:39 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate:	7/2/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:09 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-002A

Client Sample ID: B22-0
Collection Date: 6/29/2009 8:51:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090706A	QC Batch: 56324			PrepDate: 7/1/2009		Analyst: **CBR**
DRO	27	1.0		mg/Kg	1	7/6/2009 09:43 PM
ORO	110	1.0		mg/Kg	1	7/6/2009 09:43 PM
Surr: p-Terphenyl	56.7	30-130		%REC	1	7/6/2009 09:43 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
4,4´-DDE	7.3	2.0		µg/Kg	1	7/8/2009 02:53 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 02:53 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 02:53 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 02:53 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 02:53 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 02:53 PM
Surr: Decachlorobiphenyl	47.7	20-142		%REC	1	7/8/2009 02:53 PM
Surr: Tetrachloro-m-xylene	39.1	25-115		%REC	1	7/8/2009 02:53 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-003A

Client Sample ID: B23-0
Collection Date: 6/29/2009 8:51:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090706A	QC Batch: 56324			PrepDate: 7/1/2009	Analyst: **CBR**	
DRO	4.3	1.0		mg/Kg	1	7/6/2009 09:07 PM
ORO	21	1.0		mg/Kg	1	7/6/2009 09:07 PM
Surr: p-Terphenyl	66.2	30-130		%REC	1	7/6/2009 09:07 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 03:08 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 03:08 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 03:08 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 03:08 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 03:08 PM
Surr: Decachlorobiphenyl	52.9	20-142		%REC	1	7/8/2009 03:08 PM
Surr: Tetrachloro-m-xylene	47.9	25-115		%REC	1	7/8/2009 03:08 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-004A

Client Sample ID: B24-0
Collection Date: 6/29/2009 9:37:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090706A	QC Batch: 56324			PrepDate: 7/1/2009		Analyst: **CBR**
DRO	160	20		mg/Kg	10	7/6/2009 10:11 PM
ORO	1300	20		mg/Kg	10	7/6/2009 10:11 PM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/6/2009 10:11 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 03:22 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 03:22 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 03:22 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 03:22 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 03:22 PM
Surr: Decachlorobiphenyl	36.5	20-142		%REC	1	7/8/2009 03:22 PM
Surr: Tetrachloro-m-xylene	38.6	25-115		%REC	1	7/8/2009 03:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-005A

Client Sample ID: B21-1.5
Collection Date: 6/29/2009 8:57:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	6/30/2009 08:49 PM
Surr: Bromofluorobenzene (FID)	114	59-145		%REC	1	6/30/2009 08:49 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	6/30/2009 08:49 PM
Ethylbenzene	ND	5.0		µg/Kg	1	6/30/2009 08:49 PM
m,p-Xylene	ND	10		µg/Kg	1	6/30/2009 08:49 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	6/30/2009 08:49 PM
o-Xylene	ND	5.0		µg/Kg	1	6/30/2009 08:49 PM
Toluene	ND	5.0		µg/Kg	1	6/30/2009 08:49 PM
Surr: Bromofluorobenzene (PID)	108	65-140		%REC	1	6/30/2009 08:49 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-006A

Client Sample ID: B22-1.5
Collection Date: 6/29/2009 8:57:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	6/30/2009 09:04 PM
Surr: Bromofluorobenzene (FID)	102	59-145		%REC	1	6/30/2009 09:04 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	6/30/2009 09:04 PM
Ethylbenzene	ND	5.0		µg/Kg	1	6/30/2009 09:04 PM
m,p-Xylene	ND	10		µg/Kg	1	6/30/2009 09:04 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	6/30/2009 09:04 PM
o-Xylene	ND	5.0		µg/Kg	1	6/30/2009 09:04 PM
Toluene	ND	5.0		µg/Kg	1	6/30/2009 09:04 PM
Surr: Bromofluorobenzene (PID)	95.2	65-140		%REC	1	6/30/2009 09:04 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-007A

Client Sample ID: B23-1.5
Collection Date: 6/29/2009 8:57:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 01:10 PM
Arsenic	1.6	1.0		mg/Kg	1	7/11/2009 01:10 PM
Barium	130	1.0		mg/Kg	1	7/11/2009 01:10 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 01:10 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 01:10 PM
Chromium	61	1.0		mg/Kg	1	7/11/2009 01:10 PM
Cobalt	25	1.0		mg/Kg	1	7/11/2009 01:10 PM
Copper	10	2.0		mg/Kg	1	7/11/2009 01:10 PM
Lead	6.6	1.0		mg/Kg	1	7/11/2009 01:10 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 01:10 PM
Nickel	56	1.0		mg/Kg	1	7/11/2009 01:10 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 01:10 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 01:10 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 01:10 PM
Vanadium	42	1.0		mg/Kg	1	7/11/2009 01:10 PM
Zinc	20	1.0		mg/Kg	1	7/11/2009 01:10 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	6/30/2009 09:20 PM
Surr: Bromofluorobenzene (FID)	109	59-145		%REC	1	6/30/2009 09:20 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	6/30/2009 09:20 PM
Ethylbenzene	ND	5.0		µg/Kg	1	6/30/2009 09:20 PM
m,p-Xylene	ND	10		µg/Kg	1	6/30/2009 09:20 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	6/30/2009 09:20 PM
o-Xylene	ND	5.0		µg/Kg	1	6/30/2009 09:20 PM
Toluene	ND	5.0		µg/Kg	1	6/30/2009 09:20 PM
Surr: Bromofluorobenzene (PID)	104	65-140		%REC	1	6/30/2009 09:20 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B23-1.5
Lab Order:	106198	**Collection Date:**	6/29/2009 8:57:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-007A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009		Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:11 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-008A

Client Sample ID: B24-1.5
Collection Date: 6/29/2009 9:41:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	6/30/2009 09:35 PM
Surr: Bromofluorobenzene (FID)	98.5	59-145		%REC	1	6/30/2009 09:35 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	6/30/2009 09:35 PM
Ethylbenzene	ND	5.0		µg/Kg	1	6/30/2009 09:35 PM
m,p-Xylene	ND	10		µg/Kg	1	6/30/2009 09:35 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	6/30/2009 09:35 PM
o-Xylene	ND	5.0		µg/Kg	1	6/30/2009 09:35 PM
Toluene	ND	5.0		µg/Kg	1	6/30/2009 09:35 PM
Surr: Bromofluorobenzene (PID)	93.3	65-140		%REC	1	6/30/2009 09:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-016A

Client Sample ID: B47-0
Collection Date: 6/29/2009 11:28:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 01:15 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Barium	89	1.0		mg/Kg	1	7/11/2009 01:15 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Chromium	34	1.0		mg/Kg	1	7/11/2009 01:15 PM
Cobalt	11	1.0		mg/Kg	1	7/11/2009 01:15 PM
Copper	20	2.0		mg/Kg	1	7/11/2009 01:15 PM
Lead	29	1.0		mg/Kg	1	7/11/2009 01:15 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Nickel	42	1.0		mg/Kg	1	7/11/2009 01:15 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 01:15 PM
Vanadium	29	1.0		mg/Kg	1	7/11/2009 01:15 PM
Zinc	73	1.0		mg/Kg	1	7/11/2009 01:15 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009		Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:13 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-018A

Client Sample ID: B43-1
Collection Date: 6/29/2009 11:08:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 01:20 PM
Arsenic	1.9	1.0		mg/Kg	1	7/11/2009 01:20 PM
Barium	240	1.0		mg/Kg	1	7/11/2009 01:20 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 01:20 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 01:20 PM
Chromium	22	1.0		mg/Kg	1	7/11/2009 01:20 PM
Cobalt	16	1.0		mg/Kg	1	7/11/2009 01:20 PM
Copper	41	2.0		mg/Kg	1	7/11/2009 01:20 PM
Lead	19	1.0		mg/Kg	1	7/11/2009 01:20 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 01:20 PM
Nickel	43	1.0		mg/Kg	1	7/11/2009 01:20 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 01:20 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 01:20 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 01:20 PM
Vanadium	18	1.0		mg/Kg	1	7/11/2009 01:20 PM
Zinc	51	1.0		mg/Kg	1	7/11/2009 01:20 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:19 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-020A

Client Sample ID: B45-1
Collection Date: 6/29/2009 11:12:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 01:24 PM
Arsenic	1.1	1.0		mg/Kg	1	7/11/2009 01:24 PM
Barium	110	1.0		mg/Kg	1	7/11/2009 01:24 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 01:24 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 01:24 PM
Chromium	50	1.0		mg/Kg	1	7/11/2009 01:24 PM
Cobalt	12	1.0		mg/Kg	1	7/11/2009 01:24 PM
Copper	7.2	2.0		mg/Kg	1	7/11/2009 01:24 PM
Lead	7.5	1.0		mg/Kg	1	7/11/2009 01:24 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 01:24 PM
Nickel	41	1.0		mg/Kg	1	7/11/2009 01:24 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 01:24 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 01:24 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 01:24 PM
Vanadium	25	1.0		mg/Kg	1	7/11/2009 01:24 PM
Zinc	25	1.0		mg/Kg	1	7/11/2009 01:24 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-021A

Client Sample ID: B42-2
Collection Date: 6/29/2009 11:11:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 01:57 PM
Arsenic	1.6	1.0		mg/Kg	1	7/11/2009 01:57 PM
Barium	33	1.0		mg/Kg	1	7/11/2009 01:57 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 01:57 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 01:57 PM
Chromium	5.9	1.0		mg/Kg	1	7/11/2009 01:57 PM
Cobalt	2.7	1.0		mg/Kg	1	7/11/2009 01:57 PM
Copper	46	2.0		mg/Kg	1	7/11/2009 01:57 PM
Lead	9.7	1.0		mg/Kg	1	7/11/2009 01:57 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 01:57 PM
Nickel	11	1.0		mg/Kg	1	7/11/2009 01:57 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 01:57 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 01:57 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 01:57 PM
Vanadium	17	1.0		mg/Kg	1	7/11/2009 01:57 PM
Zinc	15	1.0		mg/Kg	1	7/11/2009 01:57 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:23 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-027A

Client Sample ID: B77-1
Collection Date: 6/29/2009 9:50:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 02:02 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Barium	170	1.0		mg/Kg	1	7/11/2009 02:02 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Chromium	59	1.0		mg/Kg	1	7/11/2009 02:02 PM
Cobalt	13	1.0		mg/Kg	1	7/11/2009 02:02 PM
Copper	23	2.0		mg/Kg	1	7/11/2009 02:02 PM
Lead	7.4	1.0		mg/Kg	1	7/11/2009 02:02 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Nickel	85	1.0		mg/Kg	1	7/11/2009 02:02 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 02:02 PM
Vanadium	39	1.0		mg/Kg	1	7/11/2009 02:02 PM
Zinc	44	1.0		mg/Kg	1	7/11/2009 02:02 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090706A	QC Batch: 56324			PrepDate: 7/1/2009		Analyst: **CBR**
DRO	2.4	1.0		mg/Kg	1	7/6/2009 08:57 PM
ORO	5.2	1.0		mg/Kg	1	7/6/2009 08:57 PM
Surr: p-Terphenyl	82.5	30-130		%REC	1	7/6/2009 08:57 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	6/30/2009 08:18 PM
Surr: Bromofluorobenzene (FID)	102	59-145		%REC	1	6/30/2009 08:18 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	6/30/2009 08:18 PM
Ethylbenzene	ND	5.0		µg/Kg	1	6/30/2009 08:18 PM
m,p-Xylene	ND	10		µg/Kg	1	6/30/2009 08:18 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B77-1
Lab Order: 106198 **Collection Date:** 6/29/2009 9:50:00 AM
Project: HWY 101- MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106198-027A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090630B	QC Batch: E09VS200			PrepDate:		Analyst: **KHN**
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	6/30/2009 08:18 PM
o-Xylene	ND	5.0		µg/Kg	1	6/30/2009 08:18 PM
Toluene	ND	5.0		µg/Kg	1	6/30/2009 08:18 PM
Surr: Bromofluorobenzene (PID)	95.5	65-140		%REC	1	6/30/2009 08:18 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate:	7/7/2009	Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 03:36 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 03:36 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 03:36 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 03:36 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 03:36 PM
Surr: Decachlorobiphenyl	46.8	20-142		%REC	1	7/8/2009 03:36 PM
Surr: Tetrachloro-m-xylene	45.8	25-115		%REC	1	7/8/2009 03:36 PM
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090702E	QC Batch: 56331			PrepDate:	7/2/2009	Analyst: **IL**

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B77-1
Lab Order:	106198	**Collection Date:**	6/29/2009 9:50:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-027A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
	EPA 7471A					
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-028A

Client Sample ID: B77-4
Collection Date: 6/29/2009 10:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 02:07 PM
Arsenic	1.4	1.0		mg/Kg	1	7/11/2009 02:07 PM
Barium	310	1.0		mg/Kg	1	7/11/2009 02:07 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 02:07 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 02:07 PM
Chromium	35	1.0		mg/Kg	1	7/11/2009 02:07 PM
Cobalt	11	1.0		mg/Kg	1	7/11/2009 02:07 PM
Copper	28	2.0		mg/Kg	1	7/11/2009 02:07 PM
Lead	6.5	1.0		mg/Kg	1	7/11/2009 02:07 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 02:07 PM
Nickel	57	1.0		mg/Kg	1	7/11/2009 02:07 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 02:07 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 02:07 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 02:07 PM
Vanadium	25	1.0		mg/Kg	1	7/11/2009 02:07 PM
Zinc	30	1.0		mg/Kg	1	7/11/2009 02:07 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/2/2009 05:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-035A

Client Sample ID: B69-0
Collection Date: 6/29/2009 1:16:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 02:12 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Barium	150	1.0		mg/Kg	1	7/11/2009 02:12 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Chromium	65	1.0		mg/Kg	1	7/11/2009 02:12 PM
Cobalt	13	1.0		mg/Kg	1	7/11/2009 02:12 PM
Copper	34	2.0		mg/Kg	1	7/11/2009 02:12 PM
Lead	110	1.0		mg/Kg	1	7/11/2009 02:12 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Nickel	80	1.0		mg/Kg	1	7/11/2009 02:12 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 02:12 PM
Vanadium	45	1.0		mg/Kg	1	7/11/2009 02:12 PM
Zinc	230	1.0		mg/Kg	1	7/11/2009 02:12 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	0.16	0.10		mg/Kg	1	7/2/2009 05:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-039A

Client Sample ID: B66-2
Collection Date: 6/29/2009 12:45:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 02:16 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Barium	130	1.0		mg/Kg	1	7/11/2009 02:16 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Chromium	89	1.0		mg/Kg	1	7/11/2009 02:16 PM
Cobalt	24	1.0		mg/Kg	1	7/11/2009 02:16 PM
Copper	24	2.0		mg/Kg	1	7/11/2009 02:16 PM
Lead	86	1.0		mg/Kg	1	7/11/2009 02:16 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Nickel	75	1.0		mg/Kg	1	7/11/2009 02:16 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 02:16 PM
Vanadium	63	1.0		mg/Kg	1	7/11/2009 02:16 PM
Zinc	100	1.0		mg/Kg	1	7/11/2009 02:16 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	0.24	0.10		mg/Kg	1	7/2/2009 05:31 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-040A

Client Sample ID: B64-1
Collection Date: 6/29/2009 12:44:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	4.0		mg/Kg	2	7/11/2009 03:45 PM
Arsenic	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Barium	100	2.0		mg/Kg	2	7/11/2009 03:45 PM
Beryllium	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Cadmium	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Chromium	160	2.0		mg/Kg	2	7/11/2009 03:45 PM
Cobalt	38	2.0		mg/Kg	2	7/11/2009 03:45 PM
Copper	24	4.0		mg/Kg	2	7/11/2009 03:45 PM
Lead	13	2.0		mg/Kg	2	7/11/2009 03:45 PM
Molybdenum	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Nickel	170	2.0		mg/Kg	2	7/11/2009 03:45 PM
Selenium	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Silver	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Thallium	ND	2.0		mg/Kg	2	7/11/2009 03:45 PM
Vanadium	97	2.0		mg/Kg	2	7/11/2009 03:45 PM
Zinc	38	2.0		mg/Kg	2	7/11/2009 03:45 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	0.23	0.10		mg/Kg	1	7/2/2009 05:33 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-044A

Client Sample ID: B68-1
Collection Date: 6/29/2009 1:41:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate: 7/2/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 02:28 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 02:28 PM
Barium	100	1.0		mg/Kg	1	7/11/2009 02:28 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 02:28 PM
Cadmium	1.1	1.0		mg/Kg	1	7/11/2009 02:28 PM
Chromium	94	1.0		mg/Kg	1	7/11/2009 02:28 PM
Cobalt	22	1.0		mg/Kg	1	7/11/2009 02:28 PM
Copper	31	2.0		mg/Kg	1	7/11/2009 02:28 PM
Lead	110	1.0		mg/Kg	1	7/11/2009 02:28 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 02:28 PM
Nickel	90	1.0		mg/Kg	1	7/11/2009 02:28 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 02:28 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 02:28 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 02:28 PM
Vanadium	72	1.0		mg/Kg	1	7/11/2009 02:28 PM
Zinc	120	1.0		mg/Kg	1	7/11/2009 02:28 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate: 7/2/2009	Analyst: **IL**	
Mercury	0.39	0.10		mg/Kg	1	7/2/2009 05:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-047A

Client Sample ID: B71-1
Collection Date: 6/29/2009 2:02:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711C	QC Batch: 56351			PrepDate:	7/2/2009	Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 02:34 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Barium	130	1.0		mg/Kg	1	7/11/2009 02:34 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Chromium	40	1.0		mg/Kg	1	7/11/2009 02:34 PM
Cobalt	9.5	1.0		mg/Kg	1	7/11/2009 02:34 PM
Copper	9.8	2.0		mg/Kg	1	7/11/2009 02:34 PM
Lead	6.9	1.0		mg/Kg	1	7/11/2009 02:34 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Nickel	41	1.0		mg/Kg	1	7/11/2009 02:34 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 02:34 PM
Vanadium	28	1.0		mg/Kg	1	7/11/2009 02:34 PM
Zinc	28	1.0		mg/Kg	1	7/11/2009 02:34 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090702E	QC Batch: 56331			PrepDate:	7/2/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/2/2009 04:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-56351** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110693**
Client ID: **PBS** Batch ID: **56351** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742318**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.602	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	0.017	1.0									
Chromium	0.122	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	0.037	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	0.208	1.0									

Sample ID: **LCS-56351** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110693**
Client ID: **LCSS** Batch ID: **56351** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742319**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	47.558	2.0	50.00	0.6017	93.9	80	120				
Arsenic	46.795	1.0	50.00	0	93.6	80	120				
Barium	49.191	1.0	50.00	0	98.4	80	120				
Beryllium	48.022	1.0	50.00	0	96.0	80	120				
Cadmium	48.266	1.0	50.00	0.01686	96.5	80	120				
Chromium	48.233	1.0	50.00	0.1218	96.2	80	120				
Cobalt	46.603	1.0	50.00	0	93.2	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-56351** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110693**
Client ID: **LCSS** Batch ID: **56351** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742319**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	50.053	2.0	50.00	0	100	80	120				
Lead	49.339	1.0	50.00	0	98.7	80	120				
Molybdenum	49.006	1.0	50.00	0	98.0	80	120				
Nickel	47.132	1.0	50.00	0.03674	94.2	80	120				
Selenium	44.315	1.0	50.00	0	88.6	80	120				
Silver	49.160	1.0	50.00	0	98.3	80	120				
Thallium	46.284	1.0	50.00	0	92.6	80	120				
Vanadium	50.018	1.0	50.00	0	100	80	120				
Zinc	47.482	1.0	50.00	0.2084	94.5	80	120				

Sample ID: **106198-047AMS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110693**
Client ID: **B71-1** Batch ID: **56351** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742333**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	90.271	2.0	125.0	0	72.2	25	106				
Arsenic	99.798	1.0	125.0	0.3872	79.5	42	113				
Barium	244.479	1.0	125.0	125.1	95.5	19	140				
Beryllium	106.058	1.0	125.0	0	84.8	50	109				
Cadmium	102.611	1.0	125.0	0.4883	81.7	48	106				
Chromium	153.149	1.0	125.0	40.14	90.4	44	116				
Cobalt	112.144	1.0	125.0	9.518	82.1	47	107				
Copper	131.145	2.0	125.0	9.831	97.1	49	124				
Lead	117.745	1.0	125.0	6.920	88.7	33	120				
Molybdenum	103.968	1.0	125.0	0	83.2	46	111				
Nickel	149.800	1.0	125.0	41.22	86.9	43	111				
Selenium	94.853	1.0	125.0	0	75.9	43	104				
Silver	110.051	1.0	125.0	0	88.0	53	114				
Thallium	102.413	1.0	125.0	0	81.9	41	107				
Vanadium	139.515	1.0	125.0	28.24	89.0	48	116				
Zinc	134.164	1.0	125.0	27.79	85.1	24	129				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106198-047AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110693**
Client ID: **B71-1** Batch ID: **56351** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742334**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	95.572	2.0	125.0	0	76.5	25	106	90.27	5.71	20	
Arsenic	104.029	1.0	125.0	0.3872	82.9	42	113	99.80	4.15	20	
Barium	242.347	1.0	125.0	125.1	93.8	19	140	244.5	0.876	20	
Beryllium	109.359	1.0	125.0	0	87.5	50	109	106.1	3.06	20	
Cadmium	106.519	1.0	125.0	0.4883	84.8	48	106	102.6	3.74	20	
Chromium	167.190	1.0	125.0	40.14	102	44	116	153.1	8.77	20	
Cobalt	117.951	1.0	125.0	9.518	86.7	47	107	112.1	5.05	20	
Copper	133.080	2.0	125.0	9.831	98.6	49	124	131.1	1.46	20	
Lead	118.411	1.0	125.0	6.920	89.2	33	120	117.7	0.564	20	
Molybdenum	107.841	1.0	125.0	0	86.3	46	111	104.0	3.66	20	
Nickel	159.101	1.0	125.0	41.22	94.3	43	111	149.8	6.02	20	
Selenium	98.223	1.0	125.0	0	78.6	43	104	94.85	3.49	20	
Silver	113.777	1.0	125.0	0	91.0	53	114	110.1	3.33	20	
Thallium	106.113	1.0	125.0	0	84.9	41	107	102.4	3.55	20	
Vanadium	143.654	1.0	125.0	28.24	92.3	48	116	139.5	2.92	20	
Zinc	133.283	1.0	125.0	27.79	84.4	24	129	134.2	0.659	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56372A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **PBS** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739842**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.422	5.0									

Sample ID: **LCS-56372** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **LCSS** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739843**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	250.998	5.0	250.0	0.4221	100	80	120				

Sample ID: **106198-012ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **B43-0** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739889**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	25.739	5.0						24.50	4.94	20	

Sample ID: **106198-012AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **B43-0** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739890**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	194.828	5.0	250.0	24.50	68.1	33	120				

Sample ID: **MB-56372B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **PBS** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739891**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106198-026ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **B47-2** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739902**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.867	5.0						5.072	0	20	

Sample ID: **106198-026AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **B47-2** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739903**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	191.744	5.0	250.0	5.072	74.7	33	120				

Sample ID: **106198-026AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110559**
Client ID: **B47-2** Batch ID: **56372** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1739904**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	211.070	5.0	250.0	5.072	82.4	33	120	191.7	9.60	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56373A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **PBS** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740138**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56373** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **LCSS** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740139**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	258.648	5.0	250.0	0	103	80	120				

Sample ID: **106198-041ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **B65-1** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740150**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	125.709	5.0						120.1	4.56	20	

Sample ID: **106198-041AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **B65-1** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740151**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	252.492	5.0	250.0	120.1	53.0	33	120				

Sample ID: **MB-56373B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **PBS** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740152**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106199-004BDUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **ZZZZZZ** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740163**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.538	5.0						2.780	0	20	

Sample ID: **106199-004BMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **ZZZZZZ** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740164**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	169.855	5.0	250.0	2.780	66.8	33	120				

Sample ID: **106199-004BMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110576**
Client ID: **ZZZZZZ** Batch ID: **56373** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/7/2009** SeqNo: **1740165**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	176.280	5.0	250.0	2.780	69.4	33	120	169.9	3.71	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-56331** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110477**
Client ID: **PBS** Batch ID: **56331** TestNo: **EPA 7471A** Analysis Date: **7/2/2009** SeqNo: **1737943**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-56331** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110477**
Client ID: **LCSS** Batch ID: **56331** TestNo: **EPA 7471A** Analysis Date: **7/2/2009** SeqNo: **1737944**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.763	0.10	0.8300	0	91.9	80	120				

Sample ID: **106198-047A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110477**
Client ID: **B71-1** Batch ID: **56331** TestNo: **EPA 7471A** Analysis Date: **7/2/2009** SeqNo: **1737945**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.744	0.10	0.8300	0.02761	86.3	70	130				

Sample ID: **106198-047A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/2/2009** RunNo: **110477**
Client ID: **B71-1** Batch ID: **56331** TestNo: **EPA 7471A** Analysis Date: **7/2/2009** SeqNo: **1737946**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.742	0.10	0.8300	0.02761	86.1	70	130	0.7435	0.173	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-56324** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/1/2009** RunNo: **110512**
Client ID: **PBS** Batch ID: **56324** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/6/2009** SeqNo: **1738909**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	1.534		2.670		57.5	30	130				

Sample ID: **LCS-56324** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/1/2009** RunNo: **110512**
Client ID: **LCSS** Batch ID: **56324** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/6/2009** SeqNo: **1738910**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	22.402	1.0	33.00	0	67.9	35	124				
Surr: p-Terphenyl	2.412		2.670		90.3	30	130				

Sample ID: **106215-001DMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/1/2009** RunNo: **110512**
Client ID: **ZZZZZZ** Batch ID: **56324** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/6/2009** SeqNo: **1738917**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	211.947	20	33.00	89.59	371	12	125				S
Surr: p-Terphenyl	6.073		2.670		227	30	130				S

Sample ID: **106215-001DMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/1/2009** RunNo: **110512**
Client ID: **ZZZZZZ** Batch ID: **56324** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/6/2009** SeqNo: **1738918**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	140.580	20	33.00	89.59	155	12	125	211.9	40.5	20	SR
Surr: p-Terphenyl	0		2.670		0	30	130		0	0	SDO

Sample ID: **106198-002ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/1/2009** RunNo: **110512**
Client ID: **B22-0** Batch ID: **56324** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/6/2009** SeqNo: **1739491**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **106198-002ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/1/2009** RunNo: **110512**
Client ID: **B22-0** Batch ID: **56324** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **7/6/2009** SeqNo: **1739491**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	26.140	1.0						26.78	2.43	20	
ORO	121.670	1.0						114.8	5.83	20	
Surr: p-Terphenyl	1.584		2.670		59.3	30	130		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E090630LCS3** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110404**
Client ID: **LCSS** Batch ID: **E09VS200** TestNo: **EPA 8015B(M** Analysis Date: **6/30/2009** SeqNo: **1736152**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.398	1.0	5.000	0	88.0	73	120				
Surr: Bromofluorobenzene (FID)	96.606		100.0		96.6	59	145				

Sample ID: **106198-027AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8015B(M** Analysis Date: **6/30/2009** SeqNo: **1736153**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.585	1.0	5.000	0	71.7	39	135				
Surr: Bromofluorobenzene (FID)	103.849		100.0		104	59	145				

Sample ID: **106198-027AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8015B(M** Analysis Date: **6/30/2009** SeqNo: **1736154**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.248	1.0	5.000	0	65.0	39	135	3.585	9.86	20	
Surr: Bromofluorobenzene (FID)	100.549		100.0		101	59	145		0	0	

Sample ID: **E090630MB2** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110404**
Client ID: **PBS** Batch ID: **E09VS200** TestNo: **EPA 8015B(M** Analysis Date: **6/30/2009** SeqNo: **1736155**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	98.123		100.0		98.1	59	145				

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8015B(M** Analysis Date: **6/30/2009** SeqNo: **1736157**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8015B(M** Analysis Date: **6/30/2009** SeqNo: **1736157**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	104.420		100.0		104	59	145		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E090630LCS4** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110404**
Client ID: **LCSS** Batch ID: **E09VS200** TestNo: **EPA 8021B** Analysis Date: **6/30/2009** SeqNo: **1736162**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	94.966	5.0	100.0	0	95.0	80	121				
Ethylbenzene	96.380	5.0	100.0	0	96.4	84	120				
m,p-Xylene	195.578	10	200.0	0	97.8	84	122				
Methyl tert-butyl ether	90.387	5.0	100.0	0	90.4	66	128				
o-Xylene	98.087	5.0	100.0	0	98.1	84	123				
Toluene	96.686	5.0	100.0	0	96.7	84	120				
Surr: Bromofluorobenzene (PID)	92.925		100.0		92.9	65	140				

Sample ID: **106198-027AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8021B** Analysis Date: **6/30/2009** SeqNo: **1736163**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	23.022	5.0	35.75	0	64.4	22	132				
Ethylbenzene	30.234	5.0	49.65	0	60.9	15	133				
m,p-Xylene	124.809	10	199.6	0	62.5	30	118				
Methyl tert-butyl ether	441.681	5.0	578.9	0	76.3	38	136				
o-Xylene	45.608	5.0	78.40	0	58.2	21	119				
Toluene	113.912	5.0	172.2	0	66.1	36	129				
Surr: Bromofluorobenzene (PID)	103.601		100.0		104	65	140				

Sample ID: **106198-027AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8021B** Analysis Date: **6/30/2009** SeqNo: **1736164**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	21.962	5.0	35.75	0	61.4	22	132	23.02	4.71	20	
Ethylbenzene	27.330	5.0	49.65	0	55.0	15	133	30.23	10.1	20	
m,p-Xylene	112.549	10	199.6	0	56.4	30	118	124.8	10.3	20	
Methyl tert-butyl ether	355.174	5.0	578.9	0	61.4	38	136	441.7	21.7	20	R
o-Xylene	40.587	5.0	78.40	0	51.8	21	119	45.61	11.7	20	
Toluene	102.824	5.0	172.2	0	59.7	36	129	113.9	10.2	20	

Qualifiers:

- B Analyte detected in the associated Method Blank
- ND Not Detected at the Reporting Limit
- DO Surrogate Diluted Out
- E Value above quantitation range
- R RPD outside accepted recovery limits
- Calculations are based on raw values
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **106198-027AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8021B** Analysis Date: **6/30/2009** SeqNo: **1736164**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	100.460		100.0		100	65	140		0	20	

Sample ID: **E090630MB2** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110404**
Client ID: **PBS** Batch ID: **E09VS200** TestNo: **EPA 8021B** Analysis Date: **6/30/2009** SeqNo: **1736165**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	92.410		100.0		92.4	65	140				

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110404**
Client ID: **B77-1** Batch ID: **E09VS200** TestNo: **EPA 8021B** Analysis Date: **6/30/2009** SeqNo: **1736167**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
Methyl tert-butyl ether	ND	5.0						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Xylenes, Total	ND	15						0	0	20	
Surr: Bromofluorobenzene (PID)	98.869		100.0		98.9	65	140		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56449** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **PBS** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740765**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	13.613		16.67		81.7	25	115				
Surr: Decachlorobiphenyl	14.170		16.67		85.0	20	142				

Sample ID: **LCS-56449** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **LCSS** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740766**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	12.541	1.0	16.67	0	75.2	59	113				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-56449** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **LCSS** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740766**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	12.958	2.0	16.67	0	77.7	59	108				
Endrin	12.565	2.0	16.67	0	75.4	41	132				
gamma-BHC	12.363	1.0	16.67	0	74.2	60	111				
Heptachlor	12.318	1.0	16.67	0	73.9	62	108				
Surr: Tetrachloro-m-xylene	11.797		16.67		70.8	25	115				
Surr: Decachlorobiphenyl	12.691		16.67		76.1	20	142				

Sample ID: **106240-001AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740767**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	5.974	2.0	16.67	0.5053	32.8	29	143				
Aldrin	6.103	1.0	16.67	0	36.6	44	131				S
Dieldrin	5.784	2.0	16.67	0	34.7	40	136				S
Endrin	5.835	2.0	16.67	0	35.0	41	146				S
gamma-BHC	5.255	1.0	16.67	0	31.5	45	129				S
Heptachlor	5.973	1.0	16.67	0	35.8	48	126				S
Surr: Tetrachloro-m-xylene	5.277		16.67		31.7	25	115				
Surr: Decachlorobiphenyl	6.970		16.67		41.8	20	142				

Sample ID: **106240-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740768**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	9.557	2.0	16.67	0.5053	54.3	29	143	5.974	46.1	20	R
Aldrin	9.373	1.0	16.67	0	56.2	44	131	6.103	42.3	20	R
Dieldrin	9.712	2.0	16.67	0	58.3	40	136	5.784	50.7	20	R
Endrin	9.621	2.0	16.67	0	57.7	41	146	5.835	49.0	20	R
gamma-BHC	9.159	1.0	16.67	0	54.9	45	129	5.255	54.2	20	R
Heptachlor	8.919	1.0	16.67	0	53.5	48	126	5.973	39.6	20	R

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106240-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740768**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	7.897		16.67		47.4	25	115		0	0	
Surr: Decachlorobiphenyl	10.405		16.67		62.4	20	142		0	0	

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **B77-1** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740851**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	ND	2.0						0	0	20	
4,4´-DDT	ND	2.0						0	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	6.981		16.67		41.9	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **B77-1** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740851**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	7.044		16.67		42.3	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **106198-048ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **110541**
Client ID: **B69-2** Batch ID: **R110541** TestNo: **EPA 9045C** Analysis Date: **7/7/2009** SeqNo: **1739521**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	8.270	0.10						8.310	0.483	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CHAIN OF CUSTODY RECORD

Pg 1 of 5

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: _____ Date: 6/29/09

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: GSO

Sample Condition Upon Receipt
1. CHILLED 8.1 Y☑ N☐ 4. SEALED Y☐ N☒
2. HEADSPACE (VOA) NA Y☐ N☐ 5. # OF SPLS MATCH COC Y☒ N☐
3. CONTAINER INTACT Y☒ N☐ 6. PRESERVED Y☐ N☒

Client: GEOCON
Attn: L. VIGLIOTTI
Address: 6671 BRISA St
City LIVERMORE State CA Zip Code 94550
TEL: (925) 371-5900
FAX: (") " 5915

Project Name: HWY 101 - MARIN CO. Project #: E8469-06-01 Sampler: (Printed Name) D. WATTS (Signature) WATTS

Relinquished by: (Signature and Printed Name) WATTS Date: 6/29/09 Time: 1800 Received by: (Signature and Printed Name) 6/30 Date: 6/29/09 Time: 1800
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) C. [illegible] Date: 6/30/09 Time: 8:10
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr/Submitter:
D. WATTS 6/29/2009
Print Name Date
WATTS
Signature

Send Report To:
Attn: _____
Co: See "CLIENT"
Address _____
City _____ State____ Zip____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State____ Zip____

Special Instructions/Comments:
RUN WETS ON SAMPLES WITH POTENTIAL TO FAIL STLC
PLEASE RETURN ALL GEOCON COOLERS

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	Container(s): TAT	#	Type	PRESERVATION	REMARKS
	106198-001	B21 - 0	6/29/09	0851	E	1	J	C	
	002	B22 -							
	003	B23 -							
	004	B24 -		0937					
	005	B21 - 1.5		0857					
	006	B22 -							
	007	B23 -							
	008	B24 -		0941					
	009	B46 - 1	6/29/09	1112	E	1	Bg, P	C	
	010	B47 - 1		1114					

Circle or Add Analysis(es) Requested: 8081A (Pesticides) / 8082 (PCB) / 8260B (Volatiles) / 8270C (BNA) / 6010B (Total Metals) Pb / 8015B (GRO) / 8020 (BTEX) MTBE / 8015B (DRO) / 8021 (BTEX) / TITLE 22 / CAM 17 (6010 / 7000)

SPECIFY APPROPRIATE MATRIX: SOIL / WATER / GROUND WATER / WASTEWATER

QA/QC: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report, Yellow to folder, Pink to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client:
Attn: SEE Pg 1
Address:
City State Zip Code
TEL: ( )
FAX: ( )
Project Name: Project #: Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) Will	Date 6/29/09	Time: 1800	Received by: (Signature and Printed Name) G Sa, C. [illegible]	Date: 6/29/09	Time: 1800
Relinquished by: (Signature and Printed Name)	Date :	Time:	Received by: (Signature and Printed Name)	Date: 6/30/09	Time: 810
Relinquished by: (Signature and Printed Name)	Date :	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: SEE Pg 1
Print Name Date
Signature

Send Report To:
Attn: _____
Co: _____
Address _____
City _____ State____ Zip____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State____ Zip____

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides) | 8082 (PCB) | 8260B (Volatiles) | 8270C (BNA) | 6010B (Total Metal) – Pb | 8015B (GRO) / 8020 (BTEX) | 8015B (DRO) | 8021 (BTEX) | TITLE 22 / CAM 17 (6010 / 7000) | pH

SPECIFY APPROPRIATE MATRIX: SOIL | WATER | GROUND WATER | WASTEWATER

PRESERVATION

Q A / Q C: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	106198-011	B42-0	6/29/09	1106	E	1	Bg P	C	
	012	B43-							
	013	B44-							
	014	B45-		1128					
	015	B46-							
	016	B47-					J G		
	017	B42-1		1108			Bg P		
	018	B43-					J G		
	019	B44-					Bg P		
	020	B45-		1112			J G		

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client:
Attn: SEE Pg 1
Address:
City State Zip Code
TEL: ( )
FAX: ( )
Project Name: SEE Pg 1 Project #:
Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) Will	Date: 6/29/09	Time: 1800	Received by: (Signature and Printed Name) G50	Date: 6/29/09	Time: 1800
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name) C. Ayala	Date: 6/30/09	Time: 830
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: SEE Pg 1
Print Name Date
Signature

Send Report To:
Attn: _____
Co: _____
Address _____
City _____ State_____ Zip_____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State_____ Zip_____

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides); 8082 (PCB); 8260B (Volatiles); 8270C (BNA); 6010B (Total Metal) - Pb; 8015B (GRO) / 8020 (BTEX) / TPH-GBTEX; 8015B (DRO) / TPH-D; 8021 (BTEX); TITLE 22 / CAM 17 (6010 / 7000); pH

SPECIFY APPROPRIATE MATRIX: SOIL; WATER; GROUND WATER; WASTEWATER

PRESERVATION

Q A / Q C: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	#	Type	PRESERVATION	REMARKS
	106198-021	B42-2	6/29/09	1111	E	1	J G	C	
	022	B43-					Bg P		
	023	B44-							
	024	B45-		1130					
	025	B46-		1130					
	026	B49-		1119					
	027	B77-1		0950			T m		
	028	B77-4		1005					
	029	B71-2		1431			Bg P		
	030								

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr; B= Emergency Next workday; C= Critical 2 Workdays; D= Urgent 3 Workdays; E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: Address: TEL: ( )
Attn: SEE Pg 1 City State Zip Code FAX: ( )
Project Name: SEE Pg 1 Project #: Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name)	Date: 6/29/09	Time: 1800	Received by: (Signature and Printed Name)		Date: 6/29/09	Time: 1800
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)		Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)		Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: SEE Pg 1
Print Name Date
Signature

Send Report To: Attn: Co: Address City State Zip

Bill To: Attn: Co: Address City State Zip

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides) | 8082 (PCB) | 8260B (Volatiles) | 8270C (BNA) | 6010B (Total Metal) Pb | 8015B (GRO) / 8020 (BTEX) | 8015B (DRO) | 8021 (BTEX) | TITLE 22 / CAM 17 (6010 / 7000) | pH

SPECIFY APPROPRIATE MATRIX: SOIL | WATER | GROUND WATER | WASTEWATER

QA/QC: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	PRESERVATION	REMARKS
	106198-030	B64-0	6/29/09	1243	E	1	Bag	C	
	031	B65-					P		
	032	B66-							
	033	B67-		1316					
	034	B68-							
	035	B69-					J	G	
	036	B70-		1355			Bag	P	
	037	B71-							
	038	B64-2	6/29/09	1245			J	G	
	039	B66-2		1245					

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client:
Attn: See Pg 1
Address:
City State Zip Code
TEL: ( )
FAX: ( )
Project Name: See Pg 1 Project #:
Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) Will Date: 6/29/09 Time: 1700 Received by: (Signature and Printed Name) G50 Date: 6/29/09 Time: 1800
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) C. Ingram Date: 6/30/09 Time: 0800
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: See Pg 1
Print Name Date
Signature

Send Report To:
Attn: _____
Co: _____
Address _____
City _____ State _____ Zip _____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides) | 8082 (PCB) | 8260B (Volatiles) | 8270C (BNA) | 6010B (Total Metal) Pb | 8015B (GRO) / 8020 (BTEX) | 8015B (DRO) | 8021 (BTEX) | TITLE 22 / CAM 17 (6010 / 7000) Pb | pH

SPECIFY APPROPRIATE MATRIX: SOIL | WATER | GROUND WATER | WASTEWATER

QA/QC: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	PRESERVATION	REMARKS
	106198-040	B64-1	6/28/09	1244	E	1	J G	C	
	041	B65-		1244			Bg P		
	042	B66-		1244					
	043	B67-		1341					
	044	B68-		1341			J G		
	045	B69-		1341			Bg P		
	046	B70-		1402					
	047	B71-		1402			J G		
	048	B69-2		1344			Bg P		
	049	B70-2		1344					

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

October 30, 2009

Lauren Vigliotti
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
CSDLAC No.: 10196

Workorder No.: 106198

RE: HWY 101- MARIN CO., E8469-06-01

Attention: Lauren Vigliotti

Enclosed are the results for sample(s) received on June 30, 2009 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Project: HWY 101- MARIN CO., E8469-06-01
Lab Order: 106198

CASE NARRATIVE

Results were J-Flag. "J" is used to flag those results that are between the PQL (Practical Quantitation Limit) and the calculated MDL (Method Detection Limit). Results that are "J" Flagged are estimated values since it becomes difficult to accurately quantitate the analyte near the MDL.

Analytical Comments for Method 6010

Dilution was necessary for samples 106198-001A, 106198-002A, 106198-007A, 106198-015A, 106198-016A, 106198-018A, 106198-020A, 106198-021A, 106198-027A, 106198-028A, 106198-030A, 106198-031A, 106198-032A, 106198-033A, 106198-034A, 106198-035A, 106198-036A, 106198-037A, 106198-039A, 106198-040A, 106198-041A, 106198-042A, 106198-043A, 106198-044A, 106198-045A, 106198-046A and 106198-048A, due to sample matrix.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-001A

Client Sample ID: B21-0
Collection Date: 6/29/2009 8:51:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.84	0.018	1.0	J	mg/L	20	10/29/2009 05:22 PM
Lead	3.0	0.042	1.0		mg/L	20	10/29/2009 05:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-002A

Client Sample ID: B22-0
Collection Date: 6/29/2009 8:51:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	4.7	0.042	1.0		mg/L	20	10/29/2009 05:26 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B23-1.5
Lab Order:	106198	**Collection Date:**	6/29/2009 8:57:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-007A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.14	0.018	1.0	J	mg/L	20	10/29/2009 05:30 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-015A

Client Sample ID: B46-0
Collection Date: 6/29/2009 11:28:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	4.6	0.042	1.0		mg/L	20	10/29/2009 05:34 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B47-0
Lab Order:	106198	**Collection Date:**	6/29/2009 11:28:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-016A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.18	0.018	1.0	J	mg/L	20	10/29/2009 05:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B43-1
Lab Order:	106198	**Collection Date:**	6/29/2009 11:08:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-018A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.16	0.018	1.0	J	mg/L	20	10/29/2009 05:51 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B45-1
Lab Order:	106198	**Collection Date:**	6/29/2009 11:12:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-020A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.10	0.018	1.0	J	mg/L	20	10/29/2009 05:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B42-2
Lab Order:	106198	**Collection Date:**	6/29/2009 11:11:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-021A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	ND	0.018	1.0		mg/L	20	10/29/2009 05:59 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B77-1
Lab Order:	106198	**Collection Date:**	6/29/2009 9:50:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-027A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.064	0.018	1.0	J	mg/L	20	10/30/2009 11:54 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B77-4
Lab Order:	106198	**Collection Date:**	6/29/2009 10:05:00 AM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-028A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.14	0.018	1.0	J	mg/L	20	10/29/2009 06:07 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B64-0
Lab Order:	106198	**Collection Date:**	6/29/2009 12:43:00 PM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-030A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	7.0	0.042	1.0		mg/L	20	10/29/2009 06:24 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B65-0
Lab Order:	106198	**Collection Date:**	6/29/2009 12:43:00 PM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-031A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	19	0.042	1.0		mg/L	20	10/29/2009 06:28 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-032A

Client Sample ID: B66-0
Collection Date: 6/29/2009 12:43:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	14	0.042	1.0		mg/L	20	10/29/2009 06:41 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-033A

Client Sample ID: B67-0
Collection Date: 6/29/2009 1:16:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	13	0.042	1.0		mg/L	20	10/29/2009 06:45 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-034A

Client Sample ID: B68-0
Collection Date: 6/29/2009 1:16:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	8.1	0.042	1.0		mg/L	20	10/29/2009 06:49 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B69-0
Lab Order:	106198	**Collection Date:**	6/29/2009 1:16:00 PM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-035A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.38	0.018	1.0	J	mg/L	20	10/29/2009 06:53 PM
Lead	5.9	0.042	1.0		mg/L	20	10/29/2009 06:53 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-036A

Client Sample ID: B70-0
Collection Date: 6/29/2009 1:55:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	7.4	0.042	1.0		mg/L	20	10/29/2009 06:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-037A

Client Sample ID: B71-0
Collection Date: 6/29/2009 1:55:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Lead	7.3	0.042	1.0		mg/L	20	10/29/2009 07:01 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-039A

Client Sample ID: B66-2
Collection Date: 6/29/2009 12:45:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.20	0.018	1.0	J	mg/L	20	10/29/2009 07:06 PM
Lead	3.2	0.042	1.0		mg/L	20	10/29/2009 07:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B64-1
Lab Order:	106198	**Collection Date:**	6/29/2009 12:44:00 PM
Project:	HWY 101- MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106198-040A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
WET/ EPA 6010B							
RunID: **ICP8_091029D**	QC Batch: **R114535**				PrepDate:		Analyst: **CL**
Chromium	0.13	0.018	1.0	J	mg/L	20	10/29/2009 07:10 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-041A

Client Sample ID: B65-1
Collection Date: 6/29/2009 12:44:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	6.4	0.042	1.0		mg/L	20	10/29/2009 07:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-042A

Client Sample ID: B66-1
Collection Date: 6/29/2009 12:44:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	6.6	0.042	1.0		mg/L	20	10/29/2009 07:52 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-043A

Client Sample ID: B67-1
Collection Date: 6/29/2009 1:41:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	7.0	0.042	1.0		mg/L	20	10/29/2009 07:56 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-044A

Client Sample ID: B68-1
Collection Date: 6/29/2009 1:41:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.27	0.018	1.0	J	mg/L	20	10/29/2009 08:00 PM
Lead	4.7	0.042	1.0		mg/L	20	10/29/2009 08:00 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-045A

Client Sample ID: B69-1
Collection Date: 6/29/2009 1:41:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	5.1	0.042	1.0		mg/L	20	10/29/2009 08:05 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified
E	Value above quantitation range
J	Analyte detected below quantitation limits
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-046A

Client Sample ID: B70-1
Collection Date: 6/29/2009 2:02:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	22	0.042	1.0		mg/L	20	10/29/2009 08:09 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01
Lab ID: 106198-048A

Client Sample ID: B69-2
Collection Date: 6/29/2009 1:44:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	3.6	0.042	1.0		mg/L	20	10/30/2009 11:58 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59306A** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **PBS** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814508**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									
Lead	ND	0.050									

Sample ID: **LCS-59306** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **LCSS** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814509**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	1.002	0.050	1.000	0	100	85	115				
Lead	0.956	0.050	1.000	0	95.6	85	115				

Sample ID: **106198-028ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **B77-4** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814520**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.137	1.0						0.1397	0	20	
Lead	0.079	1.0						0.05946	0	20	

Sample ID: **106198-028AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **B77-4** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814521**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.569	1.0	2.500	0.1397	97.2	77	116				
Lead	2.454	1.0	2.500	0.05946	95.8	71	121				

Sample ID: **MB-59306B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **PBS** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814522**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59306B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **PBS** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814522**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									
Lead	ND	0.050									

Sample ID: **106198-040ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **B64-1** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814533**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.132	1.0						0.1326	0	20	
Lead	0.340	1.0						0.3732	0	20	

Sample ID: **106198-040AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **B64-1** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814534**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.505	1.0	2.500	0.1326	94.9	77	116				
Lead	2.562	1.0	2.500	0.3732	87.5	71	121				

Sample ID: **106198-040AMSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114535**
Client ID: **B64-1** Batch ID: **R114535** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814535**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.342	1.0	2.500	0.1326	88.4	77	116	2.505	6.69	20	
Lead	2.483	1.0	2.500	0.3732	84.4	71	121	2.562	3.11	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59307A** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **PBS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814536**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									
Lead	ND	0.050									

Sample ID: **LCS-59307** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **LCSS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814537**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.991	0.050	1.000	0	99.1	85	115				
Lead	0.931	0.050	1.000	0	93.1	85	115				

Sample ID: **106216-003ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **ZZZZZZ** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814548**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.282	1.0						0.2858	0	20	
Lead	2.199	1.0						2.226	1.19	20	

Sample ID: **106216-003AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **ZZZZZZ** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814549**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.632	1.0	2.500	0.2858	93.8	77	116				
Lead	4.352	1.0	2.500	2.226	85.1	71	121				

Sample ID: **MB-59307B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **PBS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814550**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59307B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **PBS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814550**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.050									

Sample ID: **106216-036ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **ZZZZZZ** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814561**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.103	1.0						0.1030	0	20	
Lead	0.126	1.0						0.1302	0	20	

Sample ID: **106216-036AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **ZZZZZZ** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814562**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.397	1.0	2.500	0.1030	91.8	77	116				
Lead	2.296	1.0	2.500	0.1302	86.6	71	121				

Sample ID: **106216-036AMSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **ZZZZZZ** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814563**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.518	1.0	2.500	0.1030	96.6	77	116	2.397	4.92	20	
Lead	2.416	1.0	2.500	0.1302	91.4	71	121	2.296	5.10	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Diane Galvan

From: Lauren Vigliotti [vigliotti@geoconinc.com]
Sent: Monday, October 26, 2009 3:18 PM
To: Diane Galvan
Subject: MSN Segment B1 project

This project has been reinitiated and there should be soil samples on hold for soluble analyses under work orders – 106198, 106216 and 106238. Please run the following samples for WET lead under standard TAT. Thank you!

WO106198 – B21-0, B22-0, B46-0, B64-0, B65-0, B66-0, B67-0, B68-0, B69-0, B70-0, B71-0, B65-1, B66-1, B67-1, B68-1, B69-1, B70-1, B66-2, and B69-2

WO106216 – B7-0, B9-0, B15-0, B16-0, B48-1, B49-1, B73-0, B74-0, B75-1

****

Lauren Vigliotti
Senior Staff Geologist

Please visit our new website at http://www.geoconinc.com

Geocon Consultants, Inc
6671 Brisa Street
Livermore, CA 94550
Tel (925) 371-5900
Cell (925) 768-9874

GEOTECHNICAL ENVIRONMENTAL MATERIALS

San Diego Murrieta Burbank Bakersfield Sacramento Livermore Carson City Las Vegas Portland

CONFIDENTIALITY NOTICE: This e-mail may contain confidential and privileged material for the sole use of the intended recipient(s). Any review, use, distribution or disclosure by others is strictly prohibited. If you have received this communication in error, please notify the sender immediately by e-mail and delete the message and any file attachments from your computer. Thank you.

Diane Galvan

From: Lauren Vigliotti [vigliotti@geoconinc.com]
Sent: Monday, October 26, 2009 3:26 PM
To: Diane Galvan
Subject: MSN Segment B1

Diane:
Also, please run the following sample for WET chromium, standard TAT. Thanks!

WO-106238:
B27-1.5, B29-0, B33-0, B35-1.5, B37-0, B39-1, B41-0

WO106216:
B15-1.5, B17-0, B49-2, B51-1, B52-2, B53-0, B54-2, B55-1, B57-0, B59-1, B60-1, B63-2, B73-2, B75-0, B76-1,
B76-4, B1-0, B2-1.5, B5-0, B7-1.5, B9-0, B13-0, B19-1.5

WO106198:
B21-0, B23-1.5, B47-0, B43-1, B45-1, B42-2, B77-1, B77-4, B69-0, B66-2, B64-1, B68-1

****

Lauren Vigliotti
Senior Staff Geologist

Please visit our new website at http://www.geoconinc.com

Geocon Consultants, Inc
6671 Brisa Street
Livermore, CA 94550
Tel (925) 371-5900
Cell (925) 768-9874

GEOTECHNICAL ENVIRONMENTAL MATERIALS

San Diego Murrieta Burbank Bakersfield Sacramento Livermore Carson City Las Vegas Portland

CONFIDENTIALITY NOTICE: This e-mail may contain confidential and privileged material for the sole use of the intended recipient(s). Any review, use, distribution or disclosure by others is strictly prohibited. If you have received this communication in error, please notify the sender immediately by e-mail and delete the message and any file attachments from your computer. Thank you.

Advanced Technology Laboratories

Date: 11/9/2009

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION
WET DI/ EPA 7420

CLIENT: Geocon Consultants, Inc.
Project: HWY 101- MARIN CO., E8469-06-01
Project No:
Analyte: Lead

Lab Order: 106198
Date Received 6/30/2009 8:10:00 AM
Matrix: Soil
Analyst: IL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106198-030A	B64-0	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-031A	B65-0	0.26	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-032A	B66-0	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-033A	B67-0	0.47	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-034A	B68-0	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-035A	B69-0	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-036A	B70-0	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-037A	B71-0	0.35	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-041A	B65-1	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-042A	B66-1	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-043A	B67-1	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-045A	B69-1	ND	mg/L	59551	0.25	1	6/29/2009	11/6/2009
106198-046A	B70-1	2.2	mg/L	59551	0.25	1	6/29/2009	11/6/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 11/9/2009

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (TCLP)
EPA 1311/ 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106198
Project:	HWY 101- MARIN CO., E8469-06-01	**Date Received**	6/30/2009 8:10:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	IL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106198-030A	B64-0	ND	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-031A	B65-0	0.43	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-032A	B66-0	0.55	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-033A	B67-0	ND	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-034A	B68-0	ND	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-035A	B69-0	ND	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-036A	B70-0	0.27	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-037A	B71-0	0.43	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-041A	B65-1	ND	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-043A	B67-1	ND	mg/L	59607	0.25	1	6/29/2009	11/6/2009
106198-046A	B70-1	0.58	mg/L	59607	0.25	1	6/29/2009	11/6/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI_GEOCON

Sample ID: **MB-59551A** SampType: **MBLK** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **PBS** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819709**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **LCS-59551** SampType: **LCS** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **LCSS** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819710**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.028	0.25	5.000	0	101	80	120				

Sample ID: **106198-042A-DUP** SampType: **DUP** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **B66-1** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819721**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25						0	0	20	

Sample ID: **106198-042A-MS** SampType: **MS** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **B66-1** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819722**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.072	0.25	5.000	0	101	70	130				

Sample ID: **MB-59551B** SampType: **MBLK** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **PBS** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819723**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI_GEOCON

Sample ID: **106216-066A-DUP** SampType: **DUP** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **ZZZZZZ** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819730**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25						0	0	20	

Sample ID: **106216-066A-MS** SampType: **MS** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **ZZZZZZ** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819731**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.598	0.25	5.000	0	112	70	130				

Sample ID: **106216-066A-MSD** SampType: **MSD** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **ZZZZZZ** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819732**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.652	0.25	5.000	0	113	70	130	5.598	0.960	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-59607A** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819803**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **MB-59598A TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819804**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **LCS-59607** SampType: **LCS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **LCSS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819805**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.098	0.25	1.000	0	110	80	120				

Sample ID: **106198-043A-DUP** SampType: **DUP** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **B67-1** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819816**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25						0	0	20	

Sample ID: **106198-043A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **B67-1** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819817**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.904	0.25	2.500	0	116	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106198
Project: HWY 101- MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-59607B** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819818**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **MB-59598B TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819819**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **108303-012A-DUP** SampType: **DUP** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819829**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.089	0.25						1.051	3.56	20	

Sample ID: **108303-012A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819830**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.813	0.25	2.500	1.051	110	70	130				

Sample ID: **108303-012A-MSD** SampType: **MSD** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.714	0.25	2.500	1.051	107	70	130	3.813	2.64	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

July 13, 2009

Lauren Vigliotti
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
CSDLAC No.: 10196

Workorder No.: 106216

RE: HWY 101 - MARIN CO., E8469-06-01

Attention: Lauren Vigliotti

Enclosed are the results for sample(s) received on July 01, 2009 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Lab Order: 106216

CASE NARRATIVE

Analytical Comments for Method 6010

RPD for Duplicate (DUP) is outside criteria for samples 106216-034ADUP, 106216-043ADUP, 106216-074ADUP, 106216-083ADUP and 106216-099ADUP; however, the Laboratory Control Sample (LCS) validated the analytical batch.

Analytical Comments for Method 8015 (DRO/ORO)

Dilution was necessary for samples 106216-072A, 106216-074A, 106216-076A, 106216-078A, 106216-082A, 106216-084A and 106216-086A, due to sample matrix.

Surrogate recovery was diluted out for samples 106216-072A, 106216-076A, 106216-078A, 106216-082A, 106216-084A and 106216-086A.

RPD for Duplicate (DUP) is outside criteria for samples 106216-007ADUP and 106216-096ADUP; however, the Laboratory Control Sample (LCS) validated the analytical batch.

Analytical Comments for Method 8021

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 106216-068AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8081

Dilution was necessary for sample 106216-001A, due to sample matrix.

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 106240-001AMS; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 106240-001AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Project No:
Analyte: Lead

Lab Order: 106216
Date Received 7/1/2009 8:50:00 AM
Matrix: Soil
Analyst: CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-001A	B15-0	69	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-003A	B16-0	68	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-004A	B16-1.5	ND	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-006A	B17-1.5	5.9	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-007A	B18-0	23	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-008A	B18-1.5	5.2	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-009A	B48-0	39	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-010A	B48-1	60	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-011A	B48-2	13	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-012A	B49-0	ND	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-013A	B49-1	52	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-015A	B50-0	48	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-016A	B50-1	16	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-017A	B50-2	ND	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-018A	B51-0	8.4	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-020A	B51-2	ND	mg/Kg	56410	5.0	1	6/30/2009	7/8/2009
106216-021A	B52-0	8.7	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-022A	B52-1	ND	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Project No:
Analyte: Lead

Lab Order: 106216
Date Received 7/1/2009 8:50:00 AM
Matrix: Soil
Analyst: CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-025A	B53-1	5.0	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-026A	B53-2	5.8	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-027A	B54-0	11	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-028A	B54-1	7.6	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-030A	B55-0	ND	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-032A	B55-2	ND	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-033A	B56-0	5.6	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-034A	B56-1	ND	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-035A	B56-2	ND	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-037A	B57-1	5.3	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-038A	B57-2	5.3	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-039A	B58-0	11	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-040A	B58-1	6.7	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-041A	B58-2	ND	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-042A	B59-0	8.3	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-044A	B59-2	6.3	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-045A	B60-0	11	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009
106216-047A	B60-2	6.7	mg/Kg	56411	5.0	1	6/30/2009	7/8/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106216
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/1/2009 8:50:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-048A	B61-0	8.3	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-049A	B61-1	7.4	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-050A	B62-0	13	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-051A	B62-1	22	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-052A	B62-2	12	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-053A	B63-0	5.9	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-054A	B63-1	5.1	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-056A	B72-0	15	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-057A	B72-1	6.0	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-058A	B72-2	9.8	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-059A	B73-0	580	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-060A	B73-1	29	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-062A	B74-0	420	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-063A	B74-1	7.1	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-064A	B74-2	6.3	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-066A	B75-1	160	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-067A	B75-2	27	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-071A	B1-1.5	8.6	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Project No:
Analyte: Lead

Lab Order: 106216
Date Received 7/1/2009 8:50:00 AM
Matrix: Soil
Analyst: CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-072A	B2-0	26	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-074A	B3-0	20	mg/Kg	56412	5.0	1	6/30/2009	7/8/2009
106216-075A	B3-1.5	6.2	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-076A	B4-0	39	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-077A	B4-1.5	15	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-079A	B5-1.5	6.8	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-080A	B6-0	6.0	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-081A	B6-1.5	5.0	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-082A	B7-0	62	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-084A	B8-0	28	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-085A	B8-1.5	30	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-087A	B9-1.5	11	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-088A	B10-0	28	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-089A	B10-1.5	13	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-090A	B11-0	31	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-091A	B11-1.5	ND	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-092A	B12-0	11	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-093A	B12-1.5	8.5	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106216
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/1/2009 8:50:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-095A	B13-1.5	5.9	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-096A	B14-0	22	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-097A	B14-1.5	5.7	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-098A	B19-0	34	mg/Kg	56413	5.0	1	6/30/2009	7/8/2009
106216-100A	B20-0	21	mg/Kg	56414	5.0	1	6/30/2009	7/8/2009
106216-101A	B20-1.5	ND	mg/Kg	56414	5.0	1	6/30/2009	7/8/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

Date: 7/13/2009

ANALYTICAL RESULTS

pH
EPA 9045C

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106216
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/1/2009 8:50:00 AM
Project No:		**Matrix:**	Soil
Analyte:	pH	**Analyst:**	DDL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-016A	B50-1	6.1	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-026A	B53-2	6.8	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-030A	B55-0	6.4	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-042A	B59-0	7.3	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-055A	B63-2	8.0	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-064A	B74-2	7.0	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-070A	B1-0	6.9	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-079A	B5-1.5	7.9	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-088A	B10-0	6.2	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-097A	B14-1.5	7.5	pH Units	R110522	0.10	1	6/30/2009	7/6/2009
106216-098A	B19-0	5.9	pH Units	R110523	0.10	1	6/30/2009	7/6/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-001A

Client Sample ID: B15-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	19	1.0		mg/Kg	1	7/8/2009 04:27 AM
ORO	100	1.0		mg/Kg	1	7/8/2009 04:27 AM
Surr: p-Terphenyl	49.9	30-130		%REC	1	7/8/2009 04:27 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009	Analyst: **SMH**	
4,4´-DDD	26	2.0		µg/Kg	1	7/8/2009 05:44 PM
4,4´-DDE	320	20		µg/Kg	10	7/9/2009 12:12 PM
4,4´-DDT	17	2.0		µg/Kg	1	7/8/2009 05:44 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 05:44 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 05:44 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 05:44 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 05:44 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 05:44 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 05:44 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 05:44 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 05:44 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 05:44 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 05:44 PM
Surr: Decachlorobiphenyl	48.0	20-142		%REC	1	7/8/2009 05:44 PM
Surr: Decachlorobiphenyl	41.0	20-142		%REC	10	7/9/2009 12:12 PM
Surr: Tetrachloro-m-xylene	45.5	25-115		%REC	10	7/9/2009 12:12 PM
Surr: Tetrachloro-m-xylene	45.2	25-115		%REC	1	7/8/2009 05:44 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-002A

Client Sample ID: B15-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 03:14 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Barium	99	1.0		mg/Kg	1	7/11/2009 03:14 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Chromium	90	1.0		mg/Kg	1	7/11/2009 03:14 PM
Cobalt	16	1.0		mg/Kg	1	7/11/2009 03:14 PM
Copper	9.2	2.0		mg/Kg	1	7/11/2009 03:14 PM
Lead	6.1	1.0		mg/Kg	1	7/11/2009 03:14 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Nickel	80	1.0		mg/Kg	1	7/11/2009 03:14 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 03:14 PM
Vanadium	19	1.0		mg/Kg	1	7/11/2009 03:14 PM
Zinc	17	1.0		mg/Kg	1	7/13/2009 05:26 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090702A	QC Batch: E09VS203			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/2/2009 02:55 PM
Surr: Bromofluorobenzene (FID)	108	59-145		%REC	1	7/2/2009 02:55 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090702A	QC Batch: E09VS203			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/2/2009 02:55 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/2/2009 02:55 PM
m,p-Xylene	ND	10		µg/Kg	1	7/2/2009 02:55 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/2/2009 02:55 PM
o-Xylene	ND	5.0		µg/Kg	1	7/2/2009 02:55 PM
Toluene	ND	5.0		µg/Kg	1	7/2/2009 02:55 PM
Surr: Bromofluorobenzene (PID)	100	65-140		%REC	1	7/2/2009 02:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B15-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:34 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-003A

Client Sample ID: B16-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	15	1.0		mg/Kg	1	7/8/2009 04:17 AM
ORO	74	1.0		mg/Kg	1	7/8/2009 04:17 AM
Surr: p-Terphenyl	72.0	30-130		%REC	1	7/8/2009 04:17 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
4,4´-DDE	59	2.0		µg/Kg	1	7/8/2009 05:58 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 05:58 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 05:58 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 05:58 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 05:58 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 05:58 PM
Surr: Decachlorobiphenyl	51.4	20-142		%REC	1	7/8/2009 05:58 PM
Surr: Tetrachloro-m-xylene	50.4	25-115		%REC	1	7/8/2009 05:58 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-004A

Client Sample ID: B16-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 01:35 AM
Surr: Bromofluorobenzene (FID)	104	59-145		%REC	1	7/3/2009 01:35 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 01:35 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 01:35 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 01:35 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 01:35 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 01:35 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 01:35 AM
Surr: Bromofluorobenzene (PID)	96.9	65-140		%REC	1	7/3/2009 01:35 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B17-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-005A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 03:18 PM
Arsenic	5.1	1.0		mg/Kg	1	7/11/2009 03:18 PM
Barium	180	1.0		mg/Kg	1	7/11/2009 03:18 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 03:18 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 03:18 PM
Chromium	23	1.0		mg/Kg	1	7/11/2009 03:18 PM
Cobalt	6.3	1.0		mg/Kg	1	7/11/2009 03:18 PM
Copper	11	2.0		mg/Kg	1	7/11/2009 03:18 PM
Lead	40	1.0		mg/Kg	1	7/11/2009 03:18 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 03:18 PM
Nickel	28	1.0		mg/Kg	1	7/11/2009 03:18 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 03:18 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 03:18 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 03:18 PM
Vanadium	19	1.0		mg/Kg	1	7/11/2009 03:18 PM
Zinc	39	1.0		mg/Kg	1	7/13/2009 05:40 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	10	1.0		mg/Kg	1	7/8/2009 04:08 AM
ORO	58	1.0		mg/Kg	1	7/8/2009 04:08 AM
Surr: p-Terphenyl	61.2	30-130		%REC	1	7/8/2009 04:08 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 06:12 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B17-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-005A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate:	7/7/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 06:12 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 06:12 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 06:12 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 06:12 PM
Surr: Decachlorobiphenyl	50.5	20-142		%REC	1	7/8/2009 06:12 PM
Surr: Tetrachloro-m-xylene	52.4	25-115		%REC	1	7/8/2009 06:12 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate:	7/6/2009	Analyst: **IL**
Mercury	0.27	0.10		mg/Kg	1	7/7/2009 12:36 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B17-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-006A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 01:51 AM
Surr: Bromofluorobenzene (FID)	105	59-145		%REC	1	7/3/2009 01:51 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 01:51 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 01:51 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 01:51 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 01:51 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 01:51 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 01:51 AM
Surr: Bromofluorobenzene (PID)	98.7	65-140		%REC	1	7/3/2009 01:51 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B18-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-007A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	11	1.0		mg/Kg	1	7/8/2009 03:59 AM
ORO	59	1.0		mg/Kg	1	7/8/2009 03:59 AM
Surr: p-Terphenyl	74.2	30-130		%REC	1	7/8/2009 03:59 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate: 7/7/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 06:26 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 06:26 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 06:26 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 06:26 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 06:26 PM
Surr: Decachlorobiphenyl	46.2	20-142		%REC	1	7/8/2009 06:26 PM
Surr: Tetrachloro-m-xylene	47.9	25-115		%REC	1	7/8/2009 06:26 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-008A

Client Sample ID: B18-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 02:06 AM
Surr: Bromofluorobenzene (FID)	106	59-145		%REC	1	7/3/2009 02:06 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 02:06 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 02:06 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 02:06 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 02:06 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 02:06 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 02:06 AM
Surr: Bromofluorobenzene (PID)	99.3	65-140		%REC	1	7/3/2009 02:06 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-014A

Client Sample ID: B49-2
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 03:23 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Barium	82	1.0		mg/Kg	1	7/11/2009 03:23 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Chromium	280	1.0		mg/Kg	1	7/11/2009 03:23 PM
Cobalt	19	1.0		mg/Kg	1	7/11/2009 03:23 PM
Copper	21	2.0		mg/Kg	1	7/11/2009 03:23 PM
Lead	8.0	1.0		mg/Kg	1	7/11/2009 03:23 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Nickel	260	1.0		mg/Kg	1	7/11/2009 03:23 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 03:23 PM
Vanadium	25	1.0		mg/Kg	1	7/11/2009 03:23 PM
Zinc	36	1.0		mg/Kg	1	7/13/2009 05:32 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:38 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-019A

Client Sample ID: B51-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 03:29 PM
Arsenic	3.0	1.0		mg/Kg	1	7/11/2009 03:29 PM
Barium	140	1.0		mg/Kg	1	7/11/2009 03:29 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 03:29 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 03:29 PM
Chromium	28	1.0		mg/Kg	1	7/11/2009 03:29 PM
Cobalt	8.7	1.0		mg/Kg	1	7/11/2009 03:29 PM
Copper	8.5	2.0		mg/Kg	1	7/11/2009 03:29 PM
Lead	7.8	1.0		mg/Kg	1	7/11/2009 03:29 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 03:29 PM
Nickel	28	1.0		mg/Kg	1	7/11/2009 03:29 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 03:29 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 03:29 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 03:29 PM
Vanadium	19	1.0		mg/Kg	1	7/11/2009 03:29 PM
Zinc	20	1.0		mg/Kg	1	7/13/2009 05:43 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:40 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-023A

Client Sample ID: B52-2
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 03:33 PM
Arsenic	1.5	1.0		mg/Kg	1	7/11/2009 03:33 PM
Barium	130	1.0		mg/Kg	1	7/11/2009 03:33 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 03:33 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 03:33 PM
Chromium	83	1.0		mg/Kg	1	7/11/2009 03:33 PM
Cobalt	24	1.0		mg/Kg	1	7/11/2009 03:33 PM
Copper	12	2.0		mg/Kg	1	7/11/2009 03:33 PM
Lead	10	1.0		mg/Kg	1	7/11/2009 03:33 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 03:33 PM
Nickel	57	1.0		mg/Kg	1	7/11/2009 03:33 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 03:33 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 03:33 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 03:33 PM
Vanadium	66	1.0		mg/Kg	1	7/11/2009 03:33 PM
Zinc	20	1.0		mg/Kg	1	7/13/2009 05:44 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-024A

Client Sample ID: B53-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 03:59 PM
Arsenic	11	1.0		mg/Kg	1	7/11/2009 03:59 PM
Barium	120	1.0		mg/Kg	1	7/11/2009 03:59 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 03:59 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 03:59 PM
Chromium	45	1.0		mg/Kg	1	7/11/2009 03:59 PM
Cobalt	10	1.0		mg/Kg	1	7/11/2009 03:59 PM
Copper	10	2.0		mg/Kg	1	7/11/2009 03:59 PM
Lead	33	1.0		mg/Kg	1	7/11/2009 03:59 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 03:59 PM
Nickel	46	1.0		mg/Kg	1	7/11/2009 03:59 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 03:59 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 03:59 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 03:59 PM
Vanadium	28	1.0		mg/Kg	1	7/11/2009 03:59 PM
Zinc	36	1.0		mg/Kg	1	7/13/2009 05:36 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:44 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-029A

Client Sample ID: B54-2
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 04:04 PM
Arsenic	1.5	1.0		mg/Kg	1	7/11/2009 04:04 PM
Barium	110	1.0		mg/Kg	1	7/11/2009 04:04 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 04:04 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 04:04 PM
Chromium	40	1.0		mg/Kg	1	7/11/2009 04:04 PM
Cobalt	9.3	1.0		mg/Kg	1	7/11/2009 04:04 PM
Copper	8.7	2.0		mg/Kg	1	7/11/2009 04:04 PM
Lead	8.8	1.0		mg/Kg	1	7/11/2009 04:04 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 04:04 PM
Nickel	41	1.0		mg/Kg	1	7/11/2009 04:04 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 04:04 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 04:04 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 04:04 PM
Vanadium	26	1.0		mg/Kg	1	7/11/2009 04:04 PM
Zinc	24	1.0		mg/Kg	1	7/13/2009 05:37 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:46 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-031A

Client Sample ID: B55-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 04:09 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Barium	140	1.0		mg/Kg	1	7/11/2009 04:09 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Chromium	47	1.0		mg/Kg	1	7/11/2009 04:09 PM
Cobalt	11	1.0		mg/Kg	1	7/11/2009 04:09 PM
Copper	11	2.0		mg/Kg	1	7/11/2009 04:09 PM
Lead	6.5	1.0		mg/Kg	1	7/11/2009 04:09 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Nickel	49	1.0		mg/Kg	1	7/11/2009 04:09 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 04:09 PM
Vanadium	34	1.0		mg/Kg	1	7/11/2009 04:09 PM
Zinc	24	1.0		mg/Kg	1	7/13/2009 05:45 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 12:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-036A

Client Sample ID: B57-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 04:14 PM
Arsenic	1.2	1.0		mg/Kg	1	7/11/2009 04:14 PM
Barium	120	1.0		mg/Kg	1	7/11/2009 04:14 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 04:14 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 04:14 PM
Chromium	47	1.0		mg/Kg	1	7/11/2009 04:14 PM
Cobalt	10	1.0		mg/Kg	1	7/11/2009 04:14 PM
Copper	10	2.0		mg/Kg	1	7/11/2009 04:14 PM
Lead	8.4	1.0		mg/Kg	1	7/11/2009 04:14 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 04:14 PM
Nickel	47	1.0		mg/Kg	1	7/11/2009 04:14 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 04:14 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 04:14 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 04:14 PM
Vanadium	28	1.0		mg/Kg	1	7/11/2009 04:14 PM
Zinc	32	1.0		mg/Kg	1	7/13/2009 05:47 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	0.39	0.10		mg/Kg	1	7/7/2009 12:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-043A

Client Sample ID: B59-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711D	QC Batch: 56407			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 04:18 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Barium	110	1.0		mg/Kg	1	7/11/2009 04:18 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Chromium	47	1.0		mg/Kg	1	7/11/2009 04:18 PM
Cobalt	16	1.0		mg/Kg	1	7/11/2009 04:18 PM
Copper	14	2.0		mg/Kg	1	7/11/2009 04:18 PM
Lead	11	1.0		mg/Kg	1	7/11/2009 04:18 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Nickel	52	1.0		mg/Kg	1	7/11/2009 04:18 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 04:18 PM
Vanadium	42	1.0		mg/Kg	1	7/11/2009 04:18 PM
Zinc	32	1.0		mg/Kg	1	7/13/2009 05:53 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707B	QC Batch: 56400			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	0.17	0.10		mg/Kg	1	7/7/2009 12:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-046A

Client Sample ID: B60-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:04 PM
Arsenic	1.9	1.0		mg/Kg	1	7/11/2009 05:04 PM
Barium	190	1.0		mg/Kg	1	7/11/2009 05:04 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:04 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:04 PM
Chromium	45	1.0		mg/Kg	1	7/11/2009 05:04 PM
Cobalt	8.9	1.0		mg/Kg	1	7/11/2009 05:04 PM
Copper	9.4	2.0		mg/Kg	1	7/11/2009 05:04 PM
Lead	8.8	1.0		mg/Kg	1	7/11/2009 05:04 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:04 PM
Nickel	41	1.0		mg/Kg	1	7/11/2009 05:04 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:04 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:04 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:04 PM
Vanadium	30	1.0		mg/Kg	1	7/11/2009 05:04 PM
Zinc	33	1.0		mg/Kg	1	7/11/2009 05:04 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:11 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-055A

Client Sample ID: B63-2
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:09 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Barium	94	1.0		mg/Kg	1	7/11/2009 05:09 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Chromium	48	1.0		mg/Kg	1	7/11/2009 05:09 PM
Cobalt	23	1.0		mg/Kg	1	7/11/2009 05:09 PM
Copper	6.8	2.0		mg/Kg	1	7/11/2009 05:09 PM
Lead	8.9	1.0		mg/Kg	1	7/11/2009 05:09 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Nickel	52	1.0		mg/Kg	1	7/11/2009 05:09 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:09 PM
Vanadium	27	1.0		mg/Kg	1	7/11/2009 05:09 PM
Zinc	32	1.0		mg/Kg	1	7/11/2009 05:09 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:13 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-061A

Client Sample ID: B73-2
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:14 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Barium	170	1.0		mg/Kg	1	7/11/2009 05:14 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Chromium	26	1.0		mg/Kg	1	7/11/2009 05:14 PM
Cobalt	10	1.0		mg/Kg	1	7/11/2009 05:14 PM
Copper	21	2.0		mg/Kg	1	7/11/2009 05:14 PM
Lead	22	1.0		mg/Kg	1	7/11/2009 05:14 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Nickel	29	1.0		mg/Kg	1	7/11/2009 05:14 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:14 PM
Vanadium	42	1.0		mg/Kg	1	7/11/2009 05:14 PM
Zinc	54	1.0		mg/Kg	1	7/11/2009 05:14 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:19 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-065A

Client Sample ID: B75-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:19 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Barium	95	1.0		mg/Kg	1	7/11/2009 05:19 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Chromium	42	1.0		mg/Kg	1	7/11/2009 05:19 PM
Cobalt	12	1.0		mg/Kg	1	7/11/2009 05:19 PM
Copper	23	2.0		mg/Kg	1	7/11/2009 05:19 PM
Lead	21	1.0		mg/Kg	1	7/11/2009 05:19 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Nickel	68	1.0		mg/Kg	1	7/11/2009 05:19 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:19 PM
Vanadium	43	1.0		mg/Kg	1	7/11/2009 05:19 PM
Zinc	110	1.0		mg/Kg	1	7/11/2009 05:19 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	0.34	0.10		mg/Kg	1	7/7/2009 01:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B76-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-068A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:24 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Barium	130	1.0		mg/Kg	1	7/11/2009 05:24 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Chromium	55	1.0		mg/Kg	1	7/11/2009 05:24 PM
Cobalt	12	1.0		mg/Kg	1	7/11/2009 05:24 PM
Copper	14	2.0		mg/Kg	1	7/11/2009 05:24 PM
Lead	8.1	1.0		mg/Kg	1	7/11/2009 05:24 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Nickel	44	1.0		mg/Kg	1	7/11/2009 05:24 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:24 PM
Vanadium	44	1.0		mg/Kg	1	7/11/2009 05:24 PM
Zinc	32	1.0		mg/Kg	1	7/11/2009 05:24 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	ND	1.0		mg/Kg	1	7/8/2009 03:23 AM
ORO	5.2	1.0		mg/Kg	1	7/8/2009 03:23 AM
Surr: p-Terphenyl	72.0	30-130		%REC	1	7/8/2009 03:23 AM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090702A	QC Batch: E09VS203			PrepDate:	Analyst: **KHN**	
GRO	ND	1.0		mg/Kg	1	7/2/2009 12:48 PM
Surr: Bromofluorobenzene (FID)	102	59-145		%REC	1	7/2/2009 12:48 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090702A	QC Batch: E09VS203			PrepDate:	Analyst: **KHN**	
Benzene	ND	5.0		µg/Kg	1	7/2/2009 12:48 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/2/2009 12:48 PM
m,p-Xylene	ND	10		µg/Kg	1	7/2/2009 12:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B76-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-068A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702A	QC Batch: E09VS203			PrepDate:		Analyst: **KHN**
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/2/2009 12:48 PM
o-Xylene	ND	5.0		µg/Kg	1	7/2/2009 12:48 PM
Toluene	ND	5.0		µg/Kg	1	7/2/2009 12:48 PM
Surr: Bromofluorobenzene (PID)	93.3	65-140		%REC	1	7/2/2009 12:48 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090708A	QC Batch: 56449			PrepDate:	7/7/2009	Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
Aldrin	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
beta-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
Chlordane	ND	8.5		µg/Kg	1	7/8/2009 06:40 PM
delta-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
Dieldrin	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
Endrin	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/8/2009 06:40 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
Heptachlor	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/8/2009 06:40 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/8/2009 06:40 PM
Toxaphene	ND	50		µg/Kg	1	7/8/2009 06:40 PM
Surr: Decachlorobiphenyl	73.6	20-142		%REC	1	7/8/2009 06:40 PM
Surr: Tetrachloro-m-xylene	81.3	25-115		%REC	1	7/8/2009 06:40 PM
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090707C	QC Batch: 56401			PrepDate:	7/6/2009	Analyst: **IL**

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B76-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-068A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:23 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-069A

Client Sample ID: B76-4
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:28 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Barium	120	1.0		mg/Kg	1	7/11/2009 05:28 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Chromium	40	1.0		mg/Kg	1	7/11/2009 05:28 PM
Cobalt	9.8	1.0		mg/Kg	1	7/11/2009 05:28 PM
Copper	9.5	2.0		mg/Kg	1	7/11/2009 05:28 PM
Lead	6.2	1.0		mg/Kg	1	7/11/2009 05:28 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Nickel	36	1.0		mg/Kg	1	7/11/2009 05:28 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:28 PM
Vanadium	32	1.0		mg/Kg	1	7/11/2009 05:28 PM
Zinc	26	1.0		mg/Kg	1	7/11/2009 05:28 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B1-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-070A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:33 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Barium	180	1.0		mg/Kg	1	7/11/2009 05:33 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Chromium	42	1.0		mg/Kg	1	7/11/2009 05:33 PM
Cobalt	19	1.0		mg/Kg	1	7/11/2009 05:33 PM
Copper	28	2.0		mg/Kg	1	7/11/2009 05:33 PM
Lead	25	1.0		mg/Kg	1	7/11/2009 05:33 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Nickel	57	1.0		mg/Kg	1	7/11/2009 05:33 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:33 PM
Vanadium	34	1.0		mg/Kg	1	7/11/2009 05:33 PM
Zinc	93	1.0		mg/Kg	1	7/11/2009 05:33 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	47	2.0		mg/Kg	1	7/8/2009 04:36 AM
ORO	250	2.0		mg/Kg	1	7/8/2009 04:36 AM
Surr: p-Terphenyl	65.7	30-130		%REC	1	7/8/2009 04:36 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 07:07 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-070A

Client Sample ID: B1-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate:	7/8/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 07:07 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 07:07 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 07:07 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 07:07 PM
Surr: Decachlorobiphenyl	40.8	20-142		%REC	1	7/9/2009 07:07 PM
Surr: Tetrachloro-m-xylene	40.8	25-115		%REC	1	7/9/2009 07:07 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate:	7/6/2009	Analyst: **IL**
Mercury	0.11	0.10		mg/Kg	1	7/7/2009 01:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-071A

Client Sample ID: B1-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 02:22 AM
Surr: Bromofluorobenzene (FID)	106	59-145		%REC	1	7/3/2009 02:22 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 02:22 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 02:22 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 02:22 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 02:22 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 02:22 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 02:22 AM
Surr: Bromofluorobenzene (PID)	99.4	65-140		%REC	1	7/3/2009 02:22 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-072A

Client Sample ID: B2-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	100	20		mg/Kg	10	7/8/2009 05:14 AM
ORO	1000	20		mg/Kg	10	7/8/2009 05:14 AM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/8/2009 05:14 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 11:07 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 11:07 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 11:07 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 11:07 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 11:07 PM
Surr: Decachlorobiphenyl	30.3	20-142		%REC	1	7/9/2009 11:07 PM
Surr: Tetrachloro-m-xylene	35.5	25-115		%REC	1	7/9/2009 11:07 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-073A

Client Sample ID: B2-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:38 PM
Arsenic	3.4	1.0		mg/Kg	1	7/11/2009 05:38 PM
Barium	110	1.0		mg/Kg	1	7/11/2009 05:38 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:38 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:38 PM
Chromium	66	1.0		mg/Kg	1	7/11/2009 05:38 PM
Cobalt	16	1.0		mg/Kg	1	7/11/2009 05:38 PM
Copper	20	2.0		mg/Kg	1	7/11/2009 05:38 PM
Lead	7.8	1.0		mg/Kg	1	7/11/2009 05:38 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:38 PM
Nickel	93	1.0		mg/Kg	1	7/11/2009 05:38 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:38 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:38 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:38 PM
Vanadium	44	1.0		mg/Kg	1	7/11/2009 05:38 PM
Zinc	41	1.0		mg/Kg	1	7/11/2009 05:38 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 02:37 AM
Surr: Bromofluorobenzene (FID)	111	59-145		%REC	1	7/3/2009 02:37 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 02:37 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 02:37 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 02:37 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 02:37 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 02:37 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 02:37 AM
Surr: Bromofluorobenzene (PID)	104	65-140		%REC	1	7/3/2009 02:37 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B2-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-073A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009	Analyst: **IL**	
Mercury	0.26	0.10		mg/Kg	1	7/7/2009 01:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B3-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-074A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	31	5.0		mg/Kg	5	7/8/2009 04:45 AM
ORO	230	5.0		mg/Kg	5	7/8/2009 04:45 AM
Surr: p-Terphenyl	61.7	30-130		%REC	5	7/8/2009 04:45 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 07:21 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 07:21 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 07:21 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 07:21 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 07:21 PM
Surr: Decachlorobiphenyl	41.4	20-142		%REC	1	7/9/2009 07:21 PM
Surr: Tetrachloro-m-xylene	43.3	25-115		%REC	1	7/9/2009 07:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B3-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-075A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 02:53 AM
Surr: Bromofluorobenzene (FID)	104	59-145		%REC	1	7/3/2009 02:53 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 02:53 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 02:53 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 02:53 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 02:53 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 02:53 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 02:53 AM
Surr: Bromofluorobenzene (PID)	96.9	65-140		%REC	1	7/3/2009 02:53 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-076A

Client Sample ID: B4-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	160	20		mg/Kg	10	7/8/2009 04:55 AM
ORO	1200	20		mg/Kg	10	7/8/2009 04:55 AM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/8/2009 04:55 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 07:35 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 07:35 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
gamma-Chlordane	1.2	1.0		µg/Kg	1	7/9/2009 07:35 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 07:35 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 07:35 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 07:35 PM
Surr: Decachlorobiphenyl	58.9	20-142		%REC	1	7/9/2009 07:35 PM
Surr: Tetrachloro-m-xylene	39.4	25-115		%REC	1	7/9/2009 07:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-077A

Client Sample ID: B4-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 03:09 AM
Surr: Bromofluorobenzene (FID)	116	59-145		%REC	1	7/3/2009 03:09 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 03:09 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 03:09 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 03:09 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 03:09 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 03:09 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 03:09 AM
Surr: Bromofluorobenzene (PID)	108	65-140		%REC	1	7/3/2009 03:09 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B5-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-078A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / **EPA 6010B**						
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:42 PM
Arsenic	3.1	1.0		mg/Kg	1	7/11/2009 05:42 PM
Barium	160	1.0		mg/Kg	1	7/11/2009 05:42 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:42 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:42 PM
Chromium	36	1.0		mg/Kg	1	7/11/2009 05:42 PM
Cobalt	11	1.0		mg/Kg	1	7/11/2009 05:42 PM
Copper	29	2.0		mg/Kg	1	7/11/2009 05:42 PM
Lead	22	1.0		mg/Kg	1	7/11/2009 05:42 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:42 PM
Nickel	38	1.0		mg/Kg	1	7/11/2009 05:42 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:42 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:42 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:42 PM
Vanadium	40	1.0		mg/Kg	1	7/11/2009 05:42 PM
Zinc	77	1.0		mg/Kg	1	7/11/2009 05:42 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / **EPA 8015B(M)**						
RunID: GC16_090707F	QC Batch: 56440			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	82	20		mg/Kg	10	7/8/2009 05:04 AM
ORO	720	20		mg/Kg	10	7/8/2009 05:04 AM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/8/2009 05:04 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B / **EPA 8081A**						
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 07:49 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-078A

Client Sample ID: B5-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate:	7/8/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 07:49 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 07:49 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 07:49 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 07:49 PM
Surr: Decachlorobiphenyl	44.8	20-142		%REC	1	7/9/2009 07:49 PM
Surr: Tetrachloro-m-xylene	41.0	25-115		%REC	1	7/9/2009 07:49 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707C	QC Batch: 56401			PrepDate:	7/6/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:31 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B5-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-079A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 03:24 AM
Surr: Bromofluorobenzene (FID)	101	59-145		%REC	1	7/3/2009 03:24 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 03:24 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 03:24 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 03:24 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 03:24 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 03:24 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 03:24 AM
Surr: Bromofluorobenzene (PID)	94.7	65-140		%REC	1	7/3/2009 03:24 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-080A

Client Sample ID: B6-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	2.3	1.0		mg/Kg	1	7/9/2009 02:52 PM
ORO	22	1.0		mg/Kg	1	7/9/2009 02:52 PM
Surr: p-Terphenyl	91.5	30-130		%REC	1	7/9/2009 02:52 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 08:03 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 08:03 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 08:03 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 08:03 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 08:03 PM
Surr: Decachlorobiphenyl	44.9	20-142		%REC	1	7/9/2009 08:03 PM
Surr: Tetrachloro-m-xylene	47.7	25-115		%REC	1	7/9/2009 08:03 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-081A

Client Sample ID: B6-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 01:04 AM
Surr: Bromofluorobenzene (FID)	109	59-145		%REC	1	7/3/2009 01:04 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 01:04 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 01:04 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 01:04 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 01:04 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 01:04 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 01:04 AM
Surr: Bromofluorobenzene (PID)	101	65-140		%REC	1	7/3/2009 01:04 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-082A

Client Sample ID: B7-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	26	10		mg/Kg	10	7/9/2009 03:21 PM
ORO	340	10		mg/Kg	10	7/9/2009 03:21 PM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/9/2009 03:21 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
Chlordane	8.8	8.5		µg/Kg	1	7/9/2009 08:32 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 08:32 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 08:32 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 08:32 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 08:32 PM
Surr: Decachlorobiphenyl	43.3	20-142		%REC	1	7/9/2009 08:32 PM
Surr: Tetrachloro-m-xylene	45.8	25-115		%REC	1	7/9/2009 08:32 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-083A

Client Sample ID: B7-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711E	QC Batch: 56408			PrepDate: 7/7/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 05:57 PM
Arsenic	1.3	1.0		mg/Kg	1	7/11/2009 05:57 PM
Barium	78	1.0		mg/Kg	1	7/11/2009 05:57 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 05:57 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 05:57 PM
Chromium	19	1.0		mg/Kg	1	7/11/2009 05:57 PM
Cobalt	3.2	1.0		mg/Kg	1	7/11/2009 05:57 PM
Copper	9.0	2.0		mg/Kg	1	7/11/2009 05:57 PM
Lead	4.7	1.0		mg/Kg	1	7/11/2009 05:57 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 05:57 PM
Nickel	14	1.0		mg/Kg	1	7/11/2009 05:57 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 05:57 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 05:57 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 05:57 PM
Vanadium	19	1.0		mg/Kg	1	7/11/2009 05:57 PM
Zinc	19	1.0		mg/Kg	1	7/11/2009 05:57 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 03:40 AM
Surr: Bromofluorobenzene (FID)	103	59-145		%REC	1	7/3/2009 03:40 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090702B	QC Batch: E09VS204			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 03:40 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 03:40 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 03:40 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 03:40 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 03:40 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 03:40 AM
Surr: Bromofluorobenzene (PID)	99.1	65-140		%REC	1	7/3/2009 03:40 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B7-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-083A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090707C	QC Batch: 56401			PrepDate: 7/6/2009		Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/7/2009 01:07 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-084A

Client Sample ID: B8-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	470	40		mg/Kg	20	7/9/2009 03:41 PM
ORO	3200	40		mg/Kg	20	7/9/2009 03:41 PM
Surr: p-Terphenyl	0	30-130	SDO	%REC	20	7/9/2009 03:41 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
4,4´-DDE	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
4,4´-DDT	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
Aldrin	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
alpha-BHC	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
alpha-Chlordane	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
beta-BHC	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
Chlordane	ND	17		µg/Kg	1	7/9/2009 08:46 PM
delta-BHC	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
Dieldrin	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
Endosulfan I	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
Endosulfan II	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
Endosulfan sulfate	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
Endrin	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
Endrin aldehyde	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
Endrin ketone	ND	4.0		µg/Kg	1	7/9/2009 08:46 PM
gamma-BHC	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
gamma-Chlordane	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
Heptachlor	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
Heptachlor epoxide	ND	2.0		µg/Kg	1	7/9/2009 08:46 PM
Methoxychlor	ND	10		µg/Kg	1	7/9/2009 08:46 PM
Toxaphene	ND	100		µg/Kg	1	7/9/2009 08:46 PM
Surr: Decachlorobiphenyl	30.9	20-142		%REC	1	7/9/2009 08:46 PM
Surr: Tetrachloro-m-xylene	27.0	25-115		%REC	1	7/9/2009 08:46 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B8-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-085A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 08:20 AM
Surr: Bromofluorobenzene (FID)	101	59-145		%REC	1	7/3/2009 08:20 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 08:20 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 08:20 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 08:20 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 08:20 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 08:20 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 08:20 AM
Surr: Bromofluorobenzene (PID)	97.2	65-140		%REC	1	7/3/2009 08:20 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B9-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-086A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711F	QC Batch: 56409			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 06:33 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 06:33 PM
Barium	170	1.0		mg/Kg	1	7/11/2009 06:33 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 06:33 PM
Cadmium	1.2	1.0		mg/Kg	1	7/11/2009 06:33 PM
Chromium	84	1.0		mg/Kg	1	7/11/2009 06:33 PM
Cobalt	13	1.0		mg/Kg	1	7/11/2009 06:33 PM
Copper	40	2.0		mg/Kg	1	7/11/2009 06:33 PM
Lead	130	1.0		mg/Kg	1	7/11/2009 06:33 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 06:33 PM
Nickel	89	1.0		mg/Kg	1	7/11/2009 06:33 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 06:33 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 06:33 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 06:33 PM
Vanadium	44	1.0		mg/Kg	1	7/11/2009 06:33 PM
Zinc	170	1.0		mg/Kg	1	7/11/2009 06:33 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	160	20		mg/Kg	10	7/9/2009 03:31 PM
ORO	1200	20		mg/Kg	10	7/9/2009 03:31 PM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/9/2009 03:31 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
4,4´-DDT	4.0	2.0		µg/Kg	1	7/9/2009 09:00 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
alpha-Chlordane	1.4	1.0		µg/Kg	1	7/9/2009 09:00 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
Chlordane	12	8.5		µg/Kg	1	7/9/2009 09:00 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-086A

Client Sample ID: B9-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate:	7/8/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 09:00 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
gamma-Chlordane	1.6	1.0		µg/Kg	1	7/9/2009 09:00 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 09:00 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 09:00 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 09:00 PM
Surr: Decachlorobiphenyl	47.5	20-142		%REC	1	7/9/2009 09:00 PM
Surr: Tetrachloro-m-xylene	25.5	25-115		%REC	1	7/9/2009 09:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707D	QC Batch: 56402			PrepDate:	7/6/2009	Analyst: **IL**
Mercury	0.26	0.10		mg/Kg	1	7/7/2009 02:00 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-087A

Client Sample ID: B9-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 08:36 AM
Surr: Bromofluorobenzene (FID)	106	59-145		%REC	1	7/3/2009 08:36 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 08:36 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 08:36 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 08:36 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 08:36 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 08:36 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 08:36 AM
Surr: Bromofluorobenzene (PID)	101	65-140		%REC	1	7/3/2009 08:36 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-088A

Client Sample ID: B10-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	13	1.0		mg/Kg	1	7/9/2009 03:51 PM
ORO	91	1.0		mg/Kg	1	7/9/2009 03:51 PM
Surr: p-Terphenyl	66.6	30-130		%REC	1	7/9/2009 03:51 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709A	QC Batch: 56472			PrepDate: 7/8/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 09:14 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 09:14 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 09:14 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 09:14 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 09:14 PM
Surr: Decachlorobiphenyl	39.6	20-142		%REC	1	7/9/2009 09:14 PM
Surr: Tetrachloro-m-xylene	39.3	25-115		%REC	1	7/9/2009 09:14 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-089A

Client Sample ID: B10-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 08:52 AM
Surr: Bromofluorobenzene (FID)	107	59-145		%REC	1	7/3/2009 08:52 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 08:52 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 08:52 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 08:52 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 08:52 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 08:52 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 08:52 AM
Surr: Bromofluorobenzene (PID)	101	65-140		%REC	1	7/3/2009 08:52 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-090A

Client Sample ID: B11-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	4.6	1.0		mg/Kg	1	7/9/2009 03:02 PM
ORO	42	1.0		mg/Kg	1	7/9/2009 03:02 PM
Surr: p-Terphenyl	61.2	30-130		%REC	1	7/9/2009 03:02 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
4,4´-DDE	11	2.0		µg/Kg	1	7/9/2009 09:28 PM
4,4´-DDT	3.5	2.0		µg/Kg	1	7/9/2009 09:28 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 09:28 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 09:28 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 09:28 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 09:28 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 09:28 PM
Surr: Decachlorobiphenyl	42.1	20-142		%REC	1	7/9/2009 09:28 PM
Surr: Tetrachloro-m-xylene	40.7	25-115		%REC	1	7/9/2009 09:28 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-091A

Client Sample ID: B11-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 09:07 AM
Surr: Bromofluorobenzene (FID)	103	59-145		%REC	1	7/3/2009 09:07 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 09:07 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 09:07 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 09:07 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 09:07 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 09:07 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 09:07 AM
Surr: Bromofluorobenzene (PID)	98.9	65-140		%REC	1	7/3/2009 09:07 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-092A

Client Sample ID: B12-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	9.3	1.0		mg/Kg	1	7/9/2009 02:33 PM
ORO	44	1.0		mg/Kg	1	7/9/2009 02:33 PM
Surr: p-Terphenyl	54.7	30-130		%REC	1	7/9/2009 02:33 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 09:43 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 09:43 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 09:43 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 09:43 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 09:43 PM
Surr: Decachlorobiphenyl	42.7	20-142		%REC	1	7/9/2009 09:43 PM
Surr: Tetrachloro-m-xylene	45.3	25-115		%REC	1	7/9/2009 09:43 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B12-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-093A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 09:23 AM
Surr: Bromofluorobenzene (FID)	98.2	59-145		%REC	1	7/3/2009 09:23 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 09:23 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 09:23 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 09:23 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 09:23 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 09:23 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 09:23 AM
Surr: Bromofluorobenzene (PID)	93.5	65-140		%REC	1	7/3/2009 09:23 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B13-0
Lab Order: 106216 **Collection Date:** 6/30/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106216-094A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711F	QC Batch: 56409			PrepDate: 7/7/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/11/2009 06:38 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Barium	110	1.0		mg/Kg	1	7/11/2009 06:38 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Chromium	21	1.0		mg/Kg	1	7/11/2009 06:38 PM
Cobalt	5.8	1.0		mg/Kg	1	7/11/2009 06:38 PM
Copper	10	2.0		mg/Kg	1	7/11/2009 06:38 PM
Lead	32	1.0		mg/Kg	1	7/11/2009 06:38 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Nickel	13	1.0		mg/Kg	1	7/11/2009 06:38 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 06:38 PM
Vanadium	22	1.0		mg/Kg	1	7/11/2009 06:38 PM
Zinc	43	1.0		mg/Kg	1	7/11/2009 06:38 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	7.7	1.0		mg/Kg	1	7/9/2009 02:14 PM
ORO	69	1.0		mg/Kg	1	7/9/2009 02:14 PM
Surr: p-Terphenyl	66.8	30-130		%REC	1	7/9/2009 02:14 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate: 7/8/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 10:11 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-094A

Client Sample ID: B13-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate:	7/8/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 10:11 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 10:11 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 10:11 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 10:11 PM
Surr: Decachlorobiphenyl	31.9	20-142		%REC	1	7/9/2009 10:11 PM
Surr: Tetrachloro-m-xylene	39.0	25-115		%REC	1	7/9/2009 10:11 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090707D	QC Batch: 56402			PrepDate:	7/6/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/7/2009 02:02 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B13-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-095A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 09:38 AM
Surr: Bromofluorobenzene (FID)	102	59-145		%REC	1	7/3/2009 09:38 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 09:38 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 09:38 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 09:38 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 09:38 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 09:38 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 09:38 AM
Surr: Bromofluorobenzene (PID)	97.5	65-140		%REC	1	7/3/2009 09:38 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-096A

Client Sample ID: B14-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	4.3	1.0		mg/Kg	1	7/9/2009 02:24 PM
ORO	28	1.0		mg/Kg	1	7/9/2009 02:24 PM
Surr: p-Terphenyl	60.6	30-130		%REC	1	7/9/2009 02:24 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 10:25 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 10:25 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 10:25 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 10:25 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 10:25 PM
Surr: Decachlorobiphenyl	32.0	20-142		%REC	1	7/9/2009 10:25 PM
Surr: Tetrachloro-m-xylene	40.2	25-115		%REC	1	7/9/2009 10:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B14-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-097A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 09:54 AM
Surr: Bromofluorobenzene (FID)	104	59-145		%REC	1	7/3/2009 09:54 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 09:54 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 09:54 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 09:54 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 09:54 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 09:54 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 09:54 AM
Surr: Bromofluorobenzene (PID)	98.0	65-140		%REC	1	7/3/2009 09:54 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-098A

Client Sample ID: B19-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709A	QC Batch: 56441			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	6.2	1.0		mg/Kg	1	7/9/2009 02:43 PM
ORO	42	1.0		mg/Kg	1	7/9/2009 02:43 PM
Surr: p-Terphenyl	51.8	30-130		%REC	1	7/9/2009 02:43 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 10:39 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 10:39 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 10:39 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 10:39 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 10:39 PM
Surr: Decachlorobiphenyl	31.3	20-142		%REC	1	7/9/2009 10:39 PM
Surr: Tetrachloro-m-xylene	36.6	25-115		%REC	1	7/9/2009 10:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-099A

Client Sample ID: B19-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090711F	QC Batch: 56409			PrepDate: 7/7/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/11/2009 06:43 PM
Arsenic	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Barium	130	1.0		mg/Kg	1	7/11/2009 06:43 PM
Beryllium	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Cadmium	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Chromium	23	1.0		mg/Kg	1	7/11/2009 06:43 PM
Cobalt	18	1.0		mg/Kg	1	7/11/2009 06:43 PM
Copper	7.3	2.0		mg/Kg	1	7/11/2009 06:43 PM
Lead	4.8	1.0		mg/Kg	1	7/11/2009 06:43 PM
Molybdenum	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Nickel	14	1.0		mg/Kg	1	7/11/2009 06:43 PM
Selenium	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Silver	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Thallium	ND	1.0		mg/Kg	1	7/11/2009 06:43 PM
Vanadium	28	1.0		mg/Kg	1	7/11/2009 06:43 PM
Zinc	19	1.0		mg/Kg	1	7/11/2009 06:43 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 10:10 AM
Surr: Bromofluorobenzene (FID)	105	59-145		%REC	1	7/3/2009 10:10 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 10:10 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 10:10 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 10:10 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 10:10 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 10:10 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 10:10 AM
Surr: Bromofluorobenzene (PID)	99.8	65-140		%REC	1	7/3/2009 10:10 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B19-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-099A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090707D	QC Batch: 56402			PrepDate: 7/6/2009		Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/7/2009 02:04 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-100A

Client Sample ID: B20-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707E	QC Batch: 56443			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	6.8	1.0		mg/Kg	1	7/8/2009 01:22 AM
ORO	40	1.0		mg/Kg	1	7/8/2009 01:22 AM
Surr: p-Terphenyl	60.2	30-130		%REC	1	7/8/2009 01:22 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090709B	QC Batch: 56473			PrepDate: 7/8/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
Aldrin	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
beta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
Chlordane	ND	8.5		µg/Kg	1	7/9/2009 10:53 PM
delta-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
Dieldrin	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
Endrin	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/9/2009 10:53 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
Heptachlor	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/9/2009 10:53 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/9/2009 10:53 PM
Toxaphene	ND	50		µg/Kg	1	7/9/2009 10:53 PM
Surr: Decachlorobiphenyl	32.7	20-142		%REC	1	7/9/2009 10:53 PM
Surr: Tetrachloro-m-xylene	36.8	25-115		%REC	1	7/9/2009 10:53 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *13-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-101A

Client Sample ID: B20-1.5
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/3/2009 07:49 AM
Surr: Bromofluorobenzene (FID)	102	59-145		%REC	1	7/3/2009 07:49 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090702C	QC Batch: E09VS205			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/3/2009 07:49 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/3/2009 07:49 AM
m,p-Xylene	ND	10		µg/Kg	1	7/3/2009 07:49 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/3/2009 07:49 AM
o-Xylene	ND	5.0		µg/Kg	1	7/3/2009 07:49 AM
Toluene	ND	5.0		µg/Kg	1	7/3/2009 07:49 AM
Surr: Bromofluorobenzene (PID)	97.1	65-140		%REC	1	7/3/2009 07:49 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-56407** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **PBS** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742359**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.521	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	0.011	1.0									
Chromium	0.105	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	0.078	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									

Sample ID: **LCS-56407** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **LCSS** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742360**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	49.382	2.0	50.00	0.5210	97.7	80	120				
Arsenic	49.099	1.0	50.00	0	98.2	80	120				
Barium	51.574	1.0	50.00	0	103	80	120				
Beryllium	49.873	1.0	50.00	0	99.7	80	120				
Cadmium	50.224	1.0	50.00	0.01060	100	80	120				
Chromium	50.488	1.0	50.00	0.1052	101	80	120				
Cobalt	48.511	1.0	50.00	0	97.0	80	120				
Copper	52.300	2.0	50.00	0	105	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-56407** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **LCSS** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742360**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	51.355	1.0	50.00	0	103	80	120				
Molybdenum	51.265	1.0	50.00	0	103	80	120				
Nickel	49.169	1.0	50.00	0.07786	98.2	80	120				
Selenium	45.783	1.0	50.00	0	91.6	80	120				
Silver	50.386	1.0	50.00	0	101	80	120				
Thallium	48.458	1.0	50.00	0	96.9	80	120				
Vanadium	52.394	1.0	50.00	0	105	80	120				

Sample ID: **106216-043ADUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **B59-1** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742371**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0	0	20	
Arsenic	ND	1.0						0	0	20	
Barium	114.128	1.0						113.8	0.322	20	
Beryllium	ND	1.0						0	0	20	
Cadmium	0.591	1.0						0.6032	0	20	
Chromium	39.229	1.0						46.90	17.8	20	
Cobalt	9.122	1.0						16.20	55.9	20	R
Copper	14.179	2.0						14.06	0.820	20	
Lead	12.372	1.0						10.59	15.5	20	
Molybdenum	ND	1.0						0	0	20	
Nickel	45.714	1.0						51.84	12.6	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	34.601	1.0						41.72	18.7	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106216-043AMS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **B59-1** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742372**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	91.342	2.0	125.0	0	73.1	25	106				
Arsenic	103.342	1.0	125.0	0	82.7	42	113				
Barium	223.217	1.0	125.0	113.8	87.6	19	140				
Beryllium	107.744	1.0	125.0	0	86.2	50	109				
Cadmium	103.650	1.0	125.0	0.6032	82.4	48	106				
Chromium	150.992	1.0	125.0	46.90	83.3	44	116				
Cobalt	115.362	1.0	125.0	16.20	79.3	47	107				
Copper	137.129	2.0	125.0	14.06	98.5	49	124				
Lead	118.436	1.0	125.0	10.59	86.3	33	120				
Molybdenum	108.441	1.0	125.0	0	86.8	46	111				
Nickel	152.526	1.0	125.0	51.84	80.5	43	111				
Selenium	98.170	1.0	125.0	0	78.5	43	104				
Silver	115.206	1.0	125.0	0	92.2	53	114				
Thallium	104.611	1.0	125.0	0	83.7	41	107				
Vanadium	146.142	1.0	125.0	41.72	83.5	48	116				

Sample ID: **106216-043AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **B59-1** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742373**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	83.114	2.0	125.0	0	66.5	25	106	91.34	9.43	20	
Arsenic	97.309	1.0	125.0	0	77.8	42	113	103.3	6.01	20	
Barium	249.126	1.0	125.0	113.8	108	19	140	223.2	11.0	20	
Beryllium	103.112	1.0	125.0	0	82.5	50	109	107.7	4.39	20	
Cadmium	99.703	1.0	125.0	0.6032	79.3	48	106	103.7	3.88	20	
Chromium	162.695	1.0	125.0	46.90	92.6	44	116	151.0	7.46	20	
Cobalt	110.669	1.0	125.0	16.20	75.6	47	107	115.4	4.15	20	
Copper	145.594	2.0	125.0	14.06	105	49	124	137.1	5.99	20	
Lead	114.289	1.0	125.0	10.59	83.0	33	120	118.4	3.56	20	
Molybdenum	102.959	1.0	125.0	0	82.4	46	111	108.4	5.19	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106216-043AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110694**
Client ID: **B59-1** Batch ID: **56407** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742373**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nickel	160.803	1.0	125.0	51.84	87.2	43	111	152.5	5.28	20	
Selenium	93.182	1.0	125.0	0	74.5	43	104	98.17	5.21	20	
Silver	114.376	1.0	125.0	0	91.5	53	114	115.2	0.723	20	
Thallium	100.124	1.0	125.0	0	80.1	41	107	104.6	4.38	20	
Vanadium	157.504	1.0	125.0	41.72	92.6	48	116	146.1	7.48	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-56408** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **PBS** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742388**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.417	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	0.015	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	0.046	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	0.022	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	0.505	1.0									

Sample ID: **LCS-56408** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **LCSS** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742389**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	48.152	2.0	50.00	0.4165	95.5	80	120				
Arsenic	47.244	1.0	50.00	0	94.5	80	120				
Barium	50.354	1.0	50.00	0	101	80	120				
Beryllium	48.786	1.0	50.00	0	97.6	80	120				
Cadmium	48.817	1.0	50.00	0.01548	97.6	80	120				
Chromium	49.141	1.0	50.00	0	98.3	80	120				
Cobalt	47.458	1.0	50.00	0	94.9	80	120				
Copper	51.391	2.0	50.00	0	103	80	120				
Lead	50.168	1.0	50.00	0	100	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-56408** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **LCSS** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742389**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	50.119	1.0	50.00	0.04577	100	80	120				
Nickel	47.817	1.0	50.00	0	95.6	80	120				
Selenium	44.455	1.0	50.00	0	88.9	80	120				
Silver	49.295	1.0	50.00	0.02164	98.5	80	120				
Thallium	47.254	1.0	50.00	0	94.5	80	120				
Vanadium	51.193	1.0	50.00	0	102	80	120				
Zinc	47.953	1.0	50.00	0.5049	94.9	80	120				

Sample ID: **106216-083ADUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **B7-1.5** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742400**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0	0	20	
Arsenic	1.166	1.0						1.305	11.2	20	
Barium	84.802	1.0						77.73	8.70	20	
Beryllium	0.242	1.0						0.2247	0	20	
Cadmium	0.310	1.0						0.2992	0	20	
Chromium	18.697	1.0						18.83	0.689	20	
Cobalt	7.643	1.0						3.239	80.9	20	R
Copper	8.939	2.0						9.020	0.902	20	
Lead	4.765	1.0						4.682	1.76	20	
Molybdenum	ND	1.0						0	0	20	
Nickel	15.110	1.0						13.97	7.87	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	18.372	1.0						19.00	3.38	20	
Zinc	76.390	1.0						19.30	119	20	R

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106216-083AMS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **B7-1.5** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742401**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	83.811	2.0	125.0	0	67.0	25	106				
Arsenic	93.349	1.0	125.0	1.305	73.6	42	113				
Barium	190.390	1.0	125.0	77.73	90.1	19	140				
Beryllium	98.252	1.0	125.0	0.2247	78.4	50	109				
Cadmium	94.828	1.0	125.0	0.2992	75.6	48	106				
Chromium	126.997	1.0	125.0	18.83	86.5	44	116				
Cobalt	101.802	1.0	125.0	3.239	78.9	47	107				
Copper	121.706	2.0	125.0	9.020	90.1	49	124				
Lead	105.124	1.0	125.0	4.682	80.4	33	120				
Molybdenum	97.650	1.0	125.0	0	78.1	46	111				
Nickel	113.324	1.0	125.0	13.97	79.5	43	111				
Selenium	87.515	1.0	125.0	0	70.0	43	104				
Silver	103.260	1.0	125.0	0	82.6	53	114				
Thallium	96.219	1.0	125.0	0	77.0	41	107				
Vanadium	127.306	1.0	125.0	19.00	86.6	48	116				
Zinc	117.461	1.0	125.0	19.30	78.5	24	129				

Sample ID: **106216-083AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **B7-1.5** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742402**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	83.032	2.0	125.0	0	66.4	25	106	83.81	0.935	20	
Arsenic	91.910	1.0	125.0	1.305	72.5	42	113	93.35	1.55	20	
Barium	182.361	1.0	125.0	77.73	83.7	19	140	190.4	4.31	20	
Beryllium	98.176	1.0	125.0	0.2247	78.4	50	109	98.25	0.0781	20	
Cadmium	93.666	1.0	125.0	0.2992	74.7	48	106	94.83	1.23	20	
Chromium	124.466	1.0	125.0	18.83	84.5	44	116	127.0	2.01	20	
Cobalt	100.693	1.0	125.0	3.239	78.0	47	107	101.8	1.10	20	
Copper	121.011	2.0	125.0	9.020	89.6	49	124	121.7	0.572	20	
Lead	103.886	1.0	125.0	4.682	79.4	33	120	105.1	1.19	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106216-083AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110695**
Client ID: **B7-1.5** Batch ID: **56408** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742402**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	97.448	1.0	125.0	0	78.0	46	111	97.65	0.207	20	
Nickel	111.423	1.0	125.0	13.97	78.0	43	111	113.3	1.69	20	
Selenium	86.907	1.0	125.0	0	69.5	43	104	87.51	0.697	20	
Silver	102.251	1.0	125.0	0	81.8	53	114	103.3	0.981	20	
Thallium	95.749	1.0	125.0	0	76.6	41	107	96.22	0.490	20	
Vanadium	126.124	1.0	125.0	19.00	85.7	48	116	127.3	0.933	20	
Zinc	115.487	1.0	125.0	19.30	77.0	24	129	117.5	1.69	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-56409** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **PBS** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742403**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.393	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	0.022	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	0.047	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	0.019	1.0									
Thallium	ND	1.0									
Vanadium	0.019	1.0									
Zinc	0.226	1.0									

Sample ID: **LCS-56409** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **LCSS** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742404**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	49.202	2.0	50.00	0.3934	97.6	80	120				
Arsenic	47.455	1.0	50.00	0	94.9	80	120				
Barium	51.267	1.0	50.00	0	103	80	120				
Beryllium	49.738	1.0	50.00	0	99.5	80	120				
Cadmium	49.278	1.0	50.00	0.02226	98.5	80	120				
Chromium	49.980	1.0	50.00	0	100	80	120				
Cobalt	48.215	1.0	50.00	0	96.4	80	120				
Copper	52.736	2.0	50.00	0	105	80	120				
Lead	50.991	1.0	50.00	0	102	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-56409** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **LCSS** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742404**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	51.083	1.0	50.00	0.04719	102	80	120				
Nickel	48.329	1.0	50.00	0	96.7	80	120				
Selenium	44.690	1.0	50.00	0	89.4	80	120				
Silver	50.456	1.0	50.00	0.01878	101	80	120				
Thallium	47.836	1.0	50.00	0	95.7	80	120				
Vanadium	52.255	1.0	50.00	0.01911	104	80	120				
Zinc	48.473	1.0	50.00	0.2257	96.5	80	120				

Sample ID: **106216-099ADUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **B19-1.5** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742408**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0	0	20	
Arsenic	ND	1.0						0	0	20	
Barium	143.391	1.0						133.2	7.40	20	
Beryllium	0.202	1.0						0.1420	0	20	
Cadmium	0.388	1.0						0.3367	0	20	
Chromium	24.620	1.0						22.78	7.76	20	
Cobalt	14.932	1.0						17.67	16.8	20	
Copper	8.517	2.0						7.335	14.9	20	
Lead	6.045	1.0						4.841	22.1	20	R
Molybdenum	ND	1.0						0	0	20	
Nickel	15.013	1.0						13.93	7.50	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	30.415	1.0						28.10	7.93	20	
Zinc	18.585	1.0						19.43	4.45	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106216-099AMS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **B19-1.5** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742409**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	93.115	2.0	125.0	0	74.5	25	106				
Arsenic	94.547	1.0	125.0	0	75.6	42	113				
Barium	246.305	1.0	125.0	133.2	90.5	19	140				
Beryllium	109.900	1.0	125.0	0.1420	87.8	50	109				
Cadmium	104.482	1.0	125.0	0.3367	83.3	48	106				
Chromium	142.186	1.0	125.0	22.78	95.5	44	116				
Cobalt	119.508	1.0	125.0	17.67	81.5	47	107				
Copper	136.494	2.0	125.0	7.335	103	49	124				
Lead	115.093	1.0	125.0	4.841	88.2	33	120				
Molybdenum	107.021	1.0	125.0	0	85.6	46	111				
Nickel	125.546	1.0	125.0	13.93	89.3	43	111				
Selenium	93.106	1.0	125.0	0	74.5	43	104				
Silver	115.872	1.0	125.0	0	92.7	53	114				
Thallium	105.465	1.0	125.0	0	84.4	41	107				
Vanadium	148.437	1.0	125.0	28.10	96.3	48	116				
Zinc	126.360	1.0	125.0	19.43	85.5	24	129				

Sample ID: **106216-099AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **B19-1.5** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742410**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	90.717	2.0	125.0	0	72.6	25	106	93.11	2.61	20	
Arsenic	94.181	1.0	125.0	0	75.3	42	113	94.55	0.387	20	
Barium	258.346	1.0	125.0	133.2	100	19	140	246.3	4.77	20	
Beryllium	106.440	1.0	125.0	0.1420	85.0	50	109	109.9	3.20	20	
Cadmium	101.969	1.0	125.0	0.3367	81.3	48	106	104.5	2.43	20	
Chromium	140.938	1.0	125.0	22.78	94.5	44	116	142.2	0.881	20	
Cobalt	116.579	1.0	125.0	17.67	79.1	47	107	119.5	2.48	20	
Copper	134.550	2.0	125.0	7.335	102	49	124	136.5	1.43	20	
Lead	113.684	1.0	125.0	4.841	87.1	33	120	115.1	1.23	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106216-099AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110696**
Client ID: **B19-1.5** Batch ID: **56409** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/11/2009** SeqNo: **1742410**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	104.349	1.0	125.0	0	83.5	46	111	107.0	2.53	20	
Nickel	121.521	1.0	125.0	13.93	86.1	43	111	125.5	3.26	20	
Selenium	91.656	1.0	125.0	0	73.3	43	104	93.11	1.57	20	
Silver	114.206	1.0	125.0	0	91.4	53	114	115.9	1.45	20	
Thallium	103.555	1.0	125.0	0	82.8	41	107	105.5	1.83	20	
Vanadium	151.241	1.0	125.0	28.10	98.5	48	116	148.4	1.87	20	
Zinc	123.853	1.0	125.0	19.43	83.5	24	129	126.4	2.00	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-56546** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/13/2009** RunNo: **110745**
Client ID: **LCSS** Batch ID: **56546** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743185**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Zinc	44.439	1.0	50.00	0	88.9	80	120				

Sample ID: **106216-043A-DUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/13/2009** RunNo: **110745**
Client ID: **B59-1** Batch ID: **56546** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743195**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Zinc	34.026	1.0						32.24	5.40	20	

Sample ID: **106216-043A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/13/2009** RunNo: **110745**
Client ID: **B59-1** Batch ID: **56546** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743197**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Zinc	121.154	1.0	125.0	32.24	71.1	24	129				

Sample ID: **106216-043A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/13/2009** RunNo: **110745**
Client ID: **B59-1** Batch ID: **56546** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743198**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Zinc	123.899	1.0	125.0	32.24	73.3	24	129	121.2	2.24	20	

Sample ID: **MB-56546** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/13/2009** RunNo: **110745**
Client ID: **PBS** Batch ID: **56546** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743227**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Zinc	ND	1.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56410A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **PBS** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1740986**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56410** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **LCSS** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1740987**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	270.573	5.0	250.0	0	108	80	120				

Sample ID: **106216-008ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **B18-1.5** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1740994**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.799	5.0						5.226	10.4	20	

Sample ID: **106216-008AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **B18-1.5** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1740995**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	180.796	5.0	250.0	5.226	70.2	33	120				

Sample ID: **MB-56410B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **PBS** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1740996**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106216-020ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **B51-2** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741007**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	4.330	5.0						4.169	0	20	

Sample ID: **106216-020AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **B51-2** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741008**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	178.583	5.0	250.0	4.169	69.8	33	120				

Sample ID: **106216-020AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110619**
Client ID: **B51-2** Batch ID: **56410** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741009**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	175.719	5.0	250.0	4.169	68.6	33	120	178.6	1.62	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56411A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **PBS** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741010**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56411** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **LCSS** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741011**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	270.567	5.0	250.0	0	108	80	120				

Sample ID: **106216-034ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **B56-1** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741022**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	6.582	5.0						4.383	40.1	20	R

Sample ID: **106216-034AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **B56-1** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741023**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	179.344	5.0	250.0	4.383	70.0	33	120				

Sample ID: **MB-56411B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **PBS** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741024**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106216-047ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **B60-2** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741035**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.596	5.0						6.715	18.2	20	

Sample ID: **106216-047AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **B60-2** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741036**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	172.836	5.0	250.0	6.715	66.4	33	120				

Sample ID: **106216-047AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110620**
Client ID: **B60-2** Batch ID: **56411** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741037**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	170.486	5.0	250.0	6.715	65.5	33	120	172.8	1.37	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56412A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **PBS** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741038**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56412** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **LCSS** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741039**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	267.700	5.0	250.0	0	107	80	120				

Sample ID: **106216-058ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **B72-2** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741050**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	10.514	5.0						9.844	6.58	20	

Sample ID: **106216-058AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **B72-2** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741051**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	189.185	5.0	250.0	9.844	71.7	33	120				

Sample ID: **MB-56412B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **PBS** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741052**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106216-074ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **B3-0** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741063**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	26.175	5.0						20.17	25.9	20	R

Sample ID: **106216-074AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **B3-0** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741064**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	185.844	5.0	250.0	20.17	66.3	33	120				

Sample ID: **106216-074AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110621**
Client ID: **B3-0** Batch ID: **56412** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741065**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	219.765	5.0	250.0	20.17	79.8	33	120	185.8	16.7	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56413A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **PBS** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741066**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56413** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **LCSS** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741067**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	280.796	5.0	250.0	0	112	80	120				

Sample ID: **106216-087ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **B9-1.5** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741078**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	11.200	5.0						11.21	0.0595	20	

Sample ID: **106216-087AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **B9-1.5** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741079**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	200.484	5.0	250.0	11.21	75.7	33	120				

Sample ID: **MB-56413B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **PBS** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741080**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106216-098ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **B19-0** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741091**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	36.214	5.0						34.45	4.99	20	

Sample ID: **106216-098AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **B19-0** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741092**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	183.897	5.0	250.0	34.45	59.8	33	120				

Sample ID: **106216-098AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110622**
Client ID: **B19-0** Batch ID: **56413** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741093**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	211.457	5.0	250.0	34.45	70.8	33	120	183.9	13.9	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56414** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110623**
Client ID: **PBS** Batch ID: **56414** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741094**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56414** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110623**
Client ID: **LCSS** Batch ID: **56414** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741095**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	271.385	5.0	250.0	0	109	80	120				

Sample ID: **106216-101ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110623**
Client ID: **B20-1.5** Batch ID: **56414** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741098**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	4.304	5.0						4.534	0	20	

Sample ID: **106216-101AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110623**
Client ID: **B20-1.5** Batch ID: **56414** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741099**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	173.656	5.0	250.0	4.534	67.6	33	120				

Sample ID: **106216-101AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110623**
Client ID: **B20-1.5** Batch ID: **56414** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/8/2009** SeqNo: **1741100**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	152.874	5.0	250.0	4.534	59.3	33	120	173.7	12.7	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-56400** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110542**
Client ID: **PBS** Batch ID: **56400** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739528**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-56400** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110542**
Client ID: **LCSS** Batch ID: **56400** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739529**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.856	0.10	0.8300	0	103	80	120				

Sample ID: **106216-043A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110542**
Client ID: **B59-1** Batch ID: **56400** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739531**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.099	0.10	0.8300	0.1694	112	70	130				

Sample ID: **106216-043A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110542**
Client ID: **B59-1** Batch ID: **56400** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739532**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.128	0.10	0.8300	0.1694	116	70	130	1.099	2.66	20	

Sample ID: **106216-043A-DUP** SampType: **DUP** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110542**
Client ID: **B59-1** Batch ID: **56400** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739533**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.165	0.10						0.1694	2.58	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-56401** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110544**
Client ID: **PBS** Batch ID: **56401** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739563**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-56401** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110544**
Client ID: **LCSS** Batch ID: **56401** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739564**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.910	0.10	0.8300	0	110	80	120				

Sample ID: **106216-083A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110544**
Client ID: **B7-1.5** Batch ID: **56401** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739565**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.910	0.10	0.8300	0.02897	106	70	130				

Sample ID: **106216-083A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110544**
Client ID: **B7-1.5** Batch ID: **56401** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739566**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.917	0.10	0.8300	0.02897	107	70	130	0.9104	0.744	20	

Sample ID: **106216-083A-DUP** SampType: **DUP** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110544**
Client ID: **B7-1.5** Batch ID: **56401** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739568**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.029	0.10						0.02897	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-56402** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110551**
Client ID: **PBS** Batch ID: **56402** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739680**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-56402** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110551**
Client ID: **LCSS** Batch ID: **56402** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739681**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.908	0.10	0.8300	0	109	80	120				

Sample ID: **106240-001A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110551**
Client ID: **ZZZZZZ** Batch ID: **56402** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739682**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.873	0.10	0.8300	0	105	70	130				

Sample ID: **106240-001A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110551**
Client ID: **ZZZZZZ** Batch ID: **56402** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739683**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.888	0.10	0.8300	0	107	70	130	0.8730	1.69	20	

Sample ID: **106240-001A-DUP** SampType: **DUP** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/6/2009** RunNo: **110551**
Client ID: **ZZZZZZ** Batch ID: **56402** TestNo: **EPA 7471A** Analysis Date: **7/7/2009** SeqNo: **1739685**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-56440** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110612**
Client ID: **PBS** Batch ID: **56440** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740826**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.360		2.670		88.4	30	130				

Sample ID: **LCS-56440** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110612**
Client ID: **LCSS** Batch ID: **56440** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740827**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	26.625	1.0	33.00	0	80.7	35	124				
Surr: p-Terphenyl	2.447		2.670		91.6	30	130				

Sample ID: **106216-007AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110612**
Client ID: **B18-0** Batch ID: **56440** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740829**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	30.884	1.0	33.00	11.08	60.0	12	125				
Surr: p-Terphenyl	1.823		2.670		68.3	30	130				

Sample ID: **106216-007AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110612**
Client ID: **B18-0** Batch ID: **56440** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740830**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	31.252	1.0	33.00	11.08	61.1	12	125	30.88	1.18	20	
Surr: p-Terphenyl	1.770		2.670		66.3	30	130		0	0	

Sample ID: **106216-007ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110612**
Client ID: **B18-0** Batch ID: **56440** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **106216-007ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110612**
Client ID: **B18-0** Batch ID: **56440** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	8.895	1.0						11.08	21.9	20	R
ORO	45.941	1.0						58.80	24.5	20	R
Surr: p-Terphenyl	1.433		2.670		53.7	30	130		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-56441** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110639**
Client ID: **PBS** Batch ID: **56441** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741372**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.042		2.670		76.5	30	130				

Sample ID: **LCS-56441** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110639**
Client ID: **LCSS** Batch ID: **56441** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741373**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	21.416	1.0	33.00	0	64.9	35	124				
Surr: p-Terphenyl	2.020		2.670		75.7	30	130				

Sample ID: **106216-096AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110639**
Client ID: **B14-0** Batch ID: **56441** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741374**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	23.794	1.0	33.00	4.276	59.1	12	125				
Surr: p-Terphenyl	1.711		2.670		64.1	30	130				

Sample ID: **106216-096AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110639**
Client ID: **B14-0** Batch ID: **56441** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741375**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	28.100	1.0	33.00	4.276	72.2	12	125	23.79	16.6	20	
Surr: p-Terphenyl	1.889		2.670		70.8	30	130		0	0	

Sample ID: **106216-096ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110639**
Client ID: **B14-0** Batch ID: **56441** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741376**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **106216-096ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110639**
Client ID: **B14-0** Batch ID: **56441** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741376**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	2.252	1.0						4.276	62.0	20	R
ORO	20.140	1.0						28.15	33.2	20	R
Surr: p-Terphenyl	1.753		2.670		65.6	30	130		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-56443** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **PBS** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740748**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.073		2.670		77.7	30	130				

Sample ID: **LCS-56443** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **LCSS** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740749**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	24.316	1.0	33.00	0	73.7	35	124				
Surr: p-Terphenyl	2.181		2.670		81.7	30	130				

Sample ID: **106216-100AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **B20-0** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740750**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	31.373	1.0	33.00	6.764	74.6	12	125				
Surr: p-Terphenyl	2.206		2.670		82.6	30	130				

Sample ID: **106216-100AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **B20-0** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740751**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	30.016	1.0	33.00	6.764	70.5	12	125	31.37	4.42	20	
Surr: p-Terphenyl	2.033		2.670		76.1	30	130		0	0	

Sample ID: **106216-100ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **B20-0** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740752**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **106216-100ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **B20-0** Batch ID: **56443** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740752**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	5.751	1.0						6.764	16.2	20	
ORO	34.119	1.0						39.69	15.1	20	
Surr: p-Terphenyl	1.792		2.670		67.1	30	130		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E090702LCS1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110476**
Client ID: **LCSS** Batch ID: **E09VS203** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1737923**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.558	1.0	5.000	0	91.2	73	120				
Surr: Bromofluorobenzene (FID)	101.003		100.0		101	59	145				

Sample ID: **106216-068AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1737925**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.253	1.0	5.000	0	85.1	39	135				
Surr: Bromofluorobenzene (FID)	101.563		100.0		102	59	145				

Sample ID: **106216-068AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1737926**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.245	1.0	5.000	0	84.9	39	135	4.253	0.188	20	
Surr: Bromofluorobenzene (FID)	100.706		100.0		101	59	145		0	0	

Sample ID: **E090702MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110476**
Client ID: **PBS** Batch ID: **E09VS203** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1737927**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	103.873		100.0		104	59	145				

Sample ID: **106216-068ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1737929**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **106216-068ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1737929**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	103.222		100.0		103	59	145		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E090702LCS3** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110495**
Client ID: **LCSS** Batch ID: **E09VS204** TestNo: **EPA 8015B(M** Analysis Date: **7/2/2009** SeqNo: **1738531**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.205	1.0	5.000	0	84.1	73	120				
Surr: Bromofluorobenzene (FID)	98.993		100.0		99.0	59	145				

Sample ID: **106216-081AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738532**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.791	1.0	5.000	0	75.8	39	135				
Surr: Bromofluorobenzene (FID)	101.616		100.0		102	59	145				

Sample ID: **106216-081AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738533**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.732	1.0	5.000	0	74.6	39	135	3.791	1.57	20	
Surr: Bromofluorobenzene (FID)	105.780		100.0		106	59	145		0	0	

Sample ID: **E090702MB2** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110495**
Client ID: **PBS** Batch ID: **E09VS204** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738534**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	99.969		100.0		100	59	145				

Sample ID: **106216-081ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738536**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **106216-081ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738536**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	108.354		100.0		108	59	145		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E090702LCS5** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110501**
Client ID: **LCSS** Batch ID: **E09VS205** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738663**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.061	1.0	5.000	0	81.2	73	120				
Surr: Bromofluorobenzene (FID)	98.507		100.0		98.5	59	145				

Sample ID: **106216-101AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738664**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.401	1.0	5.000	0	68.0	39	135				
Surr: Bromofluorobenzene (FID)	100.744		100.0		101	59	145				

Sample ID: **106216-101AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738665**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.364	1.0	5.000	0	67.3	39	135	3.401	1.09	20	
Surr: Bromofluorobenzene (FID)	102.768		100.0		103	59	145		0	0	

Sample ID: **E090702MB3** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110501**
Client ID: **PBS** Batch ID: **E09VS205** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738666**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	99.337		100.0		99.3	59	145				

Sample ID: **106216-101ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738668**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **106216-101ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8015B(M** Analysis Date: **7/3/2009** SeqNo: **1738668**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	104.680		100.0		105	59	145		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E090702LCS2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110476**
Client ID: **LCSS** Batch ID: **E09VS203** TestNo: **EPA 8021B** Analysis Date: **7/2/2009** SeqNo: **1737936**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	94.641	5.0	100.0	0	94.6	80	121				
Ethylbenzene	97.507	5.0	100.0	0	97.5	84	120				
m,p-Xylene	198.188	10	200.0	0	99.1	84	122				
Methyl tert-butyl ether	92.100	5.0	100.0	0	92.1	66	128				
o-Xylene	99.707	5.0	100.0	0	99.7	84	123				
Toluene	96.982	5.0	100.0	0	97.0	84	120				
Surr: Bromofluorobenzene (PID)	97.673		100.0		97.7	65	140				

Sample ID: **106216-068AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8021B** Analysis Date: **7/2/2009** SeqNo: **1737937**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	27.921	5.0	35.75	0	78.1	22	132				
Ethylbenzene	34.525	5.0	49.65	0	69.5	15	133				
m,p-Xylene	142.022	10	199.6	0	71.2	30	118				
Methyl tert-butyl ether	492.794	5.0	578.9	0	85.1	38	136				
o-Xylene	51.123	5.0	78.40	0	65.2	21	119				
Toluene	130.626	5.0	172.2	0	75.8	36	129				
Surr: Bromofluorobenzene (PID)	100.201		100.0		100	65	140				

Sample ID: **106216-068AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8021B** Analysis Date: **7/2/2009** SeqNo: **1737938**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	26.320	5.0	35.75	0	73.6	22	132	27.92	5.90	20	
Ethylbenzene	27.464	5.0	49.65	0	55.3	15	133	34.52	22.8	20	R
m,p-Xylene	131.136	10	199.6	0	65.7	30	118	142.0	7.97	20	
Methyl tert-butyl ether	484.543	5.0	578.9	0	83.7	38	136	492.8	1.69	20	
o-Xylene	50.776	5.0	78.40	0	64.8	21	119	51.12	0.681	20	
Toluene	129.448	5.0	172.2	0	75.2	36	129	130.6	0.906	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **106216-068AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8021B** Analysis Date: **7/2/2009** SeqNo: **1737938**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	99.182		100.0		99.2	65	140		0	20	

Sample ID: **E090702MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110476**
Client ID: **PBS** Batch ID: **E09VS203** TestNo: **EPA 8021B** Analysis Date: **7/2/2009** SeqNo: **1737939**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	95.419		100.0		95.4	65	140				

Sample ID: **106216-068ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110476**
Client ID: **B76-1** Batch ID: **E09VS203** TestNo: **EPA 8021B** Analysis Date: **7/2/2009** SeqNo: **1737941**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
Methyl tert-butyl ether	ND	5.0						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Xylenes, Total	ND	15						0	0	20	
Surr: Bromofluorobenzene (PID)	95.229		100.0		95.2	65	140		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E090702LCS4** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110495**
Client ID: **LCSS** Batch ID: **E09VS204** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738550**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	96.023	5.0	100.0	0	96.0	80	121				
Ethylbenzene	96.382	5.0	100.0	0	96.4	84	120				
m,p-Xylene	195.270	10	200.0	0	97.6	84	122				
Methyl tert-butyl ether	91.884	5.0	100.0	0	91.9	66	128				
o-Xylene	99.957	5.0	100.0	0	100	84	123				
Toluene	97.246	5.0	100.0	0	97.2	84	120				
Surr: Bromofluorobenzene (PID)	97.507		100.0		97.5	65	140				

Sample ID: **106216-081AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738551**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	24.490	5.0	35.75	0	68.5	22	132				
Ethylbenzene	31.850	5.0	49.65	0	64.1	15	133				
m,p-Xylene	130.937	10	199.6	0	65.6	30	118				
Methyl tert-butyl ether	461.043	5.0	578.9	0	79.6	38	136				
o-Xylene	47.562	5.0	78.40	0	60.7	21	119				
Toluene	119.862	5.0	172.2	0	69.6	36	129				
Surr: Bromofluorobenzene (PID)	100.982		100.0		101	65	140				

Sample ID: **106216-081AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738552**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	25.285	5.0	35.75	0	70.7	22	132	24.49	3.19	20	
Ethylbenzene	31.322	5.0	49.65	0	63.1	15	133	31.85	1.67	20	
m,p-Xylene	129.650	10	199.6	0	65.0	30	118	130.9	0.988	20	
Methyl tert-butyl ether	461.766	5.0	578.9	0	79.8	38	136	461.0	0.157	20	
o-Xylene	47.188	5.0	78.40	0	60.2	21	119	47.56	0.789	20	
Toluene	118.640	5.0	172.2	0	68.9	36	129	119.9	1.02	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **106216-081AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738552**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	105.313		100.0		105	65	140		0	20	

Sample ID: **E090702MB2** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110495**
Client ID: **PBS** Batch ID: **E09VS204** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738553**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	93.656		100.0		93.7	65	140				

Sample ID: **106216-081ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110495**
Client ID: **B6-1.5** Batch ID: **E09VS204** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738555**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
Methyl tert-butyl ether	ND	5.0						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Xylenes, Total	ND	15						0	0	20	
Surr: Bromofluorobenzene (PID)	101.447		100.0		101	65	140		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E090702LCS6** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110501**
Client ID: **LCSS** Batch ID: **E09VS205** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738677**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	94.635	5.0	100.0	0	94.6	80	121				
Ethylbenzene	93.425	5.0	100.0	0	93.4	84	120				
m,p-Xylene	188.696	10	200.0	0	94.3	84	122				
Methyl tert-butyl ether	92.906	5.0	100.0	0	92.9	66	128				
o-Xylene	97.313	5.0	100.0	0	97.3	84	123				
Toluene	94.915	5.0	100.0	0	94.9	84	120				
Surr: Bromofluorobenzene (PID)	97.005		100.0		97.0	65	140				

Sample ID: **106216-101AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738678**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	23.246	5.0	35.75	0	65.0	22	132				
Ethylbenzene	28.056	5.0	49.65	0	56.5	15	133				
m,p-Xylene	116.491	10	199.6	0	58.4	30	118				
Methyl tert-butyl ether	432.365	5.0	578.9	0	74.7	38	136				
o-Xylene	42.250	5.0	78.40	0	53.9	21	119				
Toluene	110.632	5.0	172.2	0	64.2	36	129				
Surr: Bromofluorobenzene (PID)	102.291		100.0		102	65	140				

Sample ID: **106216-101AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738679**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	23.904	5.0	35.75	0	66.9	22	132	23.25	2.79	20	
Ethylbenzene	27.990	5.0	49.65	0	56.4	15	133	28.06	0.236	20	
m,p-Xylene	115.888	10	199.6	0	58.1	30	118	116.5	0.519	20	
Methyl tert-butyl ether	419.964	5.0	578.9	0	72.5	38	136	432.4	2.91	20	
o-Xylene	42.079	5.0	78.40	0	53.7	21	119	42.25	0.406	20	
Toluene	108.891	5.0	172.2	0	63.2	36	129	110.6	1.59	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **106216-101AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738679**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	104.572		100.0		105	65	140		0	20	

Sample ID: **E090702MB3** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110501**
Client ID: **PBS** Batch ID: **E09VS205** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738680**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	95.029		100.0		95.0	65	140				

Sample ID: **106216-101ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110501**
Client ID: **B20-1.5** Batch ID: **E09VS205** TestNo: **EPA 8021B** Analysis Date: **7/3/2009** SeqNo: **1738682**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
Methyl tert-butyl ether	ND	5.0						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Xylenes, Total	ND	15						0	0	20	
Surr: Bromofluorobenzene (PID)	99.863		100.0		99.9	65	140		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56449** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **PBS** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740765**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	13.613		16.67		81.7	25	115				
Surr: Decachlorobiphenyl	14.170		16.67		85.0	20	142				

Sample ID: **LCS-56449** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **LCSS** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740766**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	12.541	1.0	16.67	0	75.2	59	113				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-56449** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **LCSS** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740766**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	12.958	2.0	16.67	0	77.7	59	108				
Endrin	12.565	2.0	16.67	0	75.4	41	132				
gamma-BHC	12.363	1.0	16.67	0	74.2	60	111				
Heptachlor	12.318	1.0	16.67	0	73.9	62	108				
Surr: Tetrachloro-m-xylene	11.797		16.67		70.8	25	115				
Surr: Decachlorobiphenyl	12.691		16.67		76.1	20	142				

Sample ID: **106240-001AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740767**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	5.974	2.0	16.67	0.5053	32.8	29	143				
Aldrin	6.103	1.0	16.67	0	36.6	44	131				S
Dieldrin	5.784	2.0	16.67	0	34.7	40	136				S
Endrin	5.835	2.0	16.67	0	35.0	41	146				S
gamma-BHC	5.255	1.0	16.67	0	31.5	45	129				S
Heptachlor	5.973	1.0	16.67	0	35.8	48	126				S
Surr: Tetrachloro-m-xylene	5.277		16.67		31.7	25	115				
Surr: Decachlorobiphenyl	6.970		16.67		41.8	20	142				

Sample ID: **106240-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740768**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	9.557	2.0	16.67	0.5053	54.3	29	143	5.974	46.1	20	R
Aldrin	9.373	1.0	16.67	0	56.2	44	131	6.103	42.3	20	R
Dieldrin	9.712	2.0	16.67	0	58.3	40	136	5.784	50.7	20	R
Endrin	9.621	2.0	16.67	0	57.7	41	146	5.835	49.0	20	R
gamma-BHC	9.159	1.0	16.67	0	54.9	45	129	5.255	54.2	20	R
Heptachlor	8.919	1.0	16.67	0	53.5	48	126	5.973	39.6	20	R

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106240-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740768**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	7.897		16.67		47.4	25	115		0	0	
Surr: Decachlorobiphenyl	10.405		16.67		62.4	20	142		0	0	

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740851**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	ND	2.0						0	0	20	
4,4´-DDT	ND	2.0						0	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	6.981		16.67		41.9	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106198-027ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/7/2009** RunNo: **110606**
Client ID: **ZZZZZZ** Batch ID: **56449** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740851**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	7.044		16.67		42.3	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56472** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **PBS** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741828**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	12.528		16.67		75.2	25	115				
Surr: Decachlorobiphenyl	12.020		16.67		72.1	20	142				

Sample ID: **LCS-56472** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **LCSS** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741829**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	13.136	1.0	16.67	0	78.8	59	113				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-56472** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **LCSS** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741829**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	13.456	2.0	16.67	0	80.7	59	108				
Endrin	13.234	2.0	16.67	0	79.4	41	132				
gamma-BHC	13.147	1.0	16.67	0	78.9	60	111				
Heptachlor	12.530	1.0	16.67	0	75.2	62	108				
Surr: Tetrachloro-m-xylene	12.617		16.67		75.7	25	115				
Surr: Decachlorobiphenyl	12.256		16.67		73.5	20	142				

Sample ID: **MB-56472MS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **ZZZZZZ** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741830**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	10.426	2.0	16.67	0	62.5	29	143				
Aldrin	13.380	1.0	16.67	0	80.3	44	131				
Dieldrin	13.720	2.0	16.67	0	82.3	40	136				
Endrin	13.477	2.0	16.67	0	80.8	41	146				
gamma-BHC	13.328	1.0	16.67	0	80.0	45	129				
Heptachlor	12.789	1.0	16.67	0	76.7	48	126				
Surr: Tetrachloro-m-xylene	12.586		16.67		75.5	25	115				
Surr: Decachlorobiphenyl	12.481		16.67		74.9	20	142				

Sample ID: **MB-56472MSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **ZZZZZZ** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	11.249	2.0	16.67	0	67.5	29	143	10.43	7.59	20	
Aldrin	14.306	1.0	16.67	0	85.8	44	131	13.38	6.69	20	
Dieldrin	14.655	2.0	16.67	0	87.9	40	136	13.72	6.59	20	
Endrin	14.418	2.0	16.67	0	86.5	41	146	13.48	6.75	20	
gamma-BHC	14.281	1.0	16.67	0	85.7	45	129	13.33	6.90	20	
Heptachlor	13.793	1.0	16.67	0	82.7	48	126	12.79	7.56	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56472MSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **ZZZZZZ** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	13.446		16.67		80.7	25	115		0	0	
Surr: Decachlorobiphenyl	13.371		16.67		80.2	20	142		0	0	

Sample ID: **106216-080ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **B6-0** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741837**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	ND	2.0						0	0	20	
4,4´-DDT	ND	2.0						0	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	9.252		16.67		55.5	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106216-080ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110661**
Client ID: **B6-0** Batch ID: **56472** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741837**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	8.004		16.67		48.0	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56473** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **PBS** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741869**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	12.734		16.67		76.4	25	115				
Surr: Decachlorobiphenyl	12.054		16.67		72.3	20	142				

Sample ID: **LCS-56473** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **LCSS** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741870**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	13.359	1.0	16.67	0	80.1	59	113				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-56473** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **LCSS** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741870**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	13.744	2.0	16.67	0	82.4	59	108				
Endrin	13.507	2.0	16.67	0	81.0	41	132				
gamma-BHC	13.315	1.0	16.67	0	79.9	60	111				
Heptachlor	12.823	1.0	16.67	0	76.9	62	108				
Surr: Tetrachloro-m-xylene	12.691		16.67		76.1	25	115				
Surr: Decachlorobiphenyl	12.743		16.67		76.4	20	142				

Sample ID: **MB-56473MS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **ZZZZZZ** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741871**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	10.656	2.0	16.67	0	63.9	29	143				
Aldrin	13.487	1.0	16.67	0	80.9	44	131				
Dieldrin	13.845	2.0	16.67	0	83.1	40	136				
Endrin	13.633	2.0	16.67	0	81.8	41	146				
gamma-BHC	13.454	1.0	16.67	0	80.7	45	129				
Heptachlor	12.995	1.0	16.67	0	78.0	48	126				
Surr: Tetrachloro-m-xylene	12.644		16.67		75.8	25	115				
Surr: Decachlorobiphenyl	12.392		16.67		74.3	20	142				

Sample ID: **MB-56473MSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **ZZZZZZ** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741872**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	10.684	2.0	16.67	0	64.1	29	143	10.66	0.262	20	
Aldrin	13.475	1.0	16.67	0	80.8	44	131	13.49	0.0915	20	
Dieldrin	13.860	2.0	16.67	0	83.1	40	136	13.85	0.102	20	
Endrin	13.646	2.0	16.67	0	81.9	41	146	13.63	0.0953	20	
gamma-BHC	13.431	1.0	16.67	0	80.6	45	129	13.45	0.176	20	
Heptachlor	12.832	1.0	16.67	0	77.0	48	126	12.99	1.26	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56473MSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **ZZZZZZ** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741872**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	12.638		16.67		75.8	25	115		0	0	
Surr: Decachlorobiphenyl	12.577		16.67		75.4	20	142		0	0	

Sample ID: **106216-092ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **B12-0** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741875**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	0.788	2.0						0.6335	0	20	
4,4´-DDT	0.918	2.0						0.7050	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	8.825		16.67		52.9	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106216-092ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/8/2009** RunNo: **110662**
Client ID: **B12-0** Batch ID: **56473** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741875**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	8.033		16.67		48.2	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **106216-016ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **110522**
Client ID: **B50-1** Batch ID: **R110522** TestNo: **EPA 9045C** Analysis Date: **7/6/2009** SeqNo: **1739066**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	6.160	0.10						6.120	0.651	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **106216-098ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **110523**
Client ID: **B19-0** Batch ID: **R110523** TestNo: **EPA 9045C** Analysis Date: **7/6/2009** SeqNo: **1739077**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	5.820	0.10						5.880	1.03	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CHAIN OF CUSTODY RECORD

Pg 1 of 4

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: _____ Date: 7/01/09

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: C50

Sample Condition Upon Receipt
1. CHILLED 5.7 Y☐ N☐ 4. SEALED Y☐ N☒
2. HEADSPACE (VOA) N/A Y☐ N☐ 5. # OF SPLS MATCH COC Y☒ N☐
3. CONTAINER INTACT Y☒ N☐ 6. PRESERVED Y☐ N☒

Client: GEOCON
Attn: L. VIGLIOTTI
Address: 6671 BRISA ST.
City LIVERMORE State CA Zip Code 94550
TEL: (925) 371-5900
FAX: (") " 5915

Project Name: HWY 101 - MARIN Co. Project #: E8469-06-01 Sampler: (Printed Name) D. WATTS (Signature) [signature]

Relinquished by: (Signature and Printed Name) [signature] Date: 6/30/09 Time: 1700 Received by: (Signature and Printed Name) GSO Date: 6/30/09 Time: 1700
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: 7/1/09 Time: 0850
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr/Submitter:
D. WATTS 6/30/09
Print Name Date
[signature]
Signature

Send Report To:
Attn:
Co: SEE "CLIENT"
Address
City State Zip

Bill To:
Attn:
Co:
Address
City State Zip

Special Instructions/Comments: SEE ATTACHED TABLE
RUN WETS ON SAMPLES WITH POTENTIAL to fail STLC
PLEASE RETURN ALL GEOCON COOLERS
DO NOT COMPOSITE SAMPLE SETS

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides) | 8082 (PCB) | 8260B (Volatiles) | 8270C (BNA) | 6010B (Total Metal) | 8015B (GRO) / 8020 (BTEX) | 8015B (DRO) | 8021 (BTEX) | TITLE 22 / CAM 17 (6010 / 7000)

SPECIFY APPROPRIATE MATRIX: SOIL | WATER | GROUND WATER | WASTEWATER

ITEM	LAB USE ONLY: Batch # / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	PRESERVATION
	106216-001,002	B15 - 0, 1.5	6/30/09	VAR	E	2	VAR	4
	003,004	B16 -						
	005,006	B17 -						
	007,008	B18 -				3		
	009,010,011	B48 - 0, 1, 2						
	012,013,014	B49 -						
	015,016,017	B50 -						
	018,019,020	B51 -						
	021,022,023	B52 -						
	024,025,026	B53 -						

(Soil: X)

QA/QC: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____ REMARKS

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report, Yellow to folder, Pink to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: Attn: SEE Pg 1 | Address: City State Zip Code | TEL: ( ) FAX: ( )

Project Name: SEE Pg 1 Project #: Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) Will	Date: 6/30/09	Time: 1700	Received by: (Signature and Printed Name)	Date: 6/30/09	Time: 1700
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date: 7/1/09	Time: 0852
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: SEE Pg 1
Print Name Date
Signature

Send Report To: Attn: Co: Address City State Zip

Bill To: Attn: Co: Address City State Zip

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides) | 8082 (PCB) | 8260B (Volatiles) | 8270C (BNA) | 6010B (Total Metal) | 8015B (GRO) / 8020 (BTEX) | 8015B (DRO) | 8021 (BTEX) | TITLE 22 / CAM 17 (6010 / 7000)

SPECIFY APPROPRIATE MATRIX: SOIL | WATER | GROUND WATER | WASTEWATER

PRESERVATION

Q A / Q C: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	REMARKS
	106216-027, 028, 029	B54 - 0, 1, 2	6/30/09	VAR	E	3	VAR	C
	030, 031, 032	B55 -						
	033, 034, 035	B56 -						
	036, 037, 038	B57 -						
	039, 040, 041	B58 -						
	042, 043, 044	B59 -						
	045, 046, 047	B60 -						
	~~048, 049, 050~~	B61 - 0, 1				2		REF 1.5'
	~~051, 052, 053~~	B62 - 0, 1, 2				3		
	053, 054, 055	B63 -						

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr | B= Emergency Next workday | C= Critical 2 Workdays | D= Urgent 3 Workdays | E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client:
Attn: See Pg 1
Address:
City State Zip Code
TEL: ( )
FAX: ( )
Project Name: See Pg 1 Project #: Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) Wells	Date: 6/30/09	Time: 1700	Received by: (Signature and Printed Name) GSO	Date: 6/30/09	Time: 1700
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date: 7/1/09	Time: 0850
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: See Pg 1
Print Name Date
Signature

Send Report To:
Attn: _____
Co: _____
Address _____
City _____ State _____ Zip _____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides), 8082 (PCB), 8260B (Volatiles), 8270C (BNA), 6010B (Total Metal), 8015B (GRO) / 8020 (BTEX), 8015B (DRO), 8021 (BTEX), TITLE 22 / CAM 17 (6010 / 7000)

SPECIFY APPROPRIATE MATRIX: SOIL, WATER, GROUND WATER, WASTEWATER

PRESERVATION

QA/QC: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	PRESERVATION	REMARKS
	10626-056,057,058	B72 - 0, 1, 2	6/30/09	VAR	E	3	VAR	C	
	059,060,061	B73 -							
	062,063,064	B74 -							
	065,066,067	B75 -							
	068,069	B76 - 1, 4				2			
	070,071	B1 - 0, 1.5	6/30/09	VAR	E	2	J G	C	
	072,073	B2 -							
	074,075	B3 -							
	076,077	B4 -							
	078,079	B5 -							

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: GEOCON
Attn: L. VIGLIOTTI
Address: 6671 BRISA ST
City LIVERMORE State CA Zip Code 94550
TEL: (925) 371-5900
FAX: ( ) 371-5915

Project Name: HWY 101 - MARIN CO. Project #: E8469-06-01 Sampler: (Printed Name) CHRIS MERRITT/LUKE MONTOYA (Signature) C. MERRITT (FOR)

Relinquished by: (Signature and Printed Name)	CHRIS MERRITT	Date: 6-30-09	Time: 1700	Received by: (Signature and Printed Name)	G.Sq	Date: 6/30/09	Time: 1900
Relinquished by: (Signature and Printed Name)		Date:	Time:	Received by: (Signature and Printed Name)		Date: 7/1/09	Time: 0850
Relinquished by: (Signature and Printed Name)		Date:	Time:	Received by: (Signature and Printed Name)		Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: CM (Print Name) 6-30-09 (Date) CM (Signature)

Send Report To: Attn: _____ Co: SEE "CLIENT" Address _____ City _____ State _____ Zip _____

Bill To: Attn: _____ Co: _____ Address _____ City _____ State _____ Zip _____

Special Instructions/Comments: SEE Pg 1

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides) | 8082 (PCB) | 8260B (Volatiles) | 8270C (BNA) | 6010B (Total Metal) | 8015B (GRO) / 8020 (BTEX) | 8015B (DRO) | 8021 (BTEX) | TITLE 22 / CAM 17 (6010 / 7000)

SPECIFY APPROPRIATE MATRIX: SOIL | WATER | GROUND WATER | WASTEWATER

Container(s): TAT | # | Type

PRESERVATION

Q A / Q C: RTNE ☐ CT ☐ SWRCB ☐ Logcode _____ OTHER _____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	#	Type	PRESERVATION	REMARKS
	106216-080,081	B6 – 0, 1.5	6/30/09	VAR	X				E	2	J, G	C	
	082,083	B7 –											
	084,085	B8 –											
	086,087	B9 –											
	088,089	B10 –											
	090,091	B11 –											
	092,093	B12 –											
	094,095	B13 –											
	096,097	B14 –											
	098,099	B19 –											
	100,101	B20 –											

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report, Yellow to folder, Pink to submitter.

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NOA	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B1	0 to 0.5	---	1	---	1	as needed	1	---	1
B1	1.5 to 2	1	---	1	---	---	---	---	---
B2	0 to 0.5	---	1	1	---	as needed	1	---	---
B2	1.5 to 2	1	---	---	1	---	---	1	---
B3	0 to 0.5	---	1	1	---	as needed	1	---	---
B3	1.5 to 2	1	---	1	---	---	---	---	---
B4	0 to 0.5	---	1	1	---	as needed	1	---	---
B4	1.5 to 2	1	---	1	---	---	---	---	---
B5	0 to 0.5	---	1	---	1	as needed	1	---	---
B5	1.5 to 2	1	---	1	---	---	---	---	1
B6	0 to 0.5	---	1	1	---	as needed	1	---	---
B6	1.5 to 2	1	---	1	---	---	---	---	---
B7	0 to 0.5	---	1	1	---	as needed	1	---	---
B7	1.5 to 2	1	---	---	1	---	---	1	---
B8	0 to 0.5	---	1	1	---	as needed	1	---	---
B8	1.5 to 2	1	---	1	---	---	---	---	---
B9	0 to 0.5	---	1	---	1	as needed	1	---	---
B9	1.5 to 2	1	---	1	---	---	---	---	---
B10	0 to 0.5	---	1	1	---	as needed	1	---	1
B10	1.5 to 2	1	---	1	---	---	---	---	---
B11	0 to 0.5	---	1	1	---	as needed	1	---	---
B11	1.5 to 2	1	---	1	---	---	---	---	---
B12	0 to 0.5	---	1	1	---	as needed	1	---	---
B12	1.5 to 2	1	---	1	---	---	---	---	---
B13	0 to 0.5	---	1	---	1	as needed	1	---	---
B13	1.5 to 2	1	---	1	---	---	---	---	---
B14	0 to 0.5	---	1	1	---	as needed	1	---	---
B14	1.5 to 2	1	---	1	---	---	---	---	1
B15	0 to 0.5	---	1	1	---	as needed	1	---	---
B15	1.5 to 2	1	---	---	1	---	---	1	---
B16	0 to 0.5	---	1	1	---	as needed	1	---	---
B16	1.5 to 2	1	---	1	---	---	---	---	---
B17	0 to 0.5	---	1	---	1	as needed	1	---	---
B17	1.5 to 2	1	---	1	---	---	---	---	---
B18	0 to 0.5	---	1	1	---	as needed	1	---	---
B18	1.5 to 2	1	---	1	---	---	---	---	---
B19	0 to 0.5	---	1	1	---	as needed	1	---	1
B19	1.5 to 2	1	---	---	1	---	---	---	---

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NOA	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B20 - 0	0 to 0.5	---	1	1	---	as needed	1	---	---
B20 - 1.5	1.5 to 2	1	---	1	---	---	---	---	---
B21	0 to 0.5	---	1	---	1	as needed	1	---	---
B21	1.5 to 2	1	---	1	---	---	---	---	---
B22	0 to 0.5	---	1	1	---	as needed	1	---	---
B22	1.5 to 2	1	---	1	---	---	---	---	---
B23	0 to 0.5	---	1	1	---	as needed	1	---	---
B23	1.5 to 2	1	---	---	1	---	---	1	---
B24	0 to 0.5	---	1	1	---	as needed	1	---	---
B24	1.5 to 2	1	---	1	---	---	---	---	---
B25	0 to 0.5	---	1	---	1	as needed	1	---	---
B25	1.5 to 2	1	---	1	---	---	---	---	---
B26	0 to 0.5	---	1	1	---	as needed	1	---	---
B26	1.5 to 2	1	---	1	---	---	---	---	---
B27	0 to 0.5	---	1	1	---	as needed	1	---	---
B27	1.5 to 2	1	---	---	1	---	---	1	---
B28	0 to 0.5	---	1	1	---	as needed	1	---	1
B28	1.5 to 2	1	---	1	---	---	---	---	---
B29	0 to 0.5	---	1	---	1	as needed	1	---	---
B29	1.5 to 2	1	---	1	---	---	---	---	---
B30	0 to 0.5	---	1	1	---	as needed	1	---	---
B30	1.5 to 2	1	---	1	---	---	---	---	---
B31	0 to 0.5	---	1	1	---	as needed	1	---	---
B31	1.5 to 2	1	---	1	---	---	---	1	---
B32	0 to 0.5	---	1	1	---	as needed	1	---	---
B32	1.5 to 2	1	---	1	---	---	---	---	1
B33	0 to 0.5	---	1	---	1	as needed	1	---	---
B33	1.5 to 2	1	---	1	---	---	---	---	---
B34	0 to 0.5	---	1	1	---	as needed	1	---	---
B34	1.5 to 2	1	---	1	---	---	---	---	---
B35	0 to 0.5	---	1	1	---	as needed	1	---	---
B35	1.5 to 2	1	---	---	1	---	---	1	---
B36	0 to 0.5	---	1	1	---	as needed	1	---	---
B36	1.5 to 2	1	---	1	---	---	---	---	---
B37	0 to 0.5	---	1	---	1	as needed	1	---	1
B37	1.5 to 2	1	---	1	---	---	---	---	---
B38	0 to 0.5	---	---	1	---	as needed	---	---	---
B38	1 to 1.5	---	---	1	---	---	---	---	---

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NOA	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B38	2 to 2.5	---	---	1	---	---	---	---	---
B39	0 to 0.5	---	---	1	---	as needed	---	---	---
B39	1 to 1.5	---	---	---	1	---	---	1	---
B39	2 to 2.5	---	---	1	---	---	---	---	---
B40	0 to 0.5	---	---	1	---	as needed	---	---	---
B40	1 to 1.5	---	---	1	---	---	---	---	---
B40	2 to 2.5	---	---	1	---	---	---	---	---
B41	0 to 0.5	---	---	---	1	as needed	---	---	---
B41	1 to 1.5	---	---	1	---	---	---	---	1
B41	2 to 2.5	---	---	1	---	---	---	---	---
B42	0 to 0.5	---	---	1	---	as needed	---	---	---
B42	1 to 1.5	---	---	1	---	---	---	---	---
B42	2 to 2.5	---	---	---	1	---	---	---	---
B43	0 to 0.5	---	---	1	---	as needed	---	---	---
B43	1 to 1.5	---	---	---	1	---	---	1	1
B43	2 to 2.5	---	---	1	---	---	---	---	---
B44	0 to 0.5	---	---	1	---	as needed	---	---	---
B44	1 to 1.5	---	---	1	---	---	---	---	---
B44	2 to 2.5	---	---	1	---	---	---	---	---
B45	0 to 0.5	---	---	1	---	as needed	---	---	---
B45	1 to 1.5	---	---	---	1	---	---	---	---
B45	2 to 2.5	---	---	1	---	---	---	---	---
B46	0 to 0.5	---	---	1	---	as needed	---	---	1
B46	1 to 1.5	---	---	1	---	---	---	---	---
B46	2 to 2.5	---	---	1	---	---	---	---	---
B47	0 to 0.5	---	---	---	1	as needed	---	---	---
B47	1 to 1.5	---	---	1	---	---	---	---	---
B47	2 to 2.5	---	---	1	---	---	---	---	---
B48-0	0 to 0.5	---	---	1	---	as needed	---	---	---
B48-1	1 to 1.5	---	---	1	---	---	---	---	---
B48-2	2 to 2.5	---	---	1	---	---	---	---	---
B49	0 to 0.5	---	---	1	---	as needed	---	---	---
B49	1 to 1.5	---	---	1	---	---	---	---	---
B49	2 to 2.5	---	---	---	1	---	---	1	---
B50	0 to 0.5	---	---	1	---	as needed	---	---	---
B50	1 to 1.5	---	---	1	---	---	---	---	1
B50	2 to 2.5	---	---	1	---	---	---	---	---
B51	0 to 0.5	---	---	1	---	as needed	---	---	---
B51	1 to 1.5	---	---	---	1	---	---	---	---
B51	2 to 2.5	---	---	1	---	---	---	---	---
B52	0 to 0.5	---	---	1	---	as needed	---	---	---
B52	1 to 1.5	---	---	1	---	---	---	---	---
B52	2 to 2.5	---	---	---	1	---	---	1	---

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NOA	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B53 -0	0 to 0.5	---	---	---	1	as needed	---	---	---
B53 -1	1 to 1.5	---	---	1	---	---	---	---	---
B53 -2	2 to 2.5	---	---	1	---	---	---	---	1
B54	0 to 0.5	---	---	1	---	as needed	---	---	---
B54	1 to 1.5	---	---	1	---	---	---	---	---
B54	2 to 2.5	---	---	---	1	---	---	---	---
B55	0 to 0.5	---	---	1	---	as needed	---	---	1
B55	1 to 1.5	---	---	---	1	---	---	1	---
B55	2 to 2.5	---	---	1	---	---	---	---	---
B56	0 to 0.5	---	---	1	---	as needed	---	---	---
B56	1 to 1.5	---	---	1	---	---	---	---	---
B56	2 to 2.5	---	---	1	---	---	---	---	---
B57	0 to 0.5	---	---	---	1	as needed	---	---	---
B57	1 to 1.5	---	---	1	---	---	---	---	---
B57	2 to 2.5	---	---	1	---	---	---	---	---
B58	0 to 0.5	---	---	1	---	as needed	---	---	---
B58	1 to 1.5	---	---	1	---	---	---	---	---
B58	2 to 2.5	---	---	1	---	---	---	---	---
B59	0 to 0.5	---	---	1	---	as needed	---	---	1
B59	1 to 1.5	---	---	---	1	---	---	---	---
B59	2 to 2.5	---	---	1	---	---	---	---	---
B60	0 to 0.5	---	---	1	---	as needed	---	---	---
B60	1 to 1.5	---	---	---	1	---	---	---	---
B60	2 to 2.5	---	---	1	---	---	---	---	---
B61	0 to 0.5	---	---	1	---	as needed	---	---	---
B61	1 to 1.5	---	---	1	---	---	---	---	---
B61	2 to 2.5	---	---	1	---	---	---	---	---
B62	0 to 0.5	---	---	1	---	as needed	---	---	---
B62	1 to 1.5	---	---	1	---	---	---	---	---
B62	2 to 2.5	---	---	1	---	---	---	---	---
B63	0 to 0.5	---	---	1	---	as needed	---	---	---
B63	1 to 1.5	---	---	1	---	---	---	---	---
B63	2 to 2.5	---	---	---	1	---	---	1	1
B64	0 to 0.5	---	---	1	---	as needed	---	---	---
B64	1 to 1.5	---	---	---	1	---	---	1	1
B64	2 to 2.5	---	---	1	---	---	---	---	---
B65	0 to 0.5	---	---	1	---	as needed	---	---	---
B65	1 to 1.5	---	---	1	---	---	---	---	---
B65	2 to 2.5	---	---	1	---	---	---	---	---
B66	0 to 0.5	---	---	1	---	as needed	---	---	1
B66	1 to 1.5	---	---	1	---	---	---	---	---
B66	2 to 2.5	---	---	---	1	---	---	---	---

REF 1.5'

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NOA	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B67	0 to 0.5	---	---	1	---	as needed	---	---	---
B67	1 to 1.5	---	---	1	---	---	---	---	---
B67	2 to 2.5	---	---	1	---	---	---	---	---
B68	0 to 0.5	---	---	1	---	as needed	---	---	---
B68	1 to 1.5	---	---	---	1	---	---	1	---
B68	2 to 2.5	---	---	1	---	---	---	---	---
B69	0 to 0.5	---	---	---	1	as needed	---	---	---
B69	1 to 1.5	---	---	1	---	---	---	---	---
B69	2 to 2.5	---	---	1	---	---	---	---	1
B70	0 to 0.5	---	---	1	---	as needed	---	---	---
B70	1 to 1.5	---	---	1	---	---	---	---	---
B70	2 to 2.5	---	---	1	---	---	---	---	---
B71	0 to 0.5	---	---	1	---	as needed	---	---	---
B71	1 to 1.5	---	---	---	1	---	---	1	---
B71	2 to 2.5	---	---	1	---	---	---	---	---
B72-0	0 to 0.5	---	---	1	---	as needed	---	---	---
B72-1	1 to 1.5	---	---	1	---	---	---	---	---
B72-2	2 to 2.5	---	---	1	---	---	---	---	---
B73	0 to 0.5	---	---	1	---	as needed	---	---	---
B73	1 to 1.5	---	---	1	---	---	---	---	---
B73	2 to 2.5	---	---	---	1	---	---	---	---
B74	0 to 0.5	---	---	1	---	as needed	---	---	---
B74	1 to 1.5	---	---	1	---	---	---	---	---
B74	2 to 2.5	---	---	1	---	---	---	---	1
B75	0 to 0.5	---	---	---	1	as needed	---	---	---
B75	1 to 1.5	---	---	1	---	---	---	---	---
B75	2 to 2.5	---	---	1	---	---	---	---	---
B76-1	1 to 1.5	1	1	---	1	as needed	1	---	---
B76-4	4 to 4.5	---	---	---	1	---	---	---	---
B76GW	GW	1	1	---	1	---	---	---	---
B77GW	1 to 1.5	1	1	---	1	as needed	1	1	1
B77GW	4 to 4.5	---	---	---	1	---	---	---	---
B77GW	GW	1	1	---	1	---	---	---	---
	TOTAL	41	41	148	46	---	39	18	21

October 30, 2009

Lauren Vigliotti
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
CSDLAC No.: 10196

Workorder No.: 106216

RE: HWY 101 - MARIN CO., E8469-06-01

Attention: Lauren Vigliotti

Enclosed are the results for sample(s) received on July 01, 2009 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Lab Order: 106216

CASE NARRATIVE

Results were J-Flag. "J" is used to flag those results that are between the PQL (Practical Quantitation Limit) and the calculated MDL (Method Detection Limit). Results that are "J" Flagged are estimated values since it becomes difficult to accurately quantitate the analyte near the MDL.

Analytical Comments for Method 6010

Dilution was necessary for samples 106216-001A, 106216-002A, 106216-003A, 106216-010A, 106216-013A, 106216-014A, 106216-019A, 106216-023A, 106216-024A, 106216-029A, 106216-031A, 106216-036A, 106216-043A, 106216-046A, 106216-055A, 106216-059A, 106216-061A, 106216-062A, 106216-065A, 106216-066A, 106216-068A, 106216-069A, 106216-070A, 106216-073A, 106216-078A, 106216-082A, 106216-083A, 106216-086A, 106216-094A and 106216-099A, due to sample matrix.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B15-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-001A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	2.4	0.042	1.0		mg/L	20	10/29/2009 08:26 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B15-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-002A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.18	0.018	1.0	J	mg/L	20	10/29/2009 08:30 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B16-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-003A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	2.2	0.042	1.0		mg/L	20	10/29/2009 08:34 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B17-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-005A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.15	0.018	1.0	J	mg/L	20	10/29/2009 08:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-010A

Client Sample ID: B48-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	3.6	0.042	1.0		mg/L	20	10/29/2009 08:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-013A

Client Sample ID: B49-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Lead	0.77	0.042	1.0	J	mg/L	20	10/29/2009 08:59 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B49-2
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-014A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.18	0.018	1.0	J	mg/L	20	10/29/2009 09:11 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B51-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-019A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.11	0.018	1.0	J	mg/L	20	10/29/2009 09:16 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B52-2
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-023A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.062	0.018	1.0	J	mg/L	20	10/29/2009 09:20 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B53-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-024A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.11	0.018	1.0	J	mg/L	20	10/29/2009 09:24 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B54-2
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-029A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.093	0.018	1.0	J	mg/L	20	10/29/2009 09:28 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B55-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-031A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.059	0.018	1.0	J	mg/L	20	10/29/2009 09:32 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B57-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-036A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029E**	QC Batch: **R114536**				PrepDate:		Analyst: **CL**
Chromium	0.10	0.018	1.0	J	mg/L	20	10/29/2009 09:36 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B59-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-043A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.21	0.018	1.0	J	mg/L	20	10/29/2009 10:14 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B60-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-046A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.12	0.018	1.0	J	mg/L	20	10/29/2009 10:18 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B63-2
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-055A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.037	0.018	1.0	J	mg/L	20	10/29/2009 10:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B73-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-059A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Lead	37	0.042	1.0		mg/L	20	10/29/2009 10:26 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B73-2
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-061A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.029	0.018	1.0	J	mg/L	20	10/29/2009 10:30 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-062A

Client Sample ID: B74-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Lead	31	0.042	1.0		mg/L	20	10/29/2009 10:34 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B75-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-065A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.33	0.018	1.0	J	mg/L	20	10/29/2009 10:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-066A

Client Sample ID: B75-1
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Lead	12	0.042	1.0		mg/L	20	10/29/2009 10:51 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B76-1
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-068A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.074	0.018	1.0	J	mg/L	20	10/29/2009 10:56 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B76-4
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-069A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.094	0.018	1.0	J	mg/L	20	10/29/2009 11:00 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B1-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-070A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.13	0.018	1.0	J	mg/L	20	10/29/2009 11:16 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B2-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-073A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.13	0.018	1.0	J	mg/L	20	10/29/2009 11:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B5-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-078A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.14	0.018	1.0	J	mg/L	20	10/29/2009 11:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-082A

Client Sample ID: B7-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Lead	3.1	0.042	1.0		mg/L	20	10/29/2009 11:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B7-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-083A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.074	0.018	1.0	J	mg/L	20	10/29/2009 11:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106216-086A

Client Sample ID: B9-0
Collection Date: 6/30/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.17	0.018	1.0	J	mg/L	20	10/30/2009 12:02 PM
Lead	4.7	0.042	1.0		mg/L	20	10/30/2009 12:02 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B13-0
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-094A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.12	0.018	1.0	J	mg/L	20	10/29/2009 11:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B19-1.5
Lab Order:	106216	**Collection Date:**	6/30/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106216-099A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.056	0.018	1.0	J	mg/L	20	10/29/2009 11:54 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59307A** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **PBS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814536**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									
Lead	ND	0.050									

Sample ID: **LCS-59307** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **LCSS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814537**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.991	0.050	1.000	0	99.1	85	115				
Lead	0.931	0.050	1.000	0	93.1	85	115				

Sample ID: **106216-003ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **B16-0** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814548**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.282	1.0						0.2858	0	20	
Lead	2.199	1.0						2.226	1.19	20	

Sample ID: **106216-003AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **B16-0** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814549**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.632	1.0	2.500	0.2858	93.8	77	116				
Lead	4.352	1.0	2.500	2.226	85.1	71	121				

Sample ID: **MB-59307B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **PBS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814550**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59307B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **PBS** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814550**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									
Lead	ND	0.050									

Sample ID: **106216-036ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **B57-0** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814561**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.103	1.0						0.1030	0	20	
Lead	0.126	1.0						0.1302	0	20	

Sample ID: **106216-036AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **B57-0** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814562**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.397	1.0	2.500	0.1030	91.8	77	116				
Lead	2.296	1.0	2.500	0.1302	86.6	71	121				

Sample ID: **106216-036AMSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114536**
Client ID: **B57-0** Batch ID: **R114536** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814563**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.518	1.0	2.500	0.1030	96.6	77	116	2.397	4.92	20	
Lead	2.416	1.0	2.500	0.1302	91.4	71	121	2.296	5.10	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59308A** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **PBS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814564**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									
Lead	ND	0.050									

Sample ID: **LCS-59308** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **LCSS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814565**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	1.036	0.050	1.000	0	104	85	115				
Lead	0.965	0.050	1.000	0	96.5	85	115				

Sample ID: **106216-069ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **B76-4** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814576**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.093	1.0						0.09355	0	20	
Lead	0.095	1.0						0.1002	0	20	

Sample ID: **106216-069AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **B76-4** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814577**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.460	1.0	2.500	0.09355	94.6	77	116				
Lead	2.228	1.0	2.500	0.1002	85.1	71	121				

Sample ID: **MB-59308B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **PBS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814578**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59308B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **PBS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814578**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.050									

Sample ID: **106238-009ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **ZZZZZZ** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814589**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.645	1.0						0.6063	0	20	
Lead	0.336	1.0						0.3088	0	20	

Sample ID: **106238-009AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **ZZZZZZ** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814590**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	3.000	1.0	2.500	0.6063	95.8	77	116				
Lead	2.510	1.0	2.500	0.3088	88.1	71	121				

Sample ID: **106238-009AMSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **ZZZZZZ** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814591**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	3.075	1.0	2.500	0.6063	98.8	77	116	3.000	2.46	20	
Lead	2.524	1.0	2.500	0.3088	88.6	71	121	2.510	0.529	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Diane Galvan

From: Lauren Vigliotti [vigliotti@geoconinc.com]
Sent: Monday, October 26, 2009 3:18 PM
To: Diane Galvan
Subject: MSN Segment B1 project

This project has been reinitiated and there should be soil samples on hold for soluble analyses under work orders – 106198, 106216 and 106238. Please run the following samples for WET lead under standard TAT. Thank you!

WO106198 – B21-0, B22-0, B46-0, B64-0, B65-0, B66-0, B67-0, B68-0, B69-0, B70-0, B71-0, B65-1, B66-1, B67-1, B68-1, B69-1, B70-1, B66-2, and B69-2

WO106216 – B7-0, B9-0, B15-0, B16-0, B48-1, B49-1, B73-0, B74-0, B75-1

****

Lauren Vigliotti
Senior Staff Geologist

Please visit our new website at http://www.geoconinc.com

Geocon Consultants, Inc
6671 Brisa Street
Livermore, CA 94550
Tel (925) 371-5900
Cell (925) 768-9874

GEOCON

GEOTECHNICAL ENVIRONMENTAL MATERIALS

San Diego Murrieta Burbank Bakersfield Sacramento Livermore Carson City Las Vegas Portland

CONFIDENTIALITY NOTICE: This e-mail may contain confidential and privileged material for the sole use of the intended recipient(s). Any review, use, distribution or disclosure by others is strictly prohibited. If you have received this communication in error, please notify the sender immediately by e-mail and delete the message and any file attachments from your computer. Thank you.

Diane Galvan

From: Lauren Vigliotti [vigliotti@geoconinc.com]
Sent: Monday, October 26, 2009 3:26 PM
To: Diane Galvan
Subject: MSN Segment B1

Diane:
Also, please run the following sample for WET chromium, standard TAT. Thanks!

WO-106238:
B27-1.5, B29-0, B33-0, B35-1.5, B37-0, B39-1, B41-0

WO106216:
B15-1.5, B17-0, B49-2, B51-1, B52-2, B53-0, B54-2, B55-1, B57-0, B59-1, B60-1, B63-2, B73-2, B75-0, B76-1,
B76-4, B1-0, B2-1.5, B5-0, B7-1.5, B9-0, B13-0, B19-1.5

WO106198:
B21-0, B23-1.5, B47-0, B43-1, B45-1, B42-2, B77-1, B77-4, B69-0, B66-2, B64-1, B68-1

****

Lauren Vigliotti
Senior Staff Geologist

Please visit our new website at http://www.geoconinc.com

Geocon Consultants, Inc
6671 Brisa Street
Livermore, CA 94550
Tel (925) 371-5900
Cell (925) 768-9874

GEOCON

GEOTECHNICAL ENVIRONMENTAL MATERIALS

San Diego Murrieta Burbank Bakersfield Sacramento Livermore Carson City Las Vegas Portland

CONFIDENTIALITY NOTICE: This e-mail may contain confidential and privileged material for the sole use of the intended recipient(s). Any review, use, distribution or disclosure by others is strictly prohibited. If you have received this communication in error, please notify the sender immediately by e-mail and delete the message and any file attachments from your computer. Thank you.

Advanced Technology Laboratories

Date: 11/9/2009

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION
WET DI/ EPA 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106216
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/1/2009 8:50:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	IL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-059A	B73-0	1.4	mg/L	59551	0.25	1	6/30/2009	11/6/2009
106216-062A	B74-0	1.6	mg/L	59551	0.25	1	6/30/2009	11/6/2009
106216-066A	B75-1	ND	mg/L	59551	0.25	1	6/30/2009	11/6/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

Date: 11/9/2009

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (TCLP)
EPA 1311/ 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106216
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/1/2009 8:50:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	IL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106216-059A	B73-0	1.0	mg/L	59607	0.25	1	6/30/2009	11/6/2009
106216-062A	B74-0	0.45	mg/L	59607	0.25	1	6/30/2009	11/6/2009
106216-066A	B75-1	0.40	mg/L	59607	0.25	1	6/30/2009	11/6/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI_GEOCON

Sample ID: **MB-59551A** SampType: **MBLK** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **PBS** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819709**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **LCS-59551** SampType: **LCS** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **LCSS** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819710**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.028	0.25	5.000	0	101	80	120				

Sample ID: **106198-042A-DUP** SampType: **DUP** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **ZZZZZZ** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819721**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25						0	0	20	

Sample ID: **106198-042A-MS** SampType: **MS** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **ZZZZZZ** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819722**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.072	0.25	5.000	0	101	70	130				

Sample ID: **MB-59551B** SampType: **MBLK** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **PBS** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819723**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI_GEOCON

Sample ID: **106216-066A-DUP** SampType: **DUP** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **B75-1** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819730**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25						0	0	20	

Sample ID: **106216-066A-MS** SampType: **MS** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **B75-1** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819731**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.598	0.25	5.000	0	112	70	130				

Sample ID: **106216-066A-MSD** SampType: **MSD** TestCode: **7420_DI_GE** Units: **mg/L** Prep Date: **11/4/2009** RunNo: **114823**
Client ID: **B75-1** Batch ID: **59551** TestNo: **WET DI/ EPA WET** Analysis Date: **11/6/2009** SeqNo: **1819732**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.652	0.25	5.000	0	113	70	130	5.598	0.960	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-59607A** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819803**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **MB-59598A TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819804**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **LCS-59607** SampType: **LCS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **LCSS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819805**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.098	0.25	1.000	0	110	80	120				

Sample ID: **106198-043A-DUP** SampType: **DUP** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819816**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25						0	0	20	

Sample ID: **106198-043A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819817**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.904	0.25	2.500	0	116	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106216
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-59607B** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819818**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **MB-59598B TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **PBS** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819819**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.25									

Sample ID: **108303-012A-DUP** SampType: **DUP** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819829**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.089	0.25						1.051	3.56	20	

Sample ID: **108303-012A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819830**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.813	0.25	2.500	1.051	110	70	130				

Sample ID: **108303-012A-MSD** SampType: **MSD** TestCode: **7420_TC** Units: **mg/L** Prep Date: **11/6/2009** RunNo: **114829**
Client ID: **ZZZZZZ** Batch ID: **59607** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **11/6/2009** SeqNo: **1819831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.714	0.25	2.500	1.051	107	70	130	3.813	2.64	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

July 14, 2009

Lauren Vigliotti
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550

TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
CSDLAC No.: 10196

Workorder No.: 106238

RE: HWY 101 - MARIN CO., E8469-06-01

Attention: Lauren Vigliotti

Enclosed are the results for sample(s) received on July 02, 2009 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Lab Order: 106238

CASE NARRATIVE

Analytical Comments for Method 6010

RPD for Duplicate (DUP) is outside criteria for sample 106238-001ADUP; however, the Laboratory Control Sample (LCS) validated the analytical batch.

Analytical Comments for Method 8015 (DRO/ORO)

Dilution was necessary for sample 106238-009A, due to sample matrix.

Surrogate recovery was diluted out for sample 106238-009A.

RPD for Duplicate (DUP) is outside criteria for sample 106238-001ADUP; however, the Laboratory Control Sample (LCS) validated the analytical batch.

Analytical Comments for Method 8021

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 106238-022AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 7/14/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Project No:
Analyte: Lead

Lab Order: 106238
Date Received 7/2/2009 9:45:00 AM
Matrix: Soil
Analyst: CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106238-002A	B25-1.5	ND	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-003A	B26-0	15	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-004A	B26-1.5	5.0	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-005A	B27-0	17	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-007A	B28-0	17	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-008A	B28-1.5	7.9	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-010A	B29-1.5	ND	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-011A	B30-0	36	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-012A	B30-1.5	5.3	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-013A	B31-0	ND	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-014A	B31-1.5	6.6	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-015A	B32-0	22	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-016A	B32-1.5	6.0	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-018A	B33-1.5	ND	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-019A	B34-0	36	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-020A	B34-1.5	ND	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-021A	B35-0	23	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-023A	B36-0	34	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 7/14/2009

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106238
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/2/2009 9:45:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	CL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106238-024A	B36-1.5	5.3	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-026A	B37-1.5	6.7	mg/Kg	56460	5.0	1	7/1/2009	7/9/2009
106238-027A	B38-0	ND	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-028A	B38-1	ND	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-029A	B38-2	ND	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-030A	B39-0	8.4	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-032A	B39-2	ND	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-033A	B40-0	12	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-034A	B40-1	6.6	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-035A	B40-2	5.5	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-037A	B41-1	21	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009
106238-038A	B41-2	18	mg/Kg	56461	5.0	1	7/1/2009	7/9/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

Date: 7/14/2009

ANALYTICAL RESULTS

pH
EPA 9045C

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	106238
Project:	HWY 101 - MARIN CO., E8469-06-01	**Date Received**	7/2/2009 9:45:00 AM
Project No:		**Matrix:**	Soil
Analyte:	pH	**Analyst:**	DDL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
106238-007A	B28-0	5.8	pH Units	R110516	0.10	1	7/1/2009	7/6/2009
106238-016A	B32-1.5	6.9	pH Units	R110516	0.10	1	7/1/2009	7/6/2009
106238-025A	B37-0	6.6	pH Units	R110516	0.10	1	7/1/2009	7/6/2009
106238-037A	B41-1	7.2	pH Units	R110516	0.10	1	7/1/2009	7/6/2009

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-001A

Client Sample ID: B25-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate: 7/8/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/13/2009 09:44 PM
Arsenic	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Barium	110	1.0		mg/Kg	1	7/13/2009 09:44 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Chromium	37	1.0		mg/Kg	1	7/13/2009 09:44 PM
Cobalt	8.5	1.0		mg/Kg	1	7/13/2009 09:44 PM
Copper	17	2.0		mg/Kg	1	7/13/2009 09:44 PM
Lead	12	1.0		mg/Kg	1	7/13/2009 09:44 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Nickel	43	1.0		mg/Kg	1	7/13/2009 09:44 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 09:44 PM
Vanadium	43	1.0		mg/Kg	1	7/13/2009 09:44 PM
Zinc	38	1.0		mg/Kg	1	7/13/2009 09:44 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	6.4	1.0		mg/Kg	1	7/9/2009 08:52 PM
ORO	38	1.0		mg/Kg	1	7/9/2009 08:52 PM
Surr: p-Terphenyl	59.8	30-130		%REC	1	7/9/2009 08:52 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 11:41 AM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-001A

Client Sample ID: B25-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate:	7/9/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 11:41 AM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 11:41 AM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 11:41 AM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 11:41 AM
Surr: Decachlorobiphenyl	54.8	20-142		%REC	1	7/13/2009 11:41 AM
Surr: Tetrachloro-m-xylene	56.9	25-115		%REC	1	7/13/2009 11:41 AM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090708B	QC Batch: 56458			PrepDate:	7/8/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/8/2009 01:53 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B25-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 12:27 PM
Surr: Bromofluorobenzene (FID)	97.6	59-145		%REC	1	7/6/2009 12:27 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 12:27 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 12:27 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 12:27 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 12:27 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 12:27 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 12:27 PM
Surr: Bromofluorobenzene (PID)	88.2	65-140		%REC	1	7/6/2009 12:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-003A

Client Sample ID: B26-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	6.6	1.0		mg/Kg	1	7/9/2009 08:43 PM
ORO	32	1.0		mg/Kg	1	7/9/2009 08:43 PM
Surr: p-Terphenyl	71.8	30-130		%REC	1	7/9/2009 08:43 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 11:55 AM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 11:55 AM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 11:55 AM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 11:55 AM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 11:55 AM
Surr: Decachlorobiphenyl	54.7	20-142		%REC	1	7/13/2009 11:55 AM
Surr: Tetrachloro-m-xylene	68.9	25-115		%REC	1	7/13/2009 11:55 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-004A

Client Sample ID: B26-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 03:32 PM
Surr: Bromofluorobenzene (FID)	105	59-145		%REC	1	7/6/2009 03:32 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 03:32 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 03:32 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 03:32 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 03:32 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 03:32 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 03:32 PM
Surr: Bromofluorobenzene (PID)	94.2	65-140		%REC	1	7/6/2009 03:32 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-005A

Client Sample ID: B27-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	2.7	1.0		mg/Kg	1	7/9/2009 08:33 PM
ORO	26	1.0		mg/Kg	1	7/9/2009 08:33 PM
Surr: p-Terphenyl	55.3	30-130		%REC	1	7/9/2009 08:33 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 12:23 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 12:23 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 12:23 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 12:23 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 12:23 PM
Surr: Decachlorobiphenyl	50.2	20-142		%REC	1	7/13/2009 12:23 PM
Surr: Tetrachloro-m-xylene	55.8	25-115		%REC	1	7/13/2009 12:23 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-006A

Client Sample ID: B27-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate: 7/8/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:00 PM
Arsenic	3.7	1.0		mg/Kg	1	7/13/2009 10:00 PM
Barium	91	1.0		mg/Kg	1	7/13/2009 10:00 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:00 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:00 PM
Chromium	53	1.0		mg/Kg	1	7/13/2009 10:00 PM
Cobalt	2.4	1.0		mg/Kg	1	7/13/2009 10:00 PM
Copper	9.0	2.0		mg/Kg	1	7/13/2009 10:00 PM
Lead	6.6	1.0		mg/Kg	1	7/13/2009 10:00 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:00 PM
Nickel	27	1.0		mg/Kg	1	7/13/2009 10:00 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:00 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:00 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:00 PM
Vanadium	36	1.0		mg/Kg	1	7/13/2009 10:00 PM
Zinc	17	1.0		mg/Kg	1	7/13/2009 10:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 03:48 PM
Surr: Bromofluorobenzene (FID)	97.5	59-145		%REC	1	7/6/2009 03:48 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 03:48 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 03:48 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 03:48 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 03:48 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 03:48 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 03:48 PM
Surr: Bromofluorobenzene (PID)	87.9	65-140		%REC	1	7/6/2009 03:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B27-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-006A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090708B	QC Batch: 56458			PrepDate: 7/8/2009	Analyst: **IL**	
Mercury	ND	0.10		mg/Kg	1	7/8/2009 01:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-007A

Client Sample ID: B28-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	8.9	1.0		mg/Kg	1	7/9/2009 09:59 PM
ORO	74	1.0		mg/Kg	1	7/9/2009 09:59 PM
Surr: p-Terphenyl	65.0	30-130		%REC	1	7/9/2009 09:59 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 12:38 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 12:38 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 12:38 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 12:38 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 12:38 PM
Surr: Decachlorobiphenyl	48.7	20-142		%REC	1	7/13/2009 12:38 PM
Surr: Tetrachloro-m-xylene	47.6	25-115		%REC	1	7/13/2009 12:38 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B28-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-008A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 04:04 PM
Surr: Bromofluorobenzene (FID)	98.6	59-145		%REC	1	7/6/2009 04:04 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 04:04 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 04:04 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 04:04 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 04:04 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 04:04 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 04:04 PM
Surr: Bromofluorobenzene (PID)	89.2	65-140		%REC	1	7/6/2009 04:04 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B29-0
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-009A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate:	7/8/2009	Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:11 PM
Arsenic	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Barium	150	1.0		mg/Kg	1	7/13/2009 10:11 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Chromium	59	1.0		mg/Kg	1	7/13/2009 10:11 PM
Cobalt	15	1.0		mg/Kg	1	7/13/2009 10:11 PM
Copper	29	2.0		mg/Kg	1	7/13/2009 10:11 PM
Lead	12	1.0		mg/Kg	1	7/13/2009 10:11 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Nickel	61	1.0		mg/Kg	1	7/13/2009 10:11 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:11 PM
Vanadium	31	1.0		mg/Kg	1	7/13/2009 10:11 PM
Zinc	82	1.0		mg/Kg	1	7/14/2009 08:26 AM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate:	7/7/2009	Analyst: **CBR**
DRO	16	10		mg/Kg	10	7/9/2009 10:26 PM
ORO	350	10		mg/Kg	10	7/9/2009 10:26 PM
Surr: p-Terphenyl	0	30-130	SDO	%REC	10	7/9/2009 10:26 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate:	7/9/2009	Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 12:52 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-009A

Client Sample ID: B29-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate:	7/9/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 12:52 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 12:52 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 12:52 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 12:52 PM
Surr: Decachlorobiphenyl	46.5	20-142		%REC	1	7/13/2009 12:52 PM
Surr: Tetrachloro-m-xylene	46.2	25-115		%REC	1	7/13/2009 12:52 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090708B	QC Batch: 56458			PrepDate:	7/8/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/8/2009 01:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B29-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-010A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 04:19 PM
Surr: Bromofluorobenzene (FID)	114	59-145		%REC	1	7/6/2009 04:19 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 04:19 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 04:19 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 04:19 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 04:19 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 04:19 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 04:19 PM
Surr: Bromofluorobenzene (PID)	103	65-140		%REC	1	7/6/2009 04:19 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-011A

Client Sample ID: B30-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	6.2	1.0		mg/Kg	1	7/9/2009 10:08 PM
ORO	46	1.0		mg/Kg	1	7/9/2009 10:08 PM
Surr: p-Terphenyl	71.2	30-130		%REC	1	7/9/2009 10:08 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 01:06 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 01:06 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 01:06 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 01:06 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 01:06 PM
Surr: Decachlorobiphenyl	52.6	20-142		%REC	1	7/13/2009 01:06 PM
Surr: Tetrachloro-m-xylene	46.9	25-115		%REC	1	7/13/2009 01:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B30-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-012A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 04:35 PM
Surr: Bromofluorobenzene (FID)	104	59-145		%REC	1	7/6/2009 04:35 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 04:35 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 04:35 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 04:35 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 04:35 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 04:35 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 04:35 PM
Surr: Bromofluorobenzene (PID)	94.0	65-140		%REC	1	7/6/2009 04:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-013A

Client Sample ID: B31-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	8.7	1.0		mg/Kg	1	7/9/2009 10:17 PM
ORO	50	1.0		mg/Kg	1	7/9/2009 10:17 PM
Surr: p-Terphenyl	69.0	30-130		%REC	1	7/9/2009 10:17 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 11:27 AM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 11:27 AM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 11:27 AM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 11:27 AM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 11:27 AM
Surr: Decachlorobiphenyl	44.3	20-142		%REC	1	7/13/2009 11:27 AM
Surr: Tetrachloro-m-xylene	45.1	25-115		%REC	1	7/13/2009 11:27 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-014A

Client Sample ID: B31-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 04:51 PM
Surr: Bromofluorobenzene (FID)	106	59-145		%REC	1	7/6/2009 04:51 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 04:51 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 04:51 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 04:51 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 04:51 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 04:51 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 04:51 PM
Surr: Bromofluorobenzene (PID)	96.0	65-140		%REC	1	7/6/2009 04:51 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-015A

Client Sample ID: B32-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	8.8	1.0		mg/Kg	1	7/9/2009 09:49 PM
ORO	65	1.0		mg/Kg	1	7/9/2009 09:49 PM
Surr: p-Terphenyl	77.6	30-130		%REC	1	7/9/2009 09:49 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 01:20 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 01:20 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 01:20 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 01:20 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 01:20 PM
Surr: Decachlorobiphenyl	48.4	20-142		%REC	1	7/13/2009 01:20 PM
Surr: Tetrachloro-m-xylene	52.8	25-115		%REC	1	7/13/2009 01:20 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-016A

Client Sample ID: B32-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 05:07 PM
Surr: Bromofluorobenzene (FID)	106	59-145		%REC	1	7/6/2009 05:07 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 05:07 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 05:07 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 05:07 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 05:07 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 05:07 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 05:07 PM
Surr: Bromofluorobenzene (PID)	94.6	65-140		%REC	1	7/6/2009 05:07 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B33-0
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-017A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate:	7/8/2009	Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:15 PM
Arsenic	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Barium	140	1.0		mg/Kg	1	7/13/2009 10:15 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Chromium	90	1.0		mg/Kg	1	7/13/2009 10:15 PM
Cobalt	20	1.0		mg/Kg	1	7/13/2009 10:15 PM
Copper	23	2.0		mg/Kg	1	7/13/2009 10:15 PM
Lead	40	1.0		mg/Kg	1	7/13/2009 10:15 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Nickel	64	1.0		mg/Kg	1	7/13/2009 10:15 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:15 PM
Vanadium	46	1.0		mg/Kg	1	7/13/2009 10:15 PM
Zinc	270	1.0		mg/Kg	1	7/14/2009 08:27 AM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate:	7/7/2009	Analyst: **CBR**
DRO	2.9	1.0		mg/Kg	1	7/9/2009 09:40 PM
ORO	41	1.0		mg/Kg	1	7/9/2009 09:40 PM
Surr: p-Terphenyl	72.7	30-130		%REC	1	7/9/2009 09:40 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090712A	QC Batch: 56508			PrepDate:	7/9/2009	Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
Aldrin	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
beta-BHC	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
Chlordane	ND	8.5		µg/Kg	1	7/12/2009 03:37 PM
delta-BHC	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-017A

Client Sample ID: B33-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090712A	QC Batch: 56508			PrepDate:	7/9/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
Endrin	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/12/2009 03:37 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
Heptachlor	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/12/2009 03:37 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/12/2009 03:37 PM
Toxaphene	ND	50		µg/Kg	1	7/12/2009 03:37 PM
Surr: Decachlorobiphenyl	53.3	20-142		%REC	1	7/12/2009 03:37 PM
Surr: Tetrachloro-m-xylene	50.6	25-115		%REC	1	7/12/2009 03:37 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090708B	QC Batch: 56458			PrepDate:	7/8/2009	Analyst: **IL**
Mercury	0.11	0.10		mg/Kg	1	7/8/2009 01:59 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B33-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-018A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 05:23 PM
Surr: Bromofluorobenzene (FID)	98.2	59-145		%REC	1	7/6/2009 05:23 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 05:23 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 05:23 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 05:23 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 05:23 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 05:23 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 05:23 PM
Surr: Bromofluorobenzene (PID)	88.1	65-140		%REC	1	7/6/2009 05:23 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-019A

Client Sample ID: B34-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090709B	QC Batch: 56442			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	5.8	1.0		mg/Kg	1	7/9/2009 09:31 PM
ORO	42	1.0		mg/Kg	1	7/9/2009 09:31 PM
Surr: p-Terphenyl	78.3	30-130		%REC	1	7/9/2009 09:31 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 01:34 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 01:34 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 01:34 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 01:34 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 01:34 PM
Surr: Decachlorobiphenyl	39.8	20-142		%REC	1	7/13/2009 01:34 PM
Surr: Tetrachloro-m-xylene	45.9	25-115		%REC	1	7/13/2009 01:34 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-020A

Client Sample ID: B34-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
		EPA 8015B(M)				
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/6/2009 05:39 PM
Surr: Bromofluorobenzene (FID)	109	59-145		%REC	1	7/6/2009 05:39 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
		EPA 8021B				
RunID: GC2_090706A	QC Batch: E09VS206			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/6/2009 05:39 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/6/2009 05:39 PM
m,p-Xylene	ND	10		µg/Kg	1	7/6/2009 05:39 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/6/2009 05:39 PM
o-Xylene	ND	5.0		µg/Kg	1	7/6/2009 05:39 PM
Toluene	ND	5.0		µg/Kg	1	7/6/2009 05:39 PM
Surr: Bromofluorobenzene (PID)	98.0	65-140		%REC	1	7/6/2009 05:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-021A

Client Sample ID: B35-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707E	QC Batch: 56443			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	3.2	1.0		mg/Kg	1	7/8/2009 01:31 AM
ORO	20	1.0		mg/Kg	1	7/8/2009 01:31 AM
Surr: p-Terphenyl	84.5	30-130		%REC	1	7/8/2009 01:31 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090713A	QC Batch: 56507			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
Aldrin	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
beta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
Chlordane	ND	8.5		µg/Kg	1	7/13/2009 01:48 PM
delta-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
Dieldrin	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
Endrin	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/13/2009 01:48 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
Heptachlor	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/13/2009 01:48 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/13/2009 01:48 PM
Toxaphene	ND	50		µg/Kg	1	7/13/2009 01:48 PM
Surr: Decachlorobiphenyl	46.3	20-142		%REC	1	7/13/2009 01:48 PM
Surr: Tetrachloro-m-xylene	53.5	25-115		%REC	1	7/13/2009 01:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-022A

Client Sample ID: B35-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate: 7/8/2009		Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:19 PM
Arsenic	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Barium	160	1.0		mg/Kg	1	7/13/2009 10:19 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Chromium	58	1.0		mg/Kg	1	7/13/2009 10:19 PM
Cobalt	15	1.0		mg/Kg	1	7/13/2009 10:19 PM
Copper	14	2.0		mg/Kg	1	7/13/2009 10:19 PM
Lead	5.8	1.0		mg/Kg	1	7/13/2009 10:19 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Nickel	36	1.0		mg/Kg	1	7/13/2009 10:19 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:19 PM
Vanadium	38	1.0		mg/Kg	1	7/13/2009 10:19 PM
Zinc	26	1.0		mg/Kg	1	7/14/2009 08:29 AM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_090707A	QC Batch: E09VS207			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/7/2009 11:57 AM
Surr: Bromofluorobenzene (FID)	105	59-145		%REC	1	7/7/2009 11:57 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_090707A	QC Batch: E09VS207			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/7/2009 11:57 AM
Ethylbenzene	ND	5.0		µg/Kg	1	7/7/2009 11:57 AM
m,p-Xylene	ND	10		µg/Kg	1	7/7/2009 11:57 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/7/2009 11:57 AM
o-Xylene	ND	5.0		µg/Kg	1	7/7/2009 11:57 AM
Toluene	ND	5.0		µg/Kg	1	7/7/2009 11:57 AM
Surr: Bromofluorobenzene (PID)	93.3	65-140		%REC	1	7/7/2009 11:57 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B35-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-022A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
		EPA 7471A				
RunID: AA5_090708B	QC Batch: 56458			PrepDate: 7/8/2009	Analyst: **IL**	
Mercury	0.31	0.10		mg/Kg	1	7/8/2009 02:01 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-023A

Client Sample ID: B36-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_090707E	QC Batch: 56443			PrepDate: 7/7/2009		Analyst: **CBR**
DRO	13	1.0		mg/Kg	1	7/8/2009 01:40 AM
ORO	48	1.0		mg/Kg	1	7/8/2009 01:40 AM
Surr: p-Terphenyl	62.1	30-130		%REC	1	7/8/2009 01:40 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC9_090712A	QC Batch: 56508			PrepDate: 7/9/2009		Analyst: **SMH**
4,4´-DDD	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
Aldrin	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
beta-BHC	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
Chlordane	ND	8.5		µg/Kg	1	7/12/2009 06:55 PM
delta-BHC	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
Dieldrin	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
Endrin	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/12/2009 06:55 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
Heptachlor	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/12/2009 06:55 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/12/2009 06:55 PM
Toxaphene	ND	50		µg/Kg	1	7/12/2009 06:55 PM
Surr: Decachlorobiphenyl	36.7	20-142		%REC	1	7/12/2009 06:55 PM
Surr: Tetrachloro-m-xylene	47.3	25-115		%REC	1	7/12/2009 06:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-024A

Client Sample ID: B36-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090707A	QC Batch: E09VS207			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/7/2009 12:29 PM
Surr: Bromofluorobenzene (FID)	105	59-145		%REC	1	7/7/2009 12:29 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090707A	QC Batch: E09VS207			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/7/2009 12:29 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/7/2009 12:29 PM
m,p-Xylene	ND	10		µg/Kg	1	7/7/2009 12:29 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/7/2009 12:29 PM
o-Xylene	ND	5.0		µg/Kg	1	7/7/2009 12:29 PM
Toluene	ND	5.0		µg/Kg	1	7/7/2009 12:29 PM
Surr: Bromofluorobenzene (PID)	94.8	65-140		%REC	1	7/7/2009 12:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** B37-0
Lab Order: 106238 **Collection Date:** 7/1/2009
Project: HWY 101 - MARIN CO., E8469-06-01 **Matrix:** SOIL
Lab ID: 106238-025A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_090713J	QC Batch: 56459			PrepDate: 7/8/2009	Analyst: **CL**	
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:23 PM
Arsenic	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Barium	210	1.0		mg/Kg	1	7/13/2009 10:23 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Chromium	37	1.0		mg/Kg	1	7/13/2009 10:23 PM
Cobalt	11	1.0		mg/Kg	1	7/13/2009 10:23 PM
Copper	24	2.0		mg/Kg	1	7/13/2009 10:23 PM
Lead	34	1.0		mg/Kg	1	7/13/2009 10:23 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Nickel	53	1.0		mg/Kg	1	7/13/2009 10:23 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:23 PM
Vanadium	28	1.0		mg/Kg	1	7/13/2009 10:23 PM
Zinc	68	1.0		mg/Kg	1	7/14/2009 08:30 AM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_090707E	QC Batch: 56443			PrepDate: 7/7/2009	Analyst: **CBR**	
DRO	7.7	1.0		mg/Kg	1	7/8/2009 01:49 AM
ORO	42	1.0		mg/Kg	1	7/8/2009 01:49 AM
Surr: p-Terphenyl	76.3	30-130		%REC	1	7/8/2009 01:49 AM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC9_090712A	QC Batch: 56508			PrepDate: 7/9/2009	Analyst: **SMH**	
4,4´-DDD	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
4,4´-DDE	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
4,4´-DDT	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
Aldrin	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
alpha-BHC	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
beta-BHC	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
Chlordane	ND	8.5		µg/Kg	1	7/12/2009 07:09 PM
delta-BHC	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-025A

Client Sample ID: B37-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_090712A	QC Batch: 56508			PrepDate:	7/9/2009	Analyst: **SMH**
Dieldrin	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
Endosulfan I	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
Endosulfan II	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
Endrin	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
Endrin ketone	ND	2.0		µg/Kg	1	7/12/2009 07:09 PM
gamma-BHC	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
Heptachlor	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	7/12/2009 07:09 PM
Methoxychlor	ND	5.0		µg/Kg	1	7/12/2009 07:09 PM
Toxaphene	ND	50		µg/Kg	1	7/12/2009 07:09 PM
Surr: Decachlorobiphenyl	41.1	20-142		%REC	1	7/12/2009 07:09 PM
Surr: Tetrachloro-m-xylene	42.5	25-115		%REC	1	7/12/2009 07:09 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090708B	QC Batch: 56458			PrepDate:	7/8/2009	Analyst: **IL**
Mercury	ND	0.10		mg/Kg	1	7/8/2009 02:03 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B37-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-026A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_090707A	QC Batch: E09VS207			PrepDate:		Analyst: **KHN**
GRO	ND	1.0		mg/Kg	1	7/7/2009 12:44 PM
Surr: Bromofluorobenzene (FID)	104	59-145		%REC	1	7/7/2009 12:44 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_090707A	QC Batch: E09VS207			PrepDate:		Analyst: **KHN**
Benzene	ND	5.0		µg/Kg	1	7/7/2009 12:44 PM
Ethylbenzene	ND	5.0		µg/Kg	1	7/7/2009 12:44 PM
m,p-Xylene	ND	10		µg/Kg	1	7/7/2009 12:44 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	7/7/2009 12:44 PM
o-Xylene	ND	5.0		µg/Kg	1	7/7/2009 12:44 PM
Toluene	ND	5.0		µg/Kg	1	7/7/2009 12:44 PM
Surr: Bromofluorobenzene (PID)	93.9	65-140		%REC	1	7/7/2009 12:44 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-031A

Client Sample ID: B39-1
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate:	7/8/2009	Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:27 PM
Arsenic	1.6	1.0		mg/Kg	1	7/13/2009 10:27 PM
Barium	110	1.0		mg/Kg	1	7/13/2009 10:27 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:27 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:27 PM
Chromium	47	1.0		mg/Kg	1	7/13/2009 10:27 PM
Cobalt	8.8	1.0		mg/Kg	1	7/13/2009 10:27 PM
Copper	17	2.0		mg/Kg	1	7/13/2009 10:27 PM
Lead	6.5	1.0		mg/Kg	1	7/13/2009 10:27 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:27 PM
Nickel	50	1.0		mg/Kg	1	7/13/2009 10:27 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:27 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:27 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:27 PM
Vanadium	24	1.0		mg/Kg	1	7/13/2009 10:27 PM
Zinc	35	1.0		mg/Kg	1	7/14/2009 08:31 AM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090708B	QC Batch: 56458			PrepDate:	7/8/2009	Analyst: **IL**
Mercury	0.12	0.10		mg/Kg	1	7/8/2009 02:05 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Jul-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-036A

Client Sample ID: B41-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_090713J	QC Batch: 56459			PrepDate:	7/8/2009	Analyst: **CL**
Antimony	ND	2.0		mg/Kg	1	7/13/2009 10:30 PM
Arsenic	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Barium	260	1.0		mg/Kg	1	7/13/2009 10:30 PM
Beryllium	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Cadmium	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Chromium	73	1.0		mg/Kg	1	7/13/2009 10:30 PM
Cobalt	13	1.0		mg/Kg	1	7/13/2009 10:30 PM
Copper	33	2.0		mg/Kg	1	7/13/2009 10:30 PM
Lead	24	1.0		mg/Kg	1	7/13/2009 10:30 PM
Molybdenum	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Nickel	89	1.0		mg/Kg	1	7/13/2009 10:30 PM
Selenium	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Silver	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Thallium	ND	1.0		mg/Kg	1	7/13/2009 10:30 PM
Vanadium	35	1.0		mg/Kg	1	7/13/2009 10:30 PM
Zinc	49	1.0		mg/Kg	1	7/14/2009 08:33 AM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_090708B	QC Batch: 56458			PrepDate:	7/8/2009	Analyst: **IL**
Mercury	0.11	0.10		mg/Kg	1	7/8/2009 01:45 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-56459** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **PBS** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743282**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	0.033	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-56459** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **LCSS** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743283**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	47.322	2.0	50.00	0	94.6	80	120				
Arsenic	48.540	1.0	50.00	0	97.1	80	120				
Barium	48.554	1.0	50.00	0	97.1	80	120				
Beryllium	47.989	1.0	50.00	0	96.0	80	120				
Cadmium	49.421	1.0	50.00	0	98.8	80	120				
Chromium	46.824	1.0	50.00	0	93.6	80	120				
Cobalt	46.864	1.0	50.00	0	93.7	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-56459** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **LCSS** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743283**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	48.446	2.0	50.00	0	96.9	80	120				
Lead	50.405	1.0	50.00	0	101	80	120				
Molybdenum	46.948	1.0	50.00	0	93.9	80	120				
Nickel	46.863	1.0	50.00	0	93.7	80	120				
Selenium	51.798	1.0	50.00	0	104	80	120				
Silver	42.802	1.0	50.00	0.03256	85.5	80	120				
Thallium	46.975	1.0	50.00	0	93.9	80	120				
Vanadium	48.643	1.0	50.00	0	97.3	80	120				
Zinc	49.395	1.0	50.00	0	98.8	80	120				

Sample ID: **106238-001ADUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **B25-0** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743285**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0	0	20	
Arsenic	ND	1.0						0	0	20	
Barium	122.347	1.0						113.5	7.47	20	
Beryllium	ND	1.0						0	0	20	
Cadmium	0.680	1.0						0.6019	0	20	
Chromium	40.421	1.0						36.74	9.54	20	
Cobalt	10.671	1.0						8.485	22.8	20	R
Copper	18.514	2.0						16.94	8.90	20	
Lead	11.922	1.0						11.78	1.24	20	
Molybdenum	ND	1.0						0	0	20	
Nickel	47.577	1.0						43.42	9.14	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	48.011	1.0						43.42	10.1	20	
Zinc	42.189	1.0						37.70	11.2	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106238-001AMS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **B25-0** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743286**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	65.639	2.0	125.0	0	52.5	25	106				
Arsenic	82.435	1.0	125.0	0	65.9	42	113				
Barium	211.401	1.0	125.0	113.5	78.3	19	140				
Beryllium	89.764	1.0	125.0	0	71.8	50	109				
Cadmium	84.606	1.0	125.0	0.6019	67.2	48	106				
Chromium	132.490	1.0	125.0	36.74	76.6	44	116				
Cobalt	94.984	1.0	125.0	8.485	69.2	47	107				
Copper	123.211	2.0	125.0	16.94	85.0	49	124				
Lead	99.720	1.0	125.0	11.78	70.4	33	120				
Molybdenum	86.166	1.0	125.0	0	68.9	46	111				
Nickel	132.235	1.0	125.0	43.42	71.1	43	111				
Selenium	79.704	1.0	125.0	0	63.8	43	104				
Silver	95.409	1.0	125.0	0	76.3	53	114				
Thallium	82.266	1.0	125.0	0	65.8	41	107				
Vanadium	142.041	1.0	125.0	43.42	78.9	48	116				
Zinc	123.142	1.0	125.0	37.70	68.4	24	129				

Sample ID: **106238-001AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **B25-0** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743287**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	60.579	2.0	125.0	0	48.5	25	106	65.64	8.02	20	
Arsenic	76.800	1.0	125.0	0	61.4	42	113	82.43	7.08	20	
Barium	199.706	1.0	125.0	113.5	68.9	19	140	211.4	5.69	20	
Beryllium	84.510	1.0	125.0	0	67.6	50	109	89.76	6.03	20	
Cadmium	79.287	1.0	125.0	0.6019	62.9	48	106	84.61	6.49	20	
Chromium	125.075	1.0	125.0	36.74	70.7	44	116	132.5	5.76	20	
Cobalt	91.488	1.0	125.0	8.485	66.4	47	107	94.98	3.75	20	
Copper	114.977	2.0	125.0	16.94	78.4	49	124	123.2	6.91	20	
Lead	92.777	1.0	125.0	11.78	64.8	33	120	99.72	7.21	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **106238-001AMSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110752**
Client ID: **B25-0** Batch ID: **56459** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **7/13/2009** SeqNo: **1743287**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	80.611	1.0	125.0	0	64.5	46	111	86.17	6.66	20	
Nickel	123.878	1.0	125.0	43.42	64.4	43	111	132.2	6.53	20	
Selenium	74.240	1.0	125.0	0	59.4	43	104	79.70	7.10	20	
Silver	89.030	1.0	125.0	0	71.2	53	114	95.41	6.92	20	
Thallium	77.076	1.0	125.0	0	61.7	41	107	82.27	6.51	20	
Vanadium	133.057	1.0	125.0	43.42	71.7	48	116	142.0	6.53	20	
Zinc	115.478	1.0	125.0	37.70	62.2	24	129	123.1	6.42	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56460A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **PBS** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741399**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.276	5.0									

Sample ID: **LCS-56460** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **LCSS** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741400**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	254.486	5.0	250.0	0.2760	102	80	120				

Sample ID: **106238-013ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **B31-0** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741411**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	4.607	5.0						4.048	0	20	

Sample ID: **106238-013AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **B31-0** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741412**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	178.450	5.0	250.0	4.048	69.8	33	120				

Sample ID: **MB-56460B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **PBS** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741413**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **106238-026ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **B37-1.5** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741424**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	6.761	5.0						6.677	1.26	20	

Sample ID: **106238-026AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **B37-1.5** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741425**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	198.631	5.0	250.0	6.677	76.8	33	120				

Sample ID: **106238-026AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110641**
Client ID: **B37-1.5** Batch ID: **56460** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741426**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	192.730	5.0	250.0	6.677	74.4	33	120	198.6	3.02	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-56461A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110642**
Client ID: **PBS** Batch ID: **56461** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741427**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-56461** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110642**
Client ID: **LCSS** Batch ID: **56461** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741428**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	241.350	5.0	250.0	0	96.5	80	120				

Sample ID: **106238-038ADUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110642**
Client ID: **B41-2** Batch ID: **56461** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741439**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	15.310	5.0						17.75	14.8	20	

Sample ID: **106238-038AMS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110642**
Client ID: **B41-2** Batch ID: **56461** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741440**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	193.262	5.0	250.0	17.75	70.2	33	120				

Sample ID: **106238-038AMSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110642**
Client ID: **B41-2** Batch ID: **56461** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **7/9/2009** SeqNo: **1741441**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	198.322	5.0	250.0	17.75	72.2	33	120	193.3	2.58	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-56458** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110597**
Client ID: **PBS** Batch ID: **56458** TestNo: **EPA 7471A** Analysis Date: **7/8/2009** SeqNo: **1740614**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-56458** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110597**
Client ID: **LCSS** Batch ID: **56458** TestNo: **EPA 7471A** Analysis Date: **7/8/2009** SeqNo: **1740615**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.807	0.10	0.8300	0	97.2	80	120				

Sample ID: **106238-036A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110597**
Client ID: **B41-0** Batch ID: **56458** TestNo: **EPA 7471A** Analysis Date: **7/8/2009** SeqNo: **1740616**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.924	0.10	0.8300	0.1150	97.4	70	130				

Sample ID: **106238-036A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110597**
Client ID: **B41-0** Batch ID: **56458** TestNo: **EPA 7471A** Analysis Date: **7/8/2009** SeqNo: **1740617**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.938	0.10	0.8300	0.1150	99.2	70	130	0.9237	1.55	20	

Sample ID: **106238-036A-DUP** SampType: **DUP** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **7/8/2009** RunNo: **110597**
Client ID: **B41-0** Batch ID: **56458** TestNo: **EPA 7471A** Analysis Date: **7/8/2009** SeqNo: **1740619**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.109	0.10						0.1150	5.60	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-56442** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110647**
Client ID: **PBS** Batch ID: **56442** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741565**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.303		2.670		86.2	30	130				

Sample ID: **LCS-56442** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110647**
Client ID: **LCSS** Batch ID: **56442** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741566**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	30.012	1.0	33.00	0	90.9	35	124				
Surr: p-Terphenyl	2.722		2.670		102	30	130				

Sample ID: **106238-001AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110647**
Client ID: **B25-0** Batch ID: **56442** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741570**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	32.526	1.0	33.00	6.417	79.1	12	125				
Surr: p-Terphenyl	2.183		2.670		81.8	30	130				

Sample ID: **106238-001AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110647**
Client ID: **B25-0** Batch ID: **56442** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741571**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	30.433	1.0	33.00	6.417	72.8	12	125	32.53	6.65	20	
Surr: p-Terphenyl	1.965		2.670		73.6	30	130		0	0	

Sample ID: **106238-001ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110647**
Client ID: **B25-0** Batch ID: **56442** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741572**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **106238-001ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110647**
Client ID: **B25-0** Batch ID: **56442** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **7/9/2009** SeqNo: **1741572**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	10.483	1.0						6.417	48.1	20	R
ORO	55.995	1.0						37.84	38.7	20	R
Surr: p-Terphenyl	1.929		2.670		72.2	30	130		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-56443** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **PBS** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740748**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.073		2.670		77.7	30	130				

Sample ID: **LCS-56443** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **LCSS** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740749**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	24.316	1.0	33.00	0	73.7	35	124				
Surr: p-Terphenyl	2.181		2.670		81.7	30	130				

Sample ID: **106216-100AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **ZZZZZZ** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740750**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	31.373	1.0	33.00	6.764	74.6	12	125				
Surr: p-Terphenyl	2.206		2.670		82.6	30	130				

Sample ID: **106216-100AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **ZZZZZZ** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740751**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	30.016	1.0	33.00	6.764	70.5	12	125	31.37	4.42	20	
Surr: p-Terphenyl	2.033		2.670		76.1	30	130		0	0	

Sample ID: **106216-100ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **ZZZZZZ** Batch ID: **56443** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740752**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **106216-100ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **7/7/2009** RunNo: **110605**
Client ID: **ZZZZZZ** Batch ID: **56443** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **7/8/2009** SeqNo: **1740752**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	5.751	1.0						6.764	16.2	20	
ORO	34.119	1.0						39.69	15.1	20	
Surr: p-Terphenyl	1.792		2.670		67.1	30	130		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E090706LCS1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110515**
Client ID: **LCSS** Batch ID: **E09VS206** TestNo: **EPA 8015B(M** Analysis Date: **7/6/2009** SeqNo: **1739723**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.416	1.0	5.000	0	88.3	73	120				
Surr: Bromofluorobenzene (FID)	99.595		100.0		99.6	59	145				

Sample ID: **106238-002AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8015B(M** Analysis Date: **7/6/2009** SeqNo: **1739724**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.081	1.0	5.000	0	81.6	39	135				
Surr: Bromofluorobenzene (FID)	97.705		100.0		97.7	59	145				

Sample ID: **106238-002AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8015B(M** Analysis Date: **7/6/2009** SeqNo: **1739725**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.155	1.0	5.000	0	83.1	39	135	4.081	1.80	20	
Surr: Bromofluorobenzene (FID)	103.048		100.0		103	59	145		0	0	

Sample ID: **E090706MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110515**
Client ID: **PBS** Batch ID: **E09VS206** TestNo: **EPA 8015B(M** Analysis Date: **7/6/2009** SeqNo: **1739726**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	103.203		100.0		103	59	145				

Sample ID: **106238-002ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8015B(M** Analysis Date: **7/6/2009** SeqNo: **1739728**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **106238-002ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8015B(M** Analysis Date: **7/6/2009** SeqNo: **1739728**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	100.478		100.0		100	59	145		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E090707LCS1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110556**
Client ID: **LCSS** Batch ID: **E09VS207** TestNo: **EPA 8015B(M** Analysis Date: **7/7/2009** SeqNo: **1739760**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.496	1.0	5.000	0	89.9	73	120				
Surr: Bromofluorobenzene (FID)	100.521		100.0		101	59	145				

Sample ID: **106238-022AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8015B(M** Analysis Date: **7/7/2009** SeqNo: **1739761**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.339	1.0	5.000	0	86.8	39	135				
Surr: Bromofluorobenzene (FID)	104.289		100.0		104	59	145				

Sample ID: **106238-022AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8015B(M** Analysis Date: **7/7/2009** SeqNo: **1739762**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.114	1.0	5.000	0	82.3	39	135	4.339	5.32	20	
Surr: Bromofluorobenzene (FID)	104.284		100.0		104	59	145		0	0	

Sample ID: **E090707MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110556**
Client ID: **PBS** Batch ID: **E09VS207** TestNo: **EPA 8015B(M** Analysis Date: **7/7/2009** SeqNo: **1739763**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	100.454		100.0		100	59	145				

Sample ID: **106238-022ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8015B(M** Analysis Date: **7/7/2009** SeqNo: **1739765**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **106238-022ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8015B(M** Analysis Date: **7/7/2009** SeqNo: **1739765**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	105.207		100.0		105	59	145		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E090706LCS2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110515**
Client ID: **LCSS** Batch ID: **E09VS206** TestNo: **EPA 8021B** Analysis Date: **7/6/2009** SeqNo: **1739739**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	96.859	5.0	100.0	0	96.9	80	121				
Ethylbenzene	98.122	5.0	100.0	0	98.1	84	120				
m,p-Xylene	196.555	10	200.0	0	98.3	84	122				
Methyl tert-butyl ether	91.554	5.0	100.0	0	91.6	66	128				
o-Xylene	97.534	5.0	100.0	0	97.5	84	123				
Toluene	97.209	5.0	100.0	0	97.2	84	120				
Surr: Bromofluorobenzene (PID)	92.761		100.0		92.8	65	140				

Sample ID: **106238-002AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8021B** Analysis Date: **7/6/2009** SeqNo: **1739740**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	26.039	5.0	35.75	0	72.8	22	132				
Ethylbenzene	33.484	5.0	49.65	0	67.4	15	133				
m,p-Xylene	138.441	10	199.6	0	69.4	30	118				
Methyl tert-butyl ether	482.543	5.0	578.9	0	83.4	38	136				
o-Xylene	49.915	5.0	78.40	0	63.7	21	119				
Toluene	127.977	5.0	172.2	0	74.3	36	129				
Surr: Bromofluorobenzene (PID)	94.379		100.0		94.4	65	140				

Sample ID: **106238-002AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8021B** Analysis Date: **7/6/2009** SeqNo: **1739741**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	27.552	5.0	35.75	0	77.1	22	132	26.04	5.65	20	
Ethylbenzene	34.165	5.0	49.65	0	68.8	15	133	33.48	2.01	20	
m,p-Xylene	141.110	10	199.6	0	70.7	30	118	138.4	1.91	20	
Methyl tert-butyl ether	503.281	5.0	578.9	0	86.9	38	136	482.5	4.21	20	
o-Xylene	51.356	5.0	78.40	0	65.5	21	119	49.92	2.85	20	
Toluene	129.656	5.0	172.2	0	75.3	36	129	128.0	1.30	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **106238-002AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8021B** Analysis Date: **7/6/2009** SeqNo: **1739741**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	99.508		100.0		99.5	65	140		0	20	

Sample ID: **E090706MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110515**
Client ID: **PBS** Batch ID: **E09VS206** TestNo: **EPA 8021B** Analysis Date: **7/6/2009** SeqNo: **1739742**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	93.051		100.0		93.1	65	140				

Sample ID: **106238-002ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110515**
Client ID: **B25-1.5** Batch ID: **E09VS206** TestNo: **EPA 8021B** Analysis Date: **7/6/2009** SeqNo: **1739744**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
Methyl tert-butyl ether	ND	5.0						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Xylenes, Total	ND	15						0	0	20	
Surr: Bromofluorobenzene (PID)	90.793		100.0		90.8	65	140		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E090707LCS2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110556**
Client ID: **LCSS** Batch ID: **E09VS207** TestNo: **EPA 8021B** Analysis Date: **7/7/2009** SeqNo: **1739769**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	97.316	5.0	100.0	0	97.3	80	121				
Ethylbenzene	99.897	5.0	100.0	0	99.9	84	120				
m,p-Xylene	203.224	10	200.0	0	102	84	122				
Methyl tert-butyl ether	90.628	5.0	100.0	0	90.6	66	128				
o-Xylene	102.338	5.0	100.0	0	102	84	123				
Toluene	99.191	5.0	100.0	0	99.2	84	120				
Surr: Bromofluorobenzene (PID)	95.825		100.0		95.8	65	140				

Sample ID: **106238-022AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8021B** Analysis Date: **7/7/2009** SeqNo: **1739770**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	28.527	5.0	35.75	0	79.8	22	132				
Ethylbenzene	35.559	5.0	49.65	0	71.6	15	133				
m,p-Xylene	147.376	10	199.6	0	73.9	30	118				
Methyl tert-butyl ether	490.327	5.0	578.9	0	84.7	38	136				
o-Xylene	53.460	5.0	78.40	0	68.2	21	119				
Toluene	134.656	5.0	172.2	0	78.2	36	129				
Surr: Bromofluorobenzene (PID)	101.182		100.0		101	65	140				

Sample ID: **106238-022AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8021B** Analysis Date: **7/7/2009** SeqNo: **1739771**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	27.045	5.0	35.75	0	75.7	22	132	28.53	5.33	20	
Ethylbenzene	27.574	5.0	49.65	0	55.5	15	133	35.56	25.3	20	R
m,p-Xylene	131.990	10	199.6	0	66.1	30	118	147.4	11.0	20	
Methyl tert-butyl ether	474.830	5.0	578.9	0	82.0	38	136	490.3	3.21	20	
o-Xylene	51.602	5.0	78.40	0	65.8	21	119	53.46	3.54	20	
Toluene	128.389	5.0	172.2	0	74.5	36	129	134.7	4.76	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **106238-022AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8021B** Analysis Date: **7/7/2009** SeqNo: **1739771**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	101.219		100.0		101	65	140		0	20	

Sample ID: **E090707MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110556**
Client ID: **PBS** Batch ID: **E09VS207** TestNo: **EPA 8021B** Analysis Date: **7/7/2009** SeqNo: **1739772**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	90.223		100.0		90.2	65	140				

Sample ID: **106238-022ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **110556**
Client ID: **B35-1.5** Batch ID: **E09VS207** TestNo: **EPA 8021B** Analysis Date: **7/7/2009** SeqNo: **1739774**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
Methyl tert-butyl ether	ND	5.0						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Xylenes, Total	ND	15						0	0	20	
Surr: Bromofluorobenzene (PID)	95.101		100.0		95.1	65	140		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56507** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **PBS** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743037**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	13.837		16.67		83.0	25	115				
Surr: Decachlorobiphenyl	9.783		16.67		58.7	20	142				

Sample ID: **LCS-56507** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **LCSS** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743038**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	15.372	1.0	16.67	0	92.2	59	113				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-56507** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **LCSS** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743038**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	15.379	2.0	16.67	0	92.3	59	108				
Endrin	15.345	2.0	16.67	0	92.1	41	132				
gamma-BHC	15.650	1.0	16.67	0	93.9	60	111				
Heptachlor	14.665	1.0	16.67	0	88.0	62	108				
Surr: Tetrachloro-m-xylene	14.367		16.67		86.2	25	115				
Surr: Decachlorobiphenyl	11.418		16.67		68.5	20	142				

Sample ID: **106238-013AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **B31-0** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743039**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	8.681	2.0	16.67	0	52.1	29	143				
Aldrin	9.030	1.0	16.67	0	54.2	44	131				
Dieldrin	9.220	2.0	16.67	0	55.3	40	136				
Endrin	9.812	2.0	16.67	0	58.9	41	146				
gamma-BHC	9.305	1.0	16.67	0	55.8	45	129				
Heptachlor	9.125	1.0	16.67	0	54.7	48	126				
Surr: Tetrachloro-m-xylene	8.066		16.67		48.4	25	115				
Surr: Decachlorobiphenyl	6.968		16.67		41.8	20	142				

Sample ID: **106238-013AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **B31-0** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743040**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	8.620	2.0	16.67	0	51.7	29	143	8.681	0.707	20	
Aldrin	8.154	1.0	16.67	0	48.9	44	131	9.030	10.2	20	
Dieldrin	9.414	2.0	16.67	0	56.5	40	136	9.220	2.08	20	
Endrin	9.896	2.0	16.67	0	59.4	41	146	9.812	0.847	20	
gamma-BHC	9.940	1.0	16.67	0	59.6	45	129	9.305	6.60	20	
Heptachlor	9.254	1.0	16.67	0	55.5	48	126	9.125	1.41	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106238-013AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **B31-0** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743040**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	8.635		16.67		51.8	25	115		0	0	
Surr: Decachlorobiphenyl	7.836		16.67		47.0	20	142		0	0	

Sample ID: **106238-003ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **B26-0** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743044**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	ND	2.0						0	0	20	
4,4´-DDT	ND	2.0						0	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	11.332		16.67		68.0	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106238-003ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110732**
Client ID: **B26-0** Batch ID: **56507** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/13/2009** SeqNo: **1743044**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	9.268		16.67		55.6	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-56508** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **PBS** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742773**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	13.547		16.67		81.3	25	115				
Surr: Decachlorobiphenyl	11.613		16.67		69.7	20	142				

Sample ID: **LCS-56508** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **LCSS** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742774**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	14.466	1.0	16.67	0	86.8	59	113				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-56508** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **LCSS** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742774**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	14.045	2.0	16.67	0	84.3	59	108				
Endrin	13.202	2.0	16.67	0	79.2	41	132				
gamma-BHC	14.813	1.0	16.67	0	88.9	60	111				
Heptachlor	14.012	1.0	16.67	0	84.1	62	108				
Surr: Tetrachloro-m-xylene	13.729		16.67		82.4	25	115				
Surr: Decachlorobiphenyl	11.728		16.67		70.4	20	142				

Sample ID: **106238-017AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **B33-0** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742775**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	9.707	2.0	16.67	0	58.2	29	143				
Aldrin	10.593	1.0	16.67	0	63.5	44	131				
Dieldrin	10.505	2.0	16.67	0	63.0	40	136				
Endrin	10.898	2.0	16.67	0	65.4	41	146				
gamma-BHC	10.543	1.0	16.67	0	63.2	45	129				
Heptachlor	9.782	1.0	16.67	0	58.7	48	126				
Surr: Tetrachloro-m-xylene	8.843		16.67		53.0	25	115				
Surr: Decachlorobiphenyl	9.523		16.67		57.1	20	142				

Sample ID: **106238-017AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **B33-0** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742776**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	9.222	2.0	16.67	0	55.3	29	143	9.707	5.13	20	
Aldrin	9.135	1.0	16.67	0	54.8	44	131	10.59	14.8	20	
Dieldrin	10.169	2.0	16.67	0	61.0	40	136	10.51	3.25	20	
Endrin	10.663	2.0	16.67	0	64.0	41	146	10.90	2.18	20	
gamma-BHC	10.766	1.0	16.67	0	64.6	45	129	10.54	2.10	20	
Heptachlor	9.863	1.0	16.67	0	59.2	48	126	9.782	0.816	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106238-017AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **B33-0** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742776**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	9.107		16.67		54.6	25	115		0	0	
Surr: Decachlorobiphenyl	9.600		16.67		57.6	20	142		0	0	

Sample ID: **106238-025ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **B37-0** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742780**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	ND	2.0						0	0	20	
4,4´-DDT	ND	2.0						0	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	7.773		16.67		46.6	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **106238-025ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **7/9/2009** RunNo: **110715**
Client ID: **B37-0** Batch ID: **56508** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **7/12/2009** SeqNo: **1742780**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	7.414		16.67		44.5	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **106213-041ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **110516**
Client ID: **ZZZZZZ** Batch ID: **R110516** TestNo: **EPA 9045C** Analysis Date: **7/6/2009** SeqNo: **1738963**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	6.860	0.10						6.920	0.871	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CHAIN OF CUSTODY RECORD

Pg 1 of 2

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: _____ Date: 07/02/09

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: GSO

Sample Condition Upon Receipt:
1. CHILLED 18.2 Y☐ N☐ 4. SEALED Y☐ N☒
2. HEADSPACE (VOA) NA Y☐ N☐ 5. # OF SPLS MATCH COC Y☒ N☐
3. CONTAINER INTACT Y☒ N☐ 6. PRESERVED Y☐ N☒

Client: GEOCON
Attn: L. VIGLIOTTI
Address: 6671 BRISA ST
City LIVERMORE State CA Zip Code 94550
TEL: (925) 371-5900
FAX: (") " 5915

Project Name: Hwy 101 - MARIN Co. Project #: E8469-06-01 Sampler: (Printed Name) D. WAITT (Signature)

Relinquished by: (Signature and Printed Name) CHRIS MERRITT Date: 7-1-09 Time: 1530 Received by: (Signature and Printed Name) Christine Date: 07/02/09 Time: 9:45
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
C. MERRITT 7/1/09
Print Name Date
Signature

Send Report To:
Attn: _____
Co: SEE "CLIENT"
Address _____
City _____ State _____ Zip _____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments: DO NOT COMPOSITE SAMPLE SETS
SEE TABLE PROVIDED (6/30/2009)
RUN WET'S ON ALL SAMPLES WITH POTENTIAL TO FAIL STLC

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

Q A / Q C
RTNE ☐
CT ☒
SWRCB ☐
Logcode ____
OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	106238-001 ~~002~~	B25 - 0,1.5	7/1/09	VAR										X				E	2	J G	C	
	003 004 ~~005~~	B26 -																				
	~~005~~ 006 ~~007~~	B27 -																				
	~~007~~ 008 ~~009~~	B28 -																				
	009 ~~010~~	B29 -																				
	011 012 ~~013~~	B30 -																				
	013 014 ~~015~~	B31 -																				
	015 016 ~~017~~	B32 -																				
	017 018 ~~019~~	B33 -																				
	019 020 ~~021~~	B34 -																				

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr; B= Emergency Next workday; C= Critical 2 Workdays; D= Urgent 3 Workdays; E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: _____ Date: 07/02/08

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client:
Attn: SEE Pg 1
Address:
City State Zip Code
TEL: ( )
FAX: ( )
Project Name: Project #: Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) CHRIS MERRITT Date: 7-1-09 Time: 1530 Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: SEE Pg 1
Print Name Date
Signature

Send Report To:
Attn: _____
Co: _____
Address _____
City _____ State____ Zip____

Bill To:
Attn: _____
Co: _____
Address _____
City _____ State____ Zip____

Special Instructions/Comments:
PLEASE RETURN ALL GEOLOGIC COOLERS

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

Q A / Q C: RTNE ☐ CT ☑ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	022 106238-~~044~~ 021	B35 - 0, 1.5	7/1/09	VAR										X				E	2	J/G	C	
	023, 024 ~~012~~	B36 -																				
	025, 026 ~~013~~	B37 -																				
	027, 028, ~~044~~ 029	B38 - 0, 1, 2																		VAR		
	030, 031, 032 ~~015~~	B39 -																				
	033, 034, 035	B40 -																				
	036, 037, 038	B41 -																				

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NO[illegible]	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B20 - 0	0 to 0.5	---	1	1	---	as needed	1	---	---
B20 - 1.5	1.5 to 2	1	---	1	---	---	---	---	---
B21	0 to 0.5	---	1	---	1	as needed	1	---	---
B21	1.5 to 2	1	---	1	---	---	---	---	---
B22	0 to 0.5	---	1	1	---	as needed	1	---	---
B22	1.5 to 2	1	---	1	---	---	---	---	---
B23	0 to 0.5	---	1	1	---	as needed	1	---	---
B23	1.5 to 2	1	---	---	1	---	---	1	---
B24	0 to 0.5	---	1	1	---	as needed	1	---	---
B24	1.5 to 2	1	---	1	---	---	---	---	---
B25	0 to 0.5	---	1	---	1	as needed	1	---	---
B25	1.5 to 2	1	---	1	---	---	---	---	---
B26	0 to 0.5	---	1	1	---	as needed	1	---	---
B26	1.5 to 2	1	---	1	---	---	---	---	---
B27	0 to 0.5	---	1	1	---	as needed	1	---	---
B27	1.5 to 2	1	---	---	1	---	---	---	---
B28	0 to 0.5	---	1	1	---	as needed	1	---	1
B28	1.5 to 2	1	---	1	---	---	---	---	---
B29	0 to 0.5	---	1	---	1	as needed	1	---	---
B29	1.5 to 2	1	---	1	---	---	---	---	---
B30	0 to 0.5	---	1	1	---	as needed	1	---	---
B30	1.5 to 2	1	---	1	---	---	---	---	---
B31	0 to 0.5	---	1	1	---	as needed	1	---	---
B31	1.5 to 2	1	---	1	---	---	---	---	---
B32	0 to 0.5	---	1	1	---	as needed	1	---	---
B32	1.5 to 2	1	---	1	---	---	---	---	1
B33	0 to 0.5	---	1	---	1	as needed	1	---	---
B33	1.5 to 2	1	---	1	---	---	---	---	---
B34	0 to 0.5	---	1	1	---	as needed	1	---	---
B34	1.5 to 2	1	---	1	---	---	---	---	---
B35	0 to 0.5	---	1	1	---	as needed	1	---	---
B35	1.5 to 2	1	---	---	1	---	---	1	---
B36	0 to 0.5	---	1	1	---	as needed	1	---	---
B36	1.5 to 2	1	---	1	---	---	---	---	---
B37	0 to 0.5	---	1	---	1	as needed	1	---	1
B37	1.5 to 2	1	---	1	---	---	---	---	---
B38	0 to 0.5	---	---	1	---	as needed	---	---	---
B38	1 to 1.5	---	---	1	---	---	---	---	---

Sample Analysis Matix
Marin Sonoma Narrows - Segment B1
Marin and Sonoma Counties, California

Sample Location	Sample Depth	TPHg/BTEX/ MTBE	TPHd/mo	Total Lead	CAM 17 Metals	Soluble Metals	Pesticides	NO3	pH
EPA Method	(feet)	(8015/8021)	(8015)	(6010)	(6010/7471)	(WET/7420)	(8081)	(CARB435)	(9045)
B38	2 to 2.5	---	---	1	---	---	---	---	---
B39	0 to 0.5	---	---	1	---	as needed	---	---	---
B39	1 to 1.5	---	---	---	1	---	---	---	---
B39	2 to 2.5	---	---	1	---	---	---	---	---
B40	0 to 0.5	---	---	1	---	as needed	---	---	---
B40	1 to 1.5	---	---	1	---	---	---	---	---
B40	2 to 2.5	---	---	1	---	---	---	---	---
B41	0 to 0.5	---	---	---	1	as needed	---	---	---
B41	1 to 1.5	---	---	1	---	---	---	---	1
B41	2 to 2.5	---	---	1	---	---	---	---	---
B42	0 to 0.5	---	---	1	---	as needed	---	---	---
B42	1 to 1.5	---	---	1	---	---	---	---	---
B42	2 to 2.5	---	---	---	1	---	---	---	---
B43	0 to 0.5	---	---	1	---	as needed	---	---	---
B43	1 to 1.5	---	---	---	1	---	---	1	1
B43	2 to 2.5	---	---	1	---	---	---	---	---
B44	0 to 0.5	---	---	1	---	as needed	---	---	---
B44	1 to 1.5	---	---	1	---	---	---	---	---
B44	2 to 2.5	---	---	1	---	---	---	---	---
B45	0 to 0.5	---	---	1	---	as needed	---	---	---
B45	1 to 1.5	---	---	---	1	---	---	---	---
B45	2 to 2.5	---	---	1	---	---	---	---	---
B46	0 to 0.5	---	---	1	---	as needed	---	---	1
B46	1 to 1.5	---	---	1	---	---	---	---	---
B46	2 to 2.5	---	---	1	---	---	---	---	---
B47	0 to 0.5	---	---	---	1	as needed	---	---	---
B47	1 to 1.5	---	---	1	---	---	---	---	---
B47	2 to 2.5	---	---	1	---	---	---	---	---
B48-0	0 to 0.5	---	---	1	---	as needed	---	---	---
B48-1	1 to 1.5	---	---	1	---	---	---	---	---
B48-2	2 to 2.5	---	---	1	---	---	---	---	---
B49	0 to 0.5	---	---	1	---	as needed	---	---	---
B49	1 to 1.5	---	---	1	---	---	---	---	---
B49	2 to 2.5	---	---	---	1	---	---	1	---
B50	0 to 0.5	---	---	1	---	as needed	---	---	---
B50	1 to 1.5	---	---	1	---	---	---	---	1
B50	2 to 2.5	---	---	1	---	---	---	---	---
B51	0 to 0.5	---	---	1	---	as needed	---	---	---
B51	1 to 1.5	---	---	---	1	---	---	---	---
B51	2 to 2.5	---	---	1	---	---	---	---	---
B52	0 to 0.5	---	---	1	---	as needed	---	---	---
B52	1 to 1.5	---	---	1	---	---	---	---	---
B52	2 to 2.5	---	---	---	1	---	---	1	---

October 30, 2009

Lauren Vigliotti
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
CSDLAC No.: 10196

Workorder No.: 106238

RE: HWY 101 - MARIN CO., E8469-06-01

Attention: Lauren Vigliotti

Enclosed are the results for sample(s) received on July 02, 2009 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Project: HWY 101 - MARIN CO., E8469-06-01
Lab Order: 106238

CASE NARRATIVE

Results were J-Flag. "J" is used to flag those results that are between the PQL (Practical Quantitation Limit) and the calculated MDL (Method Detection Limit). Results that are "J" Flagged are estimated values since it becomes difficult to accurately quantitate the analyte near the MDL.

Analytical Comments for Method 6010

Dilution was necessary for samples 106238-006A, 106238-009A, 106238-017A, 106238-022A, 106238-025A, 106238-031A and 106238-036A, due to sample matrix.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B27-1.5
Lab Order:	106238	**Collection Date:**	7/1/2009
Project:	HWY 101 - MARIN CO., E8469-06-01	**Matrix:**	SOIL
Lab ID:	106238-006A		

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.11	0.018	1.0	J	mg/L	20	10/29/2009 11:58 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-009A

Client Sample ID: B29-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091029F**	QC Batch: **R114537**				PrepDate:		Analyst: **CL**
Chromium	0.61	0.018	1.0	J	mg/L	20	10/30/2009 12:02 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-017A

Client Sample ID: B33-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091030C**	QC Batch: **R114556**				PrepDate:		Analyst: **CL**
Chromium	0.29	0.018	1.0	J	mg/L	20	10/30/2009 12:28 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-022A

Client Sample ID: B35-1.5
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091030C**	QC Batch: **R114556**				PrepDate:		Analyst: **CL**
Chromium	0.075	0.018	1.0	J	mg/L	20	10/30/2009 12:32 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-025A

Client Sample ID: B37-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091030C**	QC Batch: **R114556**				PrepDate:		Analyst: **CL**
Chromium	0.11	0.018	1.0	J	mg/L	20	10/30/2009 12:36 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-031A

Client Sample ID: B39-1
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091030C**	QC Batch: **R114556**				PrepDate:		Analyst: **CL**
Chromium	0.14	0.018	1.0	J	mg/L	20	10/30/2009 12:40 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Oct-09*

CLIENT: Geocon Consultants, Inc.
Lab Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01
Lab ID: 106238-036A

Client Sample ID: B41-0
Collection Date: 7/1/2009
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC							
			WET/ EPA 6010B				
RunID: **ICP8_091030C**	QC Batch: **R114556**				PrepDate:		Analyst: **CL**
Chromium	0.15	0.018	1.0	J	mg/L	20	10/30/2009 12:44 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified	DO	Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59308A** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **PBS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814564**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									

Sample ID: **LCS-59308** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **LCSS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814565**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	1.036	0.050	1.000	0	104	85	115				

Sample ID: **106216-069ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **ZZZZZZ** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814576**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.093	1.0						0.09355	0	20	

Sample ID: **106216-069AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **ZZZZZZ** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814577**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.460	1.0	2.500	0.09355	94.6	77	116				

Sample ID: **MB-59308B** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **PBS** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/29/2009** SeqNo: **1814578**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **106238-009ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **B29-0** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814589**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.645	1.0						0.6063	0	20	

Sample ID: **106238-009AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **B29-0** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814590**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	3.000	1.0	2.500	0.6063	95.8	77	116				

Sample ID: **106238-009AMSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114537**
Client ID: **B29-0** Batch ID: **R114537** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814591**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	3.075	1.0	2.500	0.6063	98.8	77	116	3.000	2.46	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 106238
Project: HWY 101 - MARIN CO., E8469-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-59309** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114556**
Client ID: **PBS** Batch ID: **R114556** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814948**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									

Sample ID: **LCS-59309** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114556**
Client ID: **LCSS** Batch ID: **R114556** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814949**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.967	0.050	1.000	0	96.7	85	115				

Sample ID: **106238-036ADUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114556**
Client ID: **B41-0** Batch ID: **R114556** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814955**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.150	1.0						0.1490	0	20	

Sample ID: **106238-036AMS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114556**
Client ID: **B41-0** Batch ID: **R114556** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814956**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.525	1.0	2.500	0.1490	95.1	77	116				

Sample ID: **106238-036AMSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **114556**
Client ID: **B41-0** Batch ID: **R114556** TestNo: **WET/ EPA 60** Analysis Date: **10/30/2009** SeqNo: **1814957**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.571	1.0	2.500	0.1490	96.9	77	116	2.525	1.77	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Diane Galvan

From: Lauren Vigliotti [vigliotti@geoconinc.com]
Sent: Monday, October 26, 2009 3:26 PM
To: Diane Galvan
Subject: MSN Segment B1

Diane:
Also, please run the following sample for WET chromium, standard TAT. Thanks!

WO-106238:
B27-1.5, B29-0, B33-0, B35-1.5, B37-0, B39-1, B41-0

WO106216:
B15-1.5, B17-0, B49-2, B51-1, B52-2, B53-0, B54-2, B55-1, B57-0, B59-1, B60-1, B63-2, B73-2, B75-0, B76-1,
B76-4, B1-0, B2-1.5, B5-0, B7-1.5, B9-0, B13-0, B19-1.5

WO106198:
B21-0, B23-1.5, B47-0, B43-1, B45-1, B42-2, B77-1, B77-4, B69-0, B66-2, B64-1, B68-1

****

Lauren Vigliotti
Senior Staff Geologist

Please visit our new website at http://www.geoconinc.com

Geocon Consultants, Inc
6671 Brisa Street
Livermore, CA 94550
Tel (925) 371-5900
Cell (925) 768-9874

GEOCON

GEOTECHNICAL ENVIRONMENTAL MATERIALS

San Diego Murrieta Burbank Bakersfield Sacramento Livermore Carson City Las Vegas Portland

CONFIDENTIALITY NOTICE: This e-mail may contain confidential and privileged material for the sole use of the intended recipient(s). Any review, use, distribution or disclosure by others is strictly prohibited. If you have received this communication in error, please notify the sender immediately by e-mail and delete the message and any file attachments from your computer. Thank you.

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **David Watts**
Geocon Consultants
6671 Brisa Street
Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8469-06-01, Hwy.101**

Customer ID: GECN21
Customer PO: Hwy. 101
Received: 07/02/09 9:00 AM
EMSL Order: 090905205

EMSL Proj:
Analysis Date: 7/6/2009

PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B2-1.5 *090905205-0001*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B7-1.5 *090905205-0002*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B15-1.5 *090905205-0003*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B19-1.5 *090905205-0004*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B23-1.5 *090905205-0005*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B27-1.5 *090905205-0006*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B31-1.5 *090905205-0007*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B35-1.5 *090905205-0008*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B39-1 *090905205-0009*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)
Adam C. Fink (18)

Baojia Ke, Laboratory Manager
or other approved signatory

This report relates only to the samples listed above and may not be reproduced except in full, without EMSL's written approval. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. EMSL is not responsible for sample collection activities or method limitations. Some samples may contain asbestos fibers below the resolution limit of PLM. EMSL recommends that samples reported as none detected or less than the limit of detection undergo additional analysis via TEM.Samples received in good condition unless otherwise noted.

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **David Watts**
Geocon Consultants
6671 Brisa Street
Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8469-06-01, Hwy.101**

Customer ID: GECN21
Customer PO: Hwy. 101
Received: 07/02/09 9:00 AM
EMSL Order: 090905205

EMSL Proj:
Analysis Date: 7/6/2009

PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B43-1 *090905205-0010*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B49-2 *090905205-0011*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B52-2 *090905205-0012*	Hwy. 101, Redwood Rd.Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B55-1 *090905205-0013*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B63-2 *090905205-0014*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B64-1 *090905205-0015*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B68-1 *090905205-0016*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B71-1 *090905205-0017*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B77-1 *090905205-0018*	Hwy. 101, Redwood Rd.	Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Analyst(s)
Adam C. Fink (18)

Baojia Ke, Laboratory Manager
or other approved signatory

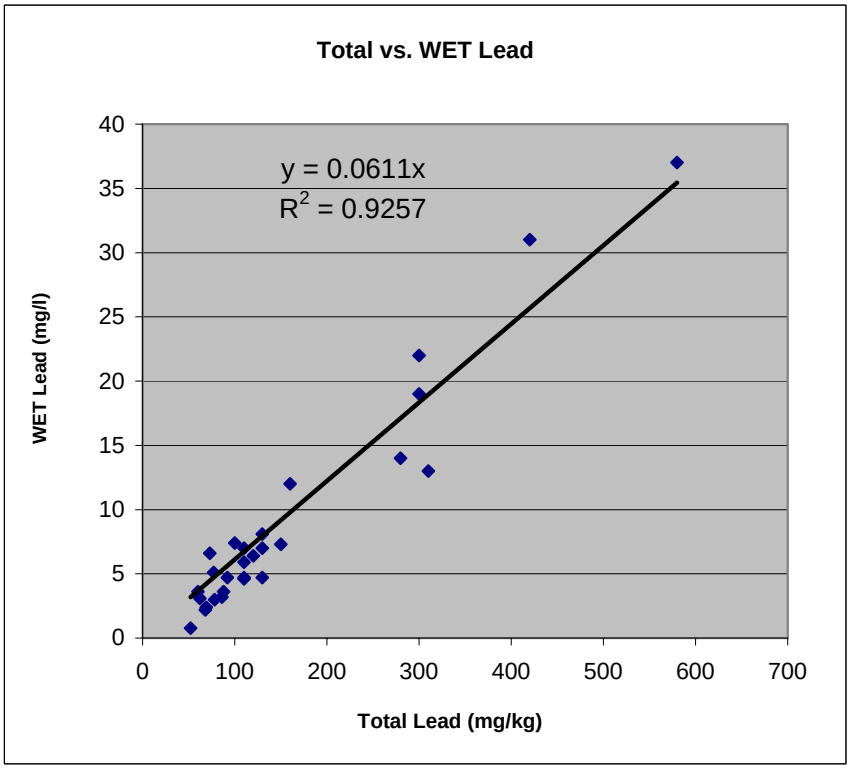
This report relates only to the samples listed above and may not be reproduced except in full, without EMSL's written approval. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. EMSL is not responsible for sample collection activities or method limitations. Some samples may contain asbestos fibers below the resolution limit of PLM. EMSL recommends that samples reported as none detected or less than the limit of detection undergo additional analysis via TEM.Samples received in good condition unless otherwise noted.

THIS IS THE LAST PAGE OF THE REPORT.

APPENDIX D

APPPENDIX D

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)
B49-1	1	52	0.77
B16-0	0	68	2.2
B15-0	0	69	2.4
B21-0	0	78	3.0
B7-0	0	62	3.1
B66-2	2	86	3.2
B48-1	1	60	3.6
B69-2	2	88	3.6
B46-0	0	110	4.6
B9-0	0	130	4.7
B22-0	0	92	4.7
B68-1	1	110	4.7
B69-1	1	77	5.1
B69-0	0	110	5.9
B65-1	1	120	6.4
B66-1	1	73	6.6
B64-0	0	130	7.0
B67-1	1	110	7.0
B71-0	0	150	7.3
B70-0	0	100	7.4
B68-0	0	130	8.1
B75-1	1	160	12
B67-0	0	310	13
B66-0	0	280	14
B65-0	0	300	19
B70-1	1	300	22
B74-0	0	420	31
B73-0	0	580	37



Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)
B49-1	1	52	0.77
	R =	0.962	

APPENDIX D

Nonparametric UCL Statistics for Full Data Sets ProUCL Version 4.00.00

A-0	
Number of Valid Observations	27
Number of Distinct Observations	21
Minimum	2.5
Maximum	130
Mean	30.52
Median	26
SD	27.5
Variance	756.2
Coefficient of Variation	0.901
Skewness	2.017
Mean of log data	3.024
SD of log data	0.983
90% Standard Bootstrap UCL	37.13
95% Standard Bootstrap UCL	39.24

A-2	
Number of Valid Observations	10
Number of Distinct Observations	8
Minimum	2.5
Maximum	25
Mean	8.09
Median	6.05
SD	6.861
Variance	47.08
Coefficient of Variation	0.848
Skewness	1.891
Mean of log data	1.818
SD of log data	0.767
90% Standard Bootstrap UCL	10.68
95% Standard Bootstrap UCL	11.39

A-1	
Number of Valid Observations	10
Number of Distinct Observations	10
Minimum	2.5
Maximum	60
Mean	17.35
Median	7.6
SD	20.78
Variance	432
Coefficient of Variation	1.198
Skewness	1.684
Mean of log data	2.334
SD of log data	1.016
90% Standard Bootstrap UCL	25.17
95% Standard Bootstrap UCL	27.52

B-0	
Number of Valid Observations	6
Number of Distinct Observations	6
Minimum	7
Maximum	92
Mean	40.33
Median	27.5
SD	36.15
Variance	1307
Coefficient of Variation	0.896
Skewness	0.755
Mean of log data	3.283
SD of log data	1.054
90% Standard Bootstrap UCL	57.96
95% Standard Bootstrap UCL	62.37

A-1.5	
Number of Valid Observations	18
Number of Distinct Observations	16
Minimum	2.5
Maximum	30
Mean	8.356
Median	6.15
SD	6.306
Variance	39.76
Coefficient of Variation	0.755
Skewness	2.628
Mean of log data	1.939
SD of log data	0.594
90% Standard Bootstrap UCL	10.17
95% Standard Bootstrap UCL	10.79

B-1.5	
Number of Valid Observations	6
Number of Distinct Observations	5
Minimum	2.5
Maximum	7
Mean	4.783
Median	5.05
SD	1.945
Variance	3.782
Coefficient of Variation	0.407
Skewness	-0.277
Mean of log data	1.484
SD of log data	0.461
90% Standard Bootstrap UCL	5.712
95% Standard Bootstrap UCL	5.981

APPENDIX D

C-0	
Number of Valid Observations	10
Number of Distinct Observations	9
Minimum	2.5
Maximum	110
Mean	27.19
Median	20.5
SD	30.71
Variance	943
Coefficient of Variation	1.129
Skewness	2.579
Mean of log data	2.871
SD of log data	0.998
90% Standard Bootstrap UCL	38.91
95% Standard Bootstrap UCL	42.36

D-0	
Number of Valid Observations	12
Number of Distinct Observations	11
Minimum	15
Maximum	580
Mean	212.2
Median	140
SD	169.5
Variance	28745
Coefficient of Variation	0.799
Skewness	0.944
Mean of log data	4.94
SD of log data	1.116
90% Standard Bootstrap UCL	273.9
95% Standard Bootstrap UCL	287.7

C-1	
Number of Valid Observations	10
Number of Distinct Observations	10
Minimum	2.5
Maximum	21
Mean	9.42
Median	7.05
SD	6.067
Variance	36.8
Coefficient of Variation	0.644
Skewness	1.216
Mean of log data	2.069
SD of log data	0.625
90% Standard Bootstrap UCL	11.71
95% Standard Bootstrap UCL	12.43

D-1	
Number of Valid Observations	14
Number of Distinct Observations	13
Minimum	6
Maximum	300
Mean	73.39
Median	51
SD	83.81
Variance	7024
Coefficient of Variation	1.142
Skewness	1.634
Mean of log data	3.522
SD of log data	1.416
90% Standard Bootstrap UCL	101.6
95% Standard Bootstrap UCL	109.6

C-2	
Number of Valid Observations	10
Number of Distinct Observations	7
Minimum	2.5
Maximum	18
Mean	6.57
Median	5.3
SD	4.731
Variance	22.39
Coefficient of Variation	0.72
Skewness	1.739
Mean of log data	1.684
SD of log data	0.653
90% Standard Bootstrap UCL	8.421
95% Standard Bootstrap UCL	8.924

D-2	
Number of Valid Observations	9
Number of Distinct Observations	9
Minimum	2.5
Maximum	88
Mean	31.88
Median	22
SD	33.5
Variance	1122
Coefficient of Variation	1.051
Skewness	1.125
Mean of log data	2.857
SD of log data	1.258
90% Standard Bootstrap UCL	45.04
95% Standard Bootstrap UCL	49.11

APPENDIX D

E-0	
Number of Valid Observations	6
Number of Distinct Observations	4
Minimum	5.6
Maximum	13
Mean	9.583
Median	11
SD	3.07
Variance	9.426
Coefficient of Variation	0.32
Skewness	-0.671
Mean of log data	2.209
SD of log data	0.363
90% Standard Bootstrap UCL	11.01
95% Standard Bootstrap UCL	11.45

E-1	
Number of Valid Observations	6
Number of Distinct Observations	6
Minimum	2.5
Maximum	22
Mean	8.783
Median	7.15
SD	6.833
Variance	46.69
Coefficient of Variation	0.778
Skewness	1.88
Mean of log data	1.957
SD of log data	0.712
90% Standard Bootstrap UCL	12.08
95% Standard Bootstrap UCL	13.06

E-2	
Number of Valid Observations	6
Number of Distinct Observations	5
Minimum	2.5
Maximum	12
Mean	6.9
Median	7.75
SD	3.805
Variance	14.48
Coefficient of Variation	0.551
Skewness	-0.125
Mean of log data	1.763
SD of log data	0.682
90% Standard Bootstrap UCL	8.691
95% Standard Bootstrap UCL	9.285

F-0	
Number of Valid Observations	13
Number of Distinct Observations	9
Minimum	2.5
Maximum	40
Mean	23.12
Median	22
SD	11.79
Variance	139
Coefficient of Variation	0.51
Skewness	-0.0499
Mean of log data	2.954
SD of log data	0.748
90% Standard Bootstrap UCL	27.22
95% Standard Bootstrap UCL	28.28

F-1.5	
Number of Valid Observations	13
Number of Distinct Observations	8
Minimum	2.5
Maximum	7.9
Mean	5.015
Median	5.3
SD	1.898
Variance	3.603
Coefficient of Variation	0.378
Skewness	-0.366
Mean of log data	1.531
SD of log data	0.443
90% Standard Bootstrap UCL	5.65
95% Standard Bootstrap UCL	5.846

APPENDIX D

ProUCL v.4.00.00 Nonparametric UCL Statistics for Full Data Sets

As	
Number of Valid Observations	44
Number of Distinct Observations	14
Minimum	0.5
Maximum	11
Mean	1.35
Median	0.5
SD	1.824
Variance	3.329
Coefficient of Variation	1.351
Skewness	3.878
Mean of log data	-0.126
SD of log data	0.813
95% Standard Bootstrap UCL	1.804
V	
Number of Valid Observations	44
Number of Distinct Observations	28
Minimum	17
Maximum	97
Mean	35.59
Median	31.5
SD	15.6
Variance	243.3
Coefficient of Variation	0.438
Skewness	1.873
Mean of log data	3.495
SD of log data	0.384
95% Standard Bootstrap UCL	39.41
TPHd	
Number of Valid Observations	39
Number of Distinct Observations	33
Minimum	0.5
Maximum	470
Mean	38.44
Median	8.9
SD	83.36
Variance	6949
Coefficient of Variation	2.168
Skewness	4.08
Mean of log data	2.518
SD of log data	1.398
95% Standard Bootstrap UCL	60.38
TPHmo	
Number of Valid Observations	39
Number of Distinct Observations	33
Minimum	5.2
Maximum	3200
Mean	287.8
Median	58
SD	597
Variance	356418
Coefficient of Variation	2.075
Skewness	3.557
Mean of log data	4.435
SD of log data	1.47
95% Standard Bootstrap UCL	439

12. “Supplemental Private Property Investigation Report, US-101 Marin-Sonoma Narrows Segment B1 Project, Marin County, California.” – February 2011

SUPPLEMENTAL PRIVATE PROPERTY INVESTIGATION REPORT

US-101 MARIN-SONOMA NARROWS SEGMENT B1 PROJECT MARIN COUNTY, CALIFORNIA

PREPARED FOR:
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 205
PLEASANTON, CALIFORNIA 94588

PREPARED BY:
GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA

GEOCON

GEOCON PROJECT NO. E8469-06-01B

FEBRUARY 2011

Project No. E8469-06-01B
February 16, 2011

Gordon Sweet
BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, California 94588

Subject: SUPPLEMENTAL PRIVATE PROPERTY INVESTIGATION REPORT
US-101 MARIN-SONOMA NARROWS SEGMENT B1 PROJECT
MARIN COUNTY, CALIFORNIA

Dear Mr. Sweet:

Geocon has performed environmental engineering services at the project location in general accordance with the scope of work outlined in our scope of work dated December 7, 2010. The investigation was performed at private properties adjacent to the southbound shoulder within the project limits of United States Highway 101, Marin-Sonoma Narrows, Segment B1 Project, in Marin County, California.

The accompanying report summarizes the services performed including limited soil sample collection from borings advanced using hand-auger techniques and laboratory testing.

The contents of this report reflect the views of Geocon Consultants, Inc., who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

If there are any questions concerning the contents of this report, or if Geocon may be of further service, please contact the undersigned at your convenience.

Sincerely,

GEOCON CONSULTANTS, INC.

Lauren Vigliotti, PG
Project Geologist

Richard Day, CEG, CHG
Vice President

(1) Addressee
(1) Chris Wilson, Caltrans District 4

TABLE OF CONTENTS

SUPPLEMENTAL PRIVATE PROPERTY INVESTIGATION REPORT Page

1.0 INTRODUCTION 1
1.1 Project Description and Proposed Improvements 1
1.2 Purpose 2

2.0 BACKGROUND 2
2.1 Hazardous Waste Determination Criteria 2
2.2 Naturally Occurring Asbestos 3
2.3 Environmental Screening Levels 3

3.0 SCOPE OF SERVICES 4
3.1 Pre-field Activities 4
3.2 Field Activities 4

4.0 INVESTIGATIVE METHODS 4
4.1 Sampling Procedures 4
4.2 Laboratory Analyses 5
4.3 Laboratory QA/QC 5

5.0 INVESTIGATIVE RESULTS 6
5.1 Subsurface Conditions 6
5.2 Laboratory Analytical Results 6
5.3 Laboratory Quality Assurance/Quality Control 7

6.0 CONCLUSIONS 7
6.1 CAM 17 Metals 7
6.2 Total Petroleum Hydrocarbons 9
6.3 Pesticides 9
6.4 Naturally Occurring Asbestos 9
6.5 Worker Protection 9

7.0 REPORT LIMITATIONS 10

FIGURES

1. Vicinity Map
2a-b. Site Plan

TABLES

1. Boring Coordinates
2. Summary of Lead and pH Results
3. Summary of CAM 17 Metals Results
4. Summary of Organics Results
5. Summary of NOA Results

APPENDICES

A. Laboratory Reports and Chain-of-custody Documentation - CD
B. Metals Statistical Analysis

SUPPLEMENTAL PRIVATE PROPERTY INVESTIGATION REPORT

1.0 INTRODUCTION

This Supplemental Private Property Investigation Report for the United States Highway (US-101) Marin-Sonoma Narrows (MSN) Segment B1 project (Project) was prepared by Geocon Consultants, Inc. at the request of BKF Engineers (BKF) and in accordance with our scope of work dated December 7, 2010.

1.1 Project Description and Proposed Improvements

The Project is located in both the City of Novato and County of Marin limits from, just north of Atherton Avenue (PM R23.2) to South San Antonio Road (PM 27.1). This investigation focuses on the project additions from 0.3 mile north of Buck Center Drive to the Redwood Sanitary Landfill interchange approximately two miles on the following parcels: Novato Redwood Properties, Inc., Assessor Parcel Number (APN) 125-180-45, Buck Center for Research in aging, APN 125-180-77, Olompali State Historic Park (SHP), APN 125-180-05 and 125-160-01.

The project improvements include the following:

- Modify the existing Redwood Landfill Interchange from its existing hook-ramp and loop-ramp configuration to a tight-diamond interchange.
- Widen Redwood Landfill Overcrossing (Bridge No. 27-0115)
- Construct frontage roads, access roads and bike paths:
    - Redwood Boulevard frontage road extension – adjacent to southbound US-101, from its current terminus north of Atherton Avenue to the Olompali SHP entrance
    - Redwood Landfill Road frontage road extension – adjacent to southbound US-101 (along the Silveira Dairy) from the Redwood Landfill Interchange to South San Antonio Road
    - Redwood Landfill Road frontage road extension – adjacent to northbound US-101, from Sanitary Landfill Road to the cul-de-sac and driveway to the Burdell Island access road
    - Olompali State Historic Park (SHP) Access Road – adjacent to southbound US-101, from the Olompali SHP entrance to the residences located a approximately “BK” Sta. 304+00
    - Olompali SHP Bike Path – adjacent to southbound US-101, from the Olompali residences located at approximately “BK” Sta. 304+00 to the Redwood Landfill Interchange
- Eliminate the at-grade intersections located at South San Antonio Road and the hook-ramps located at the entrance of Olompali SHP
- Construction of retaining walls to minimize earthwork and right-of-way impacts

The proposed construction activities will be conducted within existing Caltrans ROW, Olompali SHP and portions private properties acquired with the project. Soil sampling was conducted along the proposed frontage road, access road and bike path on the four parcels described previously. The project location is depicted on the Vicinity Map, Figure 1.

1.2 Purpose

The purpose of this investigation was to evaluate impacts due to metals, such as aerially deposited lead (ADL), petroleum hydrocarbon compounds, pesticides, or naturally occurring asbestos (NOA) and if they exist in the surface and near surface soil. Additionally this investigation determines if other constituents of concern have impacted soil at the project location. Accordingly, the information obtained from this investigation will be used by BKF to evaluate soil reuse/disposal options.

2.0 BACKGROUND

2.1 Hazardous Waste Determination Criteria

Regulatory criteria to classify a waste as California hazardous for handling and disposal purposes are contained in the CCR, Title 22, Division 4.5, Chapter 11, Article 3, §66261.24. Criteria to classify a waste as Resource, Conservation, and Recovery Act (RCRA) hazardous are contained in Chapter 40 of the Code of Federal Regulations (40 CFR), Section 261.

For waste containing metals, the waste is classified as California hazardous when: 1) the total metal content exceeds the respective Total Threshold Limit Concentration (TTLC); or 2) the soluble metal content exceeds the respective Soluble Threshold Limit Concentration (STLC) based on the standard Waste Extraction Test WET. A waste has the potential of exceeding the STLC when the waste's total metal content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when a total metal is detected at a concentration greater than or equal to ten times the respective STLC, and assuming that 100 percent of the total metals are soluble, soluble metal analysis is required. A material is classified as RCRA hazardous, or Federal hazardous, when the soluble metal content exceeds the Federal regulatory level based on the Toxicity Characteristic Leaching Procedure (TCLP).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability and corrosivity; however, for the purposes of this investigation, toxicity (i.e., lead concentrations) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified as either California hazardous or RCRA hazardous requires management as a hazardous waste.

2.2 Naturally Occurring Asbestos

As defined in current California Air Resources Board (CARB) rules, serpentine material refers to any material that contains at least 10% serpentine, and asbestos-containing serpentine refers to serpentine materials with an asbestos content greater than 5% as determined by CARB Test Method 435 (CARB 435). The use of serpentine material for road surfacing is prohibited in California by Title 17 of the California Code of Regulations (CCR) Section 93106, Asbestos Airborne Toxic Control Measure (ATCM) for Surfacing Application (ATCM 93106), unless the material has been tested and determined to have an asbestos content of less than 0.25%. Materials found to contain asbestos of 0.25% or more are considered to be designated waste if transported offsite, requiring disposal at a landfill facility designated to accept asbestos waste. Alternatively, asbestos-containing materials may be reused onsite if buried beneath a minimum 6 inches of soil.

The CARB specifies mitigation practices for construction, grading, quarrying, and surface mining operations that contain natural occurrences of asbestos outlined in Title 17, Section 93105, Asbestos ATCM for Construction, Grading, Quarrying, and Surface Mining Operations (ATCM 93105). Based on Part (e) Subpart (2) of ATCM 93105 an asbestos dust mitigation plan is required and must be implemented for a project if NOA is disturbed after the start of construction. Additionally, ATCM 93105 specifies that the air pollution control district (APCD) must be notified and an asbestos dust mitigation plan submitted to the APCD. The ATCM states that air monitoring may be required on the property. NOA potentially posses a health hazard when it becomes an airborne particulate.

The construction/maintenance activities mentioned above could disturb NOA-laden debris and soil, thereby potentially creating an airborne hazard. Mitigation practices can reduce the risk of exposure to airborne NOA containing dust. Dust suppression practices include wetting the materials being disturbed and wearing approved respirators with high-efficiency particulate air (HEPA) filters during construction activities.

2.3 Environmental Screening Levels

The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) has prepared a technical report entitled *Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater, Interim Final* (May 2008), which presents Environmental Screening Levels (ESLs) for soil, groundwater, soil gas, and surface water, to assist in evaluating sites impacted by releases of hazardous chemicals. The ESLs are conservative values for more than 100 commonly detected contaminants, which may be used to compare with environmental data collected at a site. ESLs are strictly risk assessment tools and "not regulatory clean up standards." The presence of a chemical at concentrations in excess of an ESL does not necessarily indicate that adverse impacts to human health

or the environment are occurring; this simply indicates that a potential for adverse risk may exist and that additional evaluation is or "may be" warranted (SFRWQCB, 2008).

The most conservative ESL table was used for this characterization: Table A – Shallow Soil (≤3 meters below ground surface; bgs) – Groundwater is a Current or Potential Source of Drinking Water. The respective ESLs are listed at the end of Tables 3 and 4 for comparative purposes.

3.0 SCOPE OF SERVICES

We performed the following scope of services:

3.1 Pre-field Activities

- Prepared a scope of work dated December 7, 2010 that describes the requested scope of services. The scope of work was approved by BKF. Caltrans also concurred with the scope of work in a meeting with Geocon on December 14, 2010
- Revised the existing site-specific health and safety plan to provide guidelines on the use of personal protective equipment and the health and safety procedures implemented during the field activities.
- Retained the services of Advanced Technology Laboratories (ATL) and EMSL Analytical (EMSL) to perform the sample analyses.
- Coordinated with BKF and property owners for access to the sampling locations.
- Notified Underground Service Alert (USA) at least 48 hours prior to fieldwork.

3.2 Field Activities

Geocon performed the field investigation on January 17, 2011, which consisted of the following field activities:

- Advanced 22 soil borings (S1 through S22) in the vicinity of the proposed bike lane using hand-auger techniques to a maximum depth of two feet.
- Collected 44 soil samples for selected analysis of CAM 17 metals, petroleum hydrocarbon compounds, pesticides, NOA, and pH.
- Transported samples to ATL and EMSL for analysis under standard chain-of-custody (COC) documentation.

4.0 INVESTIGATIVE METHODS

4.1 Sampling Procedures

Soil samples were collected from a total of 22 boring locations, which are shown on the Site Plan, Figures 2a and 2b. The boring locations were surveyed using Differential Global Positioning System (GPS) equipment and coordinates are presented on Table 1.

Soil samples were collected into new glass jars secured with Teflon-lined screw caps or stainless steel tubes secured with Teflon tape and plastic end caps for CAM 17 metals, petroleum hydrocarbon compounds, and pesticides analyses. Soil samples for total lead and NOA analyses were collected into new re-sealable plastic bags.

Sample containers were labeled, placed into a chilled cooler, and transported to ATL and EMSL using standard COC documentation. Soil borings were backfilled to surface with soil cuttings.

Geocon provided QA/QC procedures during the field activities. These procedures included washing the sampling equipment with a Liqui-Nox® solution followed by a double rinse with deionized water. Decontamination water was disposed to the ground surface within Caltrans right-of-way in a manner not to create runoff, away from drain inlets or potential water bodies.

4.2 Laboratory Analyses

Laboratory analyses performed by ATL and EMSL were under standard seven-day turn-around-times. Reproductions of the laboratory reports and COC documentation are presented as Appendix A.

The soil samples were analyzed as follows:

- 44 samples for total lead using Environmental Protection Agency (EPA) Method 6010 ICAP
- 10 four-point and 2 two-point composite samples for CAM 17 metals according to Title 22 CCR, EPA Test Methods 6010 ICAP and 7471A
- Sample Composite S19, S20, S21, S22-2 was further analyzed for WET chromium
- 12 four-point and 2 two-point composite samples for TPH as gasoline (TPHg), and benzene, toluene, ethylbenzene, and xylenes (BTEX), using EPA Test Method 8021B
- 12 four-point and 2 two-point composite samples for TPH as diesel (TPHd) and as motor oil (TPHmo) using EPA Test Method 8015M
- 12 four-point and 2 two-point composite samples for chlorinated pesticides using EPA Test Method 8081
- 8 samples for NOA using CARB Test Method 435
- 5 samples for pH using EPA Method 9045

4.3 Laboratory QA/QC

QA/QC procedures were performed for each method of analysis with specificity for each analyte listed in the test method's QA/QC. The laboratory QA/QC procedures included the following:

- One method blank for every ten samples, batch of samples or type of matrix, whichever was more frequent.

- One sample analyzed in duplicate for every ten samples, batch of samples or type of matrix, whichever was more frequent
- One spiked sample for every ten samples, batch of samples or type of matrix; whichever was more frequent, with spike made at ten times the detection limit or at the analyte level

Prior to submitting the samples to the laboratories, the COC documentation was reviewed for accuracy and completeness (Appendix A).

5.0 INVESTIGATIVE RESULTS

5.1 Subsurface Conditions

Observations during field activities indicated that surface soil at the project location generally consist of gray and brown, gravelly sand and silt. Groundwater was not encountered during the advancement of the soil borings.

5.2 Laboratory Analytical Results

A summary of the analytical results are presented in Tables 2 through 5. Reproductions of the laboratory reports and chain-of-custody documentation are presented as Appendix A.

- Total lead was reported at concentrations ranging from 3.6 milligrams per kilogram (mg/kg) to 25 mg/kg.
- Total chromium was reported in the composite samples at concentrations ranging from 11 to 68 mg/kg, with one sample (Composite S19, S20, S21, S22-2) exceeding ten times the STLC of 50 milligrams per liter (mg/l) for hexavalent chromium.
- WET chromium was not detected above the laboratory reporting limit of 1.0 mg/l in sample Composite S19, S20, S21, S22-2.
- The following metals were not detected above their respective laboratory reporting limits: antimony, beryllium, cadmium, molybdenum, selenium, silver, and thallium. Remaining CAM 17 metals were reported at concentrations less than ten times their respective STLCs.
- TPHg or BTEX were not detected above their respective laboratory reporting limits.
- TPHd was reported above the laboratory reporting limit in two of the twelve composite samples at concentrations of 2.4 mg/kg and 10 mg/kg.
- TPHmo was reported in three of the twelve composites at concentrations ranging from 1.1 to 21 mg/kg.
- Pesticides were not detected above their respective laboratory reporting limits.
- NOA was not detected above the target analytical sensitivity level of 0.25%.

5.3 Laboratory Quality Assurance/Quality Control

We reviewed the QA/QC results provided with the laboratory analytical reports. The data indicate non-detect results for the method blanks.

The relative percent differences (RPDs) of the duplicate samples for several of the analyses were outside criteria. The RPDs for several of the matrix spike duplicate samples for the analyses were outside criteria. The Case Narratives in the laboratory reports state that each analytical batch was validated by the laboratory control sample (LCS). The data showed acceptable recoveries and RPDs for the remainder of the duplicates and matrix spikes. Dilution was necessary for several analyses due to sample matrix.

Based on this limited data review, no additional qualifications of the soil data are necessary, and the data are of sufficient quality for the purposes of this report.

6.0 CONCLUSIONS

6.1 CAM 17 Metals

Based on the reported CAM 17 metals and WET chromium results, soil excavated at the project location would not be classified as hazardous waste.

The CAM 17 metals concentrations in reported in the soil samples were compared to ESLs (Table A, SFRWQCB, May 2008). Arsenic and vanadium were the only metals with reported concentrations greater than their respective ESL values in the soil samples collected during the investigation. Arsenic was detected at concentrations between 1.1 and 3.8 mg/kg, exceeding the residential land use ESL of 0.39 mg/kg and the commercial/industrial land use ESL of 1.6 mg/kg for shallow soil ($\leq$3 meters; SFRWQCB, Table A). Vanadium was reported in the soil samples at concentrations between 13 mg/kg and 26 mg/kg, exceeding the residential land use ESL of 16 mg/kg for shallow soil.

Upper one-sided 95% Upper Confidence Limits (UCLs) were calculated for the full set of arsenic and vanadium data collected during the investigation. The upper one-sided 95% UCLs of the arithmetic mean are defined as the values that, when calculated repeatedly for randomly drawn subsets of site data, equal or exceed the true mean 95% of the time. Statistical confidence limits are the classical tool for addressing uncertainties of a distribution mean. The UCLs of the arithmetic mean concentration are used as the mean concentrations because it is not possible to know the true mean due to the essentially infinite number of soil samples that could be collected from a site. The UCLs therefore account for

uncertainties due to limited sampling data. As data become less limited at a site, uncertainties decrease, and the UCLs move closer to the true mean.

Non-parametric bootstrap techniques used to calculate the UCLs for the metals data collected during the investigation. For those samples in which a total metal was not detected at concentrations exceeding the laboratory reporting limit, a value equal to one-half of the detection limit was used in the UCL calculation.

Risk assessment characterization is based on the 95% UCL of the lead content in the waste for the relevant depths; this is in accordance with the Risk Assessment Guidance for Superfund (RAGS) Volume 1 Documentation for Exposure Assessment. Per Caltrans, the 90% UCLs are to be used to evaluate onsite reuse and the 95% UCLs are to be used to evaluate offsite disposal.

The arsenic and vanadium UCLs were compared with the residential and commercial/industrial land use ESLs and with published background levels typically present in California soils as presented in *Background Concentrations of Trace and Major Elements in California Soils* (Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996). The bootstrap results are included in Appendix B. The calculated standard bootstrap UCLs, ESLs and published background concentrations are summarized in the table below:

Metal	95% UCL	RESIDENTIAL ESL	COMMERCIAL/ INDUSTRIAL ESL	PUBLISHED BACKGROUND MEAN[1]	PUBLISHED BACKGROUND RANGE [1]
Arsenic	2.424	0.39	1.6	3.5	0.6 to 11.0
Vanadium	20.19	16	200	112	39 to 288

Concentrations reported in milligrams per kilogram (mg/kg)

[1] Kearney Foundation of Soil Science, March 1996

The 95% UCL arsenic value for soil samples collected during the investigation is greater than the residential and commercial/industrial land use ESL; however, it is less than the published background mean. The SFRWQCB *November 2007 Update to Environmental Screening Levels (ESLs) Technical Document* states that ambient background concentrations of arsenic typically exceed risk-based screening levels. In such instances, it may be more appropriate to compare site data to regionally specific established background levels.

The 95% UCL vanadium concentration for soil samples collected at the project location is greater than the residential land use ESL; however, it is less than the commercial/industrial land use ESL and the published background values.

Offsite reuse or disposal of excavated soil may be restricted based on arsenic and vanadium content.

6.2 Total Petroleum Hydrocarbons

TPHd and TPHmo were reported at concentrations that are below their respective residential and commercial/industrial land use ESLs. Therefore, there should be no restrictions on reuse or offsite disposal of excavated soil based on TPHd and TPHmo content.

6.3 Pesticides

Pesticides were not detected above their respective laboratory reporting limits.

6.4 Naturally Occurring Asbestos

The mapped geology of the general area of the project location is indicative of a metamorphic regime where NOA minerals may occur; however, NOA was not detected above the 0.25% analytical sensitivity.

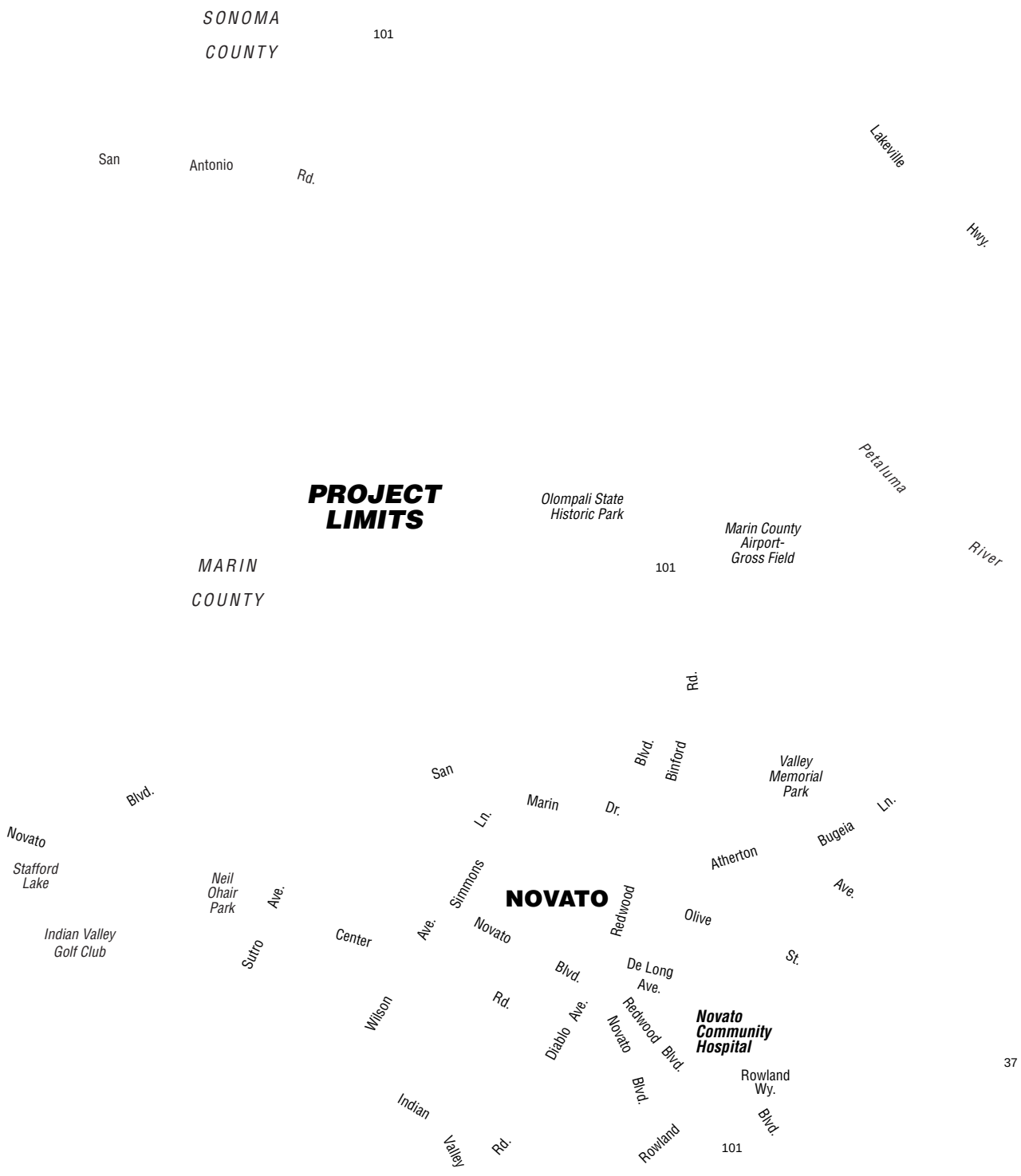
6.5 Worker Protection

Per Caltrans requirements, the contractor(s) should prepare a project-specific health and safety plan to prevent or minimize worker exposure to metals in soil. The plan should include protocols for environmental and personnel monitoring, requirements for personal protective equipment, and other health and safety protocols and procedures for the handling of metals in soil.

7.0 REPORT LIMITATIONS

This report has been prepared exclusively for BKF Engineers. The information contained herein is only valid as of the date of the field sampling and will require an update to reflect additional information obtained.

This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty, express or implied, with respect to the content of this report or any subsequent reports, correspondence or consultation. Geocon strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.



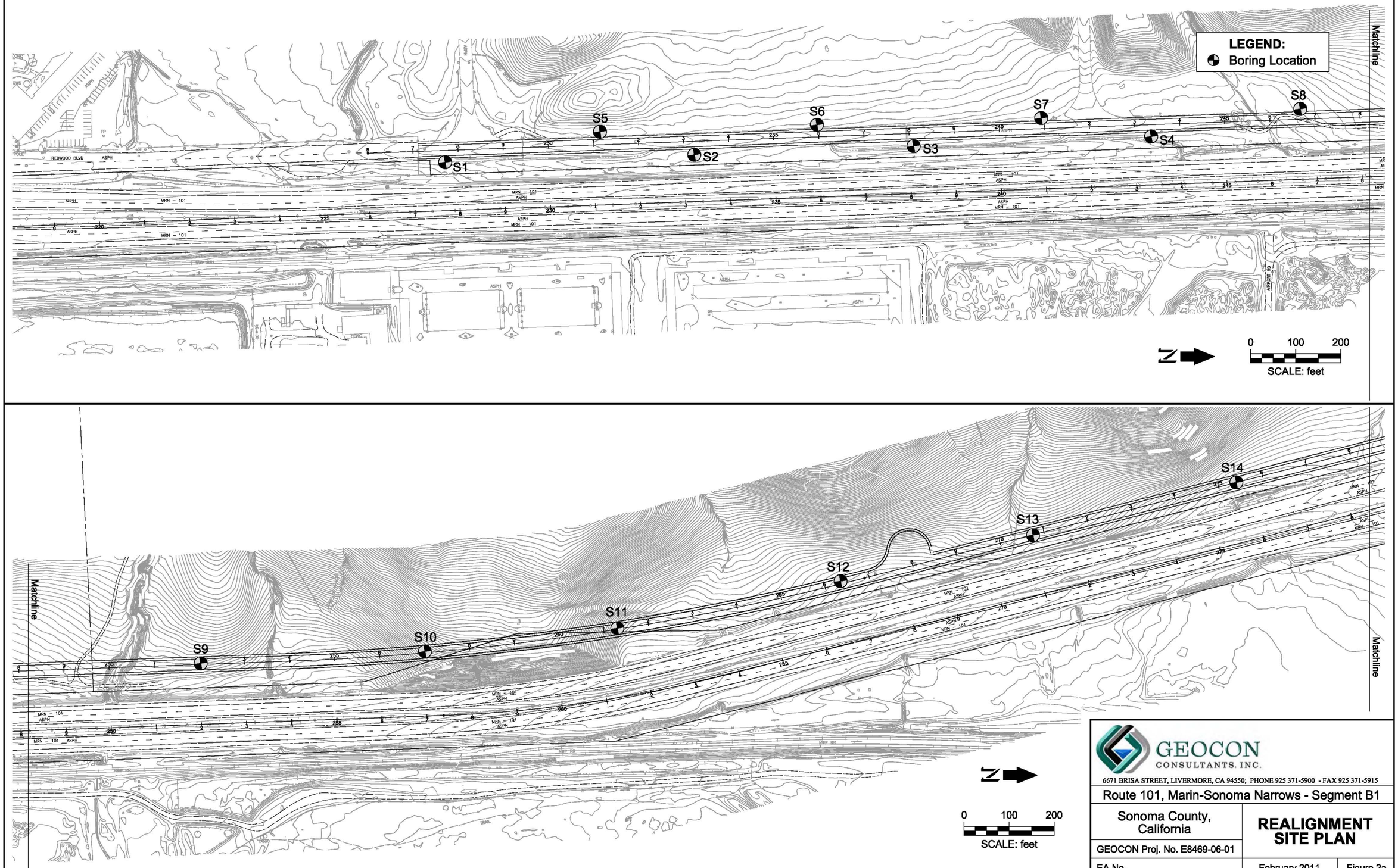
GEOCON
CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

US Route 101, Marin Sonoma Narrows,
Segment B1 Realignment

Marin County, California

VICINITY MAP

E8469-06-01B February 2011 Figure 1



GEOCON CONSULTANTS, INC.

6671 BRISA STREET, LIVERMORE, CA 94550; PHONE 925 371-5900 - FAX 925 371-5915

Route 101, Marin-Sonoma Narrows - Segment B1

Sonoma County, California

REALIGNMENT SITE PLAN

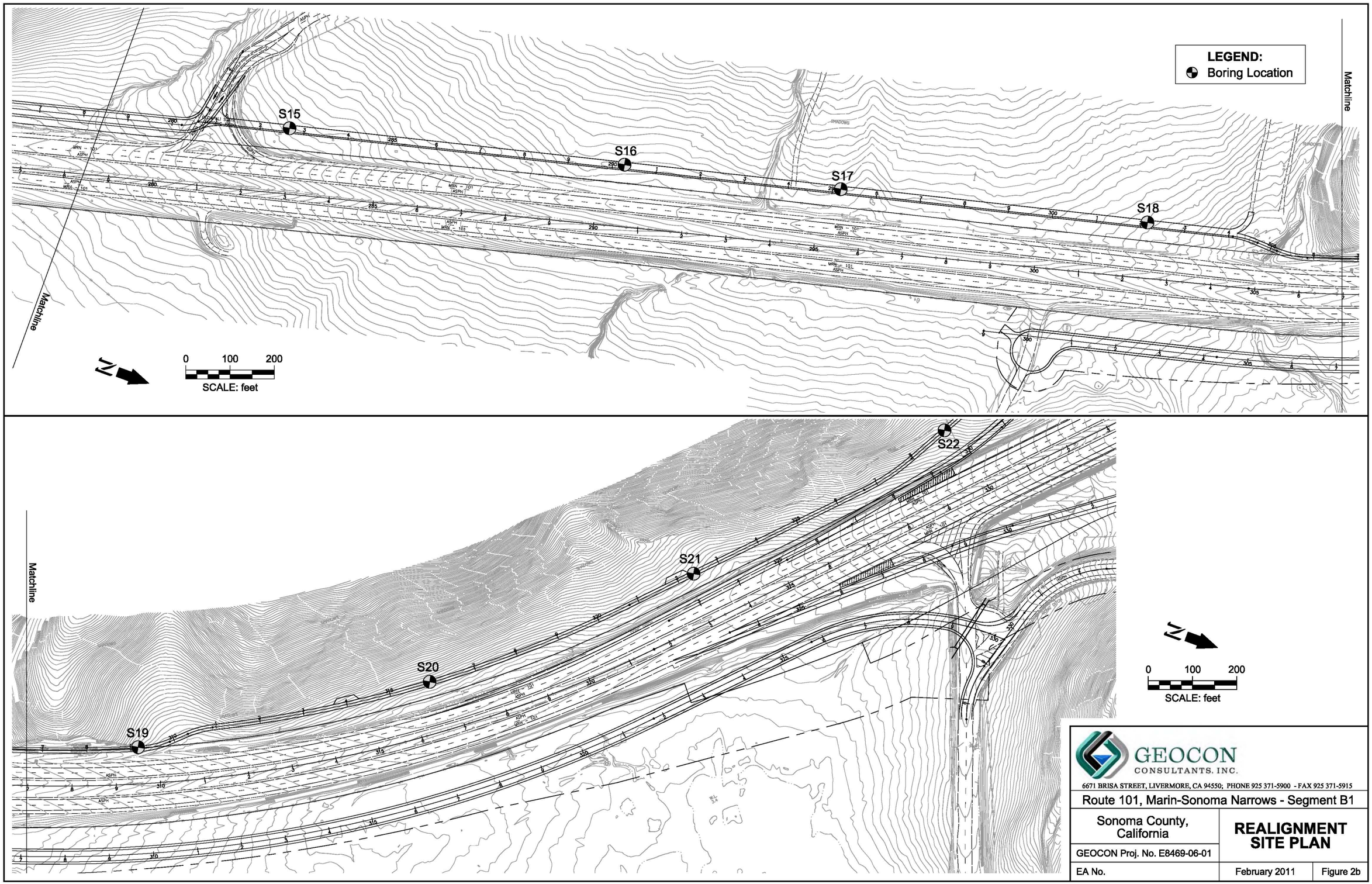
GEOCON Proj. No. E8469-06-01

EA No.

February 2011

Figure 2a

SITE0211



GEOCON CONSULTANTS, INC.

6671 BRISA STREET, LIVERMORE, CA 94550; PHONE 925 371-5900 - FAX 925 371-5915

Route 101, Marin-Sonoma Narrows - Segment B1

Sonoma County, California

REALIGNMENT SITE PLAN

GEOCON Proj. No. E8469-06-01

EA No.

February 2011

Figure 2b

SITE0211

TABLE 1
Boring Coordinates
US-101 Marin-Sonoma Narrows Segment B1 Project
Supplemental Private Property Investigation
Marin County, California

Boring	Northing	Easting
S1	2,242,617.148	5,967,998.283
S2	2,243,168.002	5,967,982.704
S3	2,243,653.316	5,967,964.010
S4	2,244,180.763	5,967,942.200
S5	2,242,958.896	5,967,932.852
S6	2,243,439.528	5,967,917.273
S7	2,243,937.326	5,967,901.695
S8	2,244,510.027	5,967,881.442
S9	2,245,045.355	5,967,882.508
S10	2,245,543.225	5,967,856.000
S11	2,245,969.302	5,967,804.544
S12	2,246,464.051	5,967,700.073
S13	2,246,890.128	5,967,597.162
S14	2,247,339.615	5,967,481.776
S15	2,248,037.855	5,967,285.021
S16	2,248,777.468	5,967,104.659
S17	2,249,254.711	5,966,987.660
S18	2,249,931.804	5,966,822.493
S19	2,250,606.011	5,966,657.387
S20	2,251,174.214	5,966,294.249
S21	2,251,651.429	5,965,860.177
S22	2,252,072.705	5,965,361.945

Coordinates are shown in feet, NAD 83 (Zone 3)

TABLE 2
Summary of Lead and pH Results
US-101 Marin-Sonoma Narrows Segment B1 Project
Supplemental Private Property Investigation
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	pH
S1-0	0	25	7.3
S1-2	2	8.7	---
S2-0	0	23	---
S2-2	2	6.6	---
S3-0	0	11	---
S3-2	2	7.1	---
S4-0	0	13	---
S4-2	2	7.3	---
S5-0	0	12	---
S5-2	2	5.9	7.4
S6-0	0	17	---
S6-2	2	<5.0	---
S7-0	0	17	---
S7-2	2	6.3	---
S8-0	0	15	---
S8-2	2	6.4	---
S9-0	0	14	---
S9-2	2	<5.0	---
S10-0	0	8.4	---
S10-2	2	<5.0	6.6
S11-0	0	7.6	---
S11-2	2	<5.0	---
S12-0	0	11	---
S12-2	2	<5.0	---
S13-0	0	5.5	---
S13-2	2	<5.0	---
S14-0	0	11	---
S14-2	2	<5.0	---
S15-0	0	15	---
S15-2	2	5.7	6.7
S16-0	0	6.3	---

TABLE 2
Summary of Lead and pH Results
US-101 Marin-Sonoma Narrows Segment B1 Project
Supplemental Private Property Investigation
Marin County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	pH
S16-2	2	<5.0	---
S17-0	0	8.2	---
S17-2	2	<5.0	---
S18-0	0	5.3	---
S18-2	2	<5.0	---
S19-0	0	8.8	---
S19-2	2	6.4	---
S20-0	0	23	---
S20-2	2	23	6.1
S21-0	0	21	---
S21-2	2	5.6	---
S22-0	0	12	---
S22-2	2	<5.0	---
Composite-S1,S2,S3,S4-0	0	20	---
Composite-S1,S2,S3,S4-2	2	5.0	---
Composite-S5,S6,S7,S8-0	0	14	---
Composite-S5,S6,S7,S8-2	2	4.7	---
Composite-S9,S10,S11,S12-0	0	11	---
Composite-S9,S10,S11,S12-2	2	3.3	---
Composite-S13,S14-0	0	10	---
Composite-S13,S14-2	2	3.6	---
Composite-S15,S16,S17,S18-0	0	11	---
Composite-S15,S16,S17,S18-2	2	4.4	---
Composite-S19,S20,S21,S22-0	0	19	---
Composite-S19,S20,S21,S22-2	2	12	---

Notes:

mg/kg = Milligrams per kilogram

mg/l = Milligrams per liter

--- = Not analyzed

<5.0 = Analyte was not detected above the laboratory reporting limit

TABLE 3
Summary of CAM 17 Metals Results
US-101 Marin-Sonoma Narrows Segment B1 Project
Supplemental Private Property Investigation
Marin County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Composite-S1,S2,S3,S4-0	0	<2.0	3.8	140	<1.0	<1.0	27	18	15	20	<0.10	<1.0	55	<1.0	<1.0	<1.0	26	39
Composite-S1,S2,S3,S4-2	2	<2.0	2.7	120	<1.0	<1.0	28	6.7	13	5.0	0.10	<1.0	38	<1.0	<1.0	<1.0	23	27
Composite-S5,S6,S7,S8-0	0	<2.0	3.2	110	<1.0	<1.0	23	10	14	14	<0.10	<1.0	32	<1.0	<1.0	<1.0	24	28
Composite-S5,S6,S7,S8-2	2	<2.0	2.7	98	<1.0	<1.0	18	6.2	12	4.7	<0.10	<1.0	21	<1.0	<1.0	<1.0	19	20
Composite-S9,S10,S11,S12-0	0	<2.0	2.1	82	<1.0	<1.0	15	12	8.1	11	<0.10	<1.0	12	<1.0	<1.0	<1.0	19	19
Composite-S9,S10,S11,S12-2	2	<4.0	<1.0	87	<2.0	<2.0	15	6.8	5.3	3.3	<0.10	<2.0	10	<2.0	<2.0	<2.0	14	9.2
Composite-S13,S14-0	0	<2.0	<1.0	55	<1.0	<1.0	11	8.3	4.6	10	0.14	<1.0	7.1	<1.0	<1.0	<1.0	13	9.8
Composite-S13,S14-2	2	<2.0	1.1	51	<1.0	<1.0	12	1.6	4.7	3.6	<0.10	<1.0	6.1	<1.0	<1.0	<1.0	11	9.0
Composite-S15,S16,S17,S18-0	0	<2.0	<1.0	100	<2.0	<1.0	20	11	6.4	11	<0.10	<1.0	32	<1.0	<1.0	<1.0	18	16
Composite-S15,S16,S17,S18-2	2	<2.0	<1.0	110	<2.0	<1.0	15	9.2	6.3	4.4	0.11	<1.0	22	<1.0	<1.0	<1.0	17	15
Composite-S19,S20,S21,S22-0	0	<2.0	2.6	100	<1.0	<1.0	49	13	8.7	19	<0.10	<1.0	55	<1.0	<1.0	<1.0	17	30
Composite-S19,S20,S21,S22-2	2	<2.0	2.4	95	<1.0	<1.0	68	11	9.0	12	<0.10	<1.0	70	<1.0	<1.0	<1.0	17	24
							<1.0											
ESLs																		
Residential Land Use		6.3	0.39	750	4.0	1.7	750	40	230	200	1.3	40	150	10	20	1.3	16	600
Comm/Ind Land Use		40	16	1500	8.0	7.4	750	80	230	750	10	40	150	10	40	16	200	600
Construction Exposure		310	15	2,600	98	39	1,200,000	94	310,000	750	58	78	260	3,900	3,900	62	770	230,000

Notes:

Results are shown in milligrams per kilogram (mg/kg).

Values listed for chromium are for Chromium III, as there is no standard for total chromium.

< = Analyte was not detected above the laboratory reporting limit.

Result shown in italics is for WET chromium, in units of milligrams per liter.

ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, Revised May 2008.

TABLE 4
Summary of Organics Results
US-101 Marin-Sonoma Narrows Segment B1 Project
Supplemental Private Property Investigation
Marin County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (µg/kg)	Pesticides (µg/kg)
Composite-S1,S2,S3,S4-0	0	<1.0	10	21	ND	ND
Composite-S1,S2,S3,S4-2	2	<1.0	<1.0	<1.0	ND	ND
Composite-S5,S6,S7,S8-0	0	<1.0	<1.0	<1.0	ND	ND
Composite-S5,S6,S7,S8-2	2	<1.0	<1.0	<1.0	ND	ND
Composite-S9,S10,S11,S12-0	0	<1.0	<1.0	1.1	ND	ND
Composite-S9,S10,S11,S12-2	2	<1.0	<1.0	<1.0	ND	ND
Composite-S13,S14-0	0	<1.0	<1.0	<1.0	ND	ND
Composite-S13,S14-2	2	<1.0	<1.0	<1.0	ND	ND
Composite-S15,S16,S17,S18-0	0	<1.0	<1.0	<1.0	ND	ND
Composite-S15,S16,S17,S18-2	2	<1.0	<1.0	<1.0	ND	ND
Composite-S19,S20,S21,S22-0	0	<1.0	2.4	4.5	ND	ND
Composite-S19,S20,S21,S22-2	2	<1.0	<1.0	<1.0	ND	ND
ESLs						
Residential		83	83	370	---	
Commercial/Industrial		83	83	2,500	---	
Construction Exposure		4,200	4,200	12,000	---	

Notes:

mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
BTEX = Benzene, toluene, ethylbenzene, and xylenes
ND = Not detected above laboratory reporting limit
TPHg = Total Petroleum Hydrocarbons (TPH) as gasoline
< = Not detected above the stated laboratory reporting limit
ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, May 2008.
TPHd = TPH as diesel
TPHmo = TPH as motor oil
MTBE = Methyl-tert-butyl ether
--- = Not Applicable

TABLE 5
Summary of NOA Results
US-101 Marin-Sonoma Narrows Segment B1 Project
Supplemental Private Property Investigation
Marin County, California

Sample ID	Sample Depth (feet)	Asbestos Content (% dry weight)
S1-2	2	ND
S4-2	2	ND
S6-2	2	ND
S10-2	2	ND
S13-2	2	ND
S16-2	2	ND
S19-2	2	ND
S22-2	2	ND

Notes

ND = None detected at 0.25% target analytical sensitivity.

APPENDIX B

As	V
0.5	14
0.5	13
0.5	18
0.5	17
1.1	11
2.1	19
2.4	17
2.6	17
2.7	23
2.7	19
3.2	24
3.8	26

As

Number of Valid Observations	12
Number of Distinct Observations	8
Minimum	0.5
Maximum	3.8
Mean	1.883
Median	2.25
SD	1.2
Variance	1.44
Coefficient of Variation	0.637
Skewness	-0.00885
Mean of log data	0.365
SD of log data	0.835
95% Standard Bootstrap UCL	2.424

V

Number of Valid Observations	12
Number of Distinct Observations	9
Minimum	11
Maximum	26
Mean	18.17
Median	17.5
SD	4.469
Variance	19.97
Coefficient of Variation	0.246
Skewness	0.257
Mean of log data	2.871
SD of log data	0.252
95% Standard Bootstrap UCL	20.19

APPENDIX A

January 26, 2011

Chris Merritt
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 115854

RE: MSN SEGMENT B1 ADDTNL, E8469-06-01B

Attention: Chris Merritt

Enclosed are the results for sample(s) received on January 19, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc.
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B
Lab Order: 115854

CASE NARRATIVE

Analytical Comments for Method 6010

Dilution was necessary for samples 115854-050A and 115854-054A, due to sample matrix.

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 115854-053ADUP and 115854-053AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

RPD for Duplicate (DUP) and/or Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for samples 115854-053ADUP, 115854-053AMSD and 115854-054ADUP; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8015 (DRO/ORO)

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 115854-050AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8015 (GRO)

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for samples 115864-003AMSD and 115869-016AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8021

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 115864-003AMS, 115864-003AMSD, 115869-016AMS and 115869-016AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 115869-016AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 1/26/2011

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	115854
Project:	MSN SEGMENT B1 ADDTNL, E8469-06-01B	**Date Received**	1/19/2011 8:30:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	JSD

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
115854-001A	S1-0	25	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-002A	S1-2	8.7	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-003A	S2-0	23	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-004A	S2-2	6.6	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-005A	S3-0	11	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-006A	S3-2	7.1	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-007A	S4-0	13	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-008A	S4-2	7.3	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-009A	S5-0	12	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-010A	S5-2	5.9	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-011A	S6-0	17	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-012A	S6-2	ND	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-013A	S7-0	17	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-014A	S7-2	6.3	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-015A	S8-0	15	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-016A	S8-2	6.4	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-017A	S9-0	14	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-018A	S9-2	ND	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

Date: 1/26/2011

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT: Geocon Consultants, Inc.
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B
Project No:
Analyte: Lead

Lab Order: 115854
Date Received 1/19/2011 8:30:00 AM
Matrix: Soil
Analyst: JSD

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
115854-019A	S10-0	8.4	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-020A	S10-2	ND	mg/Kg	69881	5.0	1	1/17/2011	1/21/2011
115854-021A	S11-0	7.6	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-022A	S11-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-023A	S12-0	11	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-024A	S12-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-025A	S13-0	5.5	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-026A	S13-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-027A	S14-0	11	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-028A	S14-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-029A	S15-0	15	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-030A	S15-2	5.7	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-031A	S16-0	6.3	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-032A	S16-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-033A	S17-0	8.2	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-034A	S17-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-035A	S18-0	5.3	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011
115854-036A	S18-2	ND	mg/Kg	69882	5.0	1	1/17/2011	1/21/2011

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: 1/26/2011

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	115854
Project:	MSN SEGMENT B1 ADDTNL, E8469-06-01B	**Date Received**	1/19/2011 8:30:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	JSD

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
115854-037A	S19-0	8.8	mg/Kg	69882	5.0	1	1/18/2011	1/21/2011
115854-038A	S19-2	6.4	mg/Kg	69882	5.0	1	1/18/2011	1/21/2011
115854-039A	S20-0	23	mg/Kg	69882	5.0	1	1/18/2011	1/21/2011
115854-040A	S20-2	23	mg/Kg	69882	5.0	1	1/18/2011	1/21/2011
115854-041A	S21-0	21	mg/Kg	69883	5.0	1	1/18/2011	1/21/2011
115854-042A	S21-2	5.6	mg/Kg	69883	5.0	1	1/18/2011	1/21/2011
115854-043A	S22-0	12	mg/Kg	69883	5.0	1	1/18/2011	1/21/2011
115854-044A	S22-2	ND	mg/Kg	69883	5.0	1	1/18/2011	1/21/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

Date: 1/26/2011

ANALYTICAL RESULTS

pH
EPA 9045C

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	115854
Project:	MSN SEGMENT B1 ADDTNL, E8469-06-01B	**Date Received**	1/19/2011 8:30:00 AM
Project No:		**Matrix:**	Soil
Analyte:	pH	**Analyst:**	CBB

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
115854-001A	S1-0	7.3	pH Units	R129132	0.10	1	1/17/2011	1/25/2011
115854-010A	S5-2	7.4	pH Units	R129132	0.10	1	1/17/2011	1/25/2011
115854-020A	S10-2	6.6	pH Units	R129132	0.10	1	1/17/2011	1/25/2011
115854-030A	S15-2	6.7	pH Units	R129132	0.10	1	1/17/2011	1/25/2011
115854-040A	S20-2	6.1	pH Units	R129132	0.10	1	1/18/2011	1/25/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S1,S2,S3,S4-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-045A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011	Analyst: **JSD**	
Antimony	ND	2.0		mg/Kg	1	1/24/2011 04:41 PM
Arsenic	3.8	1.0		mg/Kg	1	1/24/2011 04:41 PM
Barium	140	1.0		mg/Kg	1	1/24/2011 04:41 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 04:41 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 04:41 PM
Chromium	27	1.0		mg/Kg	1	1/24/2011 04:41 PM
Cobalt	18	1.0		mg/Kg	1	1/24/2011 04:41 PM
Copper	15	2.0		mg/Kg	1	1/24/2011 04:41 PM
Lead	20	1.0		mg/Kg	1	1/24/2011 04:41 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 04:41 PM
Nickel	55	1.0		mg/Kg	1	1/24/2011 04:41 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 04:41 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 04:41 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 04:41 PM
Vanadium	26	1.0		mg/Kg	1	1/24/2011 04:41 PM
Zinc	39	1.0		mg/Kg	1	1/24/2011 04:41 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011	Analyst: **CBR**	
DRO	10	1.0		mg/Kg	1	1/20/2011 10:28 PM
ORO	21	1.0		mg/Kg	1	1/20/2011 10:28 PM
Surr: p-Terphenyl	114	30-128		%REC	1	1/20/2011 10:28 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
GRO	ND	1.0		mg/Kg	1	1/20/2011 05:08 PM
Surr: Bromofluorobenzene (FID)	89.5	56-137		%REC	1	1/20/2011 05:08 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
Benzene	ND	5.0		µg/Kg	1	1/20/2011 05:08 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/20/2011 05:08 PM
m,p-Xylene	ND	10		µg/Kg	1	1/20/2011 05:08 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S1,S2,S3,S4-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-045A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/20/2011 05:08 PM
Toluene	ND	5.0		µg/Kg	1	1/20/2011 05:08 PM
Surr: Bromofluorobenzene (PID)	91.9	64-116		%REC	1	1/20/2011 05:08 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_110124A	QC Batch: 69923			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 12:09 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 12:09 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 12:09 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 12:09 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 12:09 PM
Surr: Decachlorobiphenyl	63.7	21-132		%REC	1	1/24/2011 12:09 PM
Surr: Tetrachloro-m-xylene	58.9	22-110		%REC	1	1/24/2011 12:09 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:44 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S1,S2,S3,S4-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-046A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011	Analyst: **JSD**	
Antimony	ND	2.0		mg/Kg	1	1/24/2011 04:45 PM
Arsenic	2.7	1.0		mg/Kg	1	1/24/2011 04:45 PM
Barium	120	1.0		mg/Kg	1	1/24/2011 04:45 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 04:45 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 04:45 PM
Chromium	28	1.0		mg/Kg	1	1/24/2011 04:45 PM
Cobalt	6.7	1.0		mg/Kg	1	1/24/2011 04:45 PM
Copper	13	2.0		mg/Kg	1	1/24/2011 04:45 PM
Lead	5.0	1.0		mg/Kg	1	1/24/2011 04:45 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 04:45 PM
Nickel	38	1.0		mg/Kg	1	1/24/2011 04:45 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 04:45 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 04:45 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 04:45 PM
Vanadium	23	1.0		mg/Kg	1	1/24/2011 04:45 PM
Zinc	27	1.0		mg/Kg	1	1/24/2011 04:45 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011	Analyst: **CBR**	
DRO	ND	1.0		mg/Kg	1	1/20/2011 08:55 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 08:55 PM
Surr: p-Terphenyl	62.4	30-128		%REC	1	1/20/2011 08:55 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
GRO	ND	1.0		mg/Kg	1	1/20/2011 05:38 PM
Surr: Bromofluorobenzene (FID)	97.1	56-137		%REC	1	1/20/2011 05:38 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
Benzene	ND	5.0		µg/Kg	1	1/20/2011 05:38 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/20/2011 05:38 PM
m,p-Xylene	ND	10		µg/Kg	1	1/20/2011 05:38 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S1,S2,S3,S4-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-046A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/20/2011 05:38 PM
Toluene	ND	5.0		µg/Kg	1	1/20/2011 05:38 PM
Surr: Bromofluorobenzene (PID)	99.4	64-116		%REC	1	1/20/2011 05:38 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_110124A	QC Batch: 69923			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 11:56 AM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 11:56 AM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 11:56 AM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 11:56 AM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 11:56 AM
Surr: Decachlorobiphenyl	89.1	21-132		%REC	1	1/24/2011 11:56 AM
Surr: Tetrachloro-m-xylene	78.0	22-110		%REC	1	1/24/2011 11:56 AM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_110124D	QC Batch: 69909			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	0.10	0.10		mg/Kg	1	1/24/2011 12:46 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S5,S6,S7,S8-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-047A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / **EPA 6010B**						
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011		Analyst: **JSD**
Antimony	ND	2.0		mg/Kg	1	1/24/2011 04:49 PM
Arsenic	3.2	1.0		mg/Kg	1	1/24/2011 04:49 PM
Barium	110	1.0		mg/Kg	1	1/24/2011 04:49 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 04:49 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 04:49 PM
Chromium	23	1.0		mg/Kg	1	1/24/2011 04:49 PM
Cobalt	10	1.0		mg/Kg	1	1/24/2011 04:49 PM
Copper	14	2.0		mg/Kg	1	1/24/2011 04:49 PM
Lead	14	1.0		mg/Kg	1	1/24/2011 04:49 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 04:49 PM
Nickel	32	1.0		mg/Kg	1	1/24/2011 04:49 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 04:49 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 04:49 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 04:49 PM
Vanadium	24	1.0		mg/Kg	1	1/24/2011 04:49 PM
Zinc	28	1.0		mg/Kg	1	1/24/2011 04:49 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / **EPA 8015B(M)**						
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011		Analyst: **CBR**
DRO	ND	1.0		mg/Kg	1	1/20/2011 10:09 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 10:09 PM
Surr: p-Terphenyl	60.3	30-128		%REC	1	1/20/2011 10:09 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
GRO	ND	1.0		mg/Kg	1	1/21/2011 08:00 PM
Surr: Bromofluorobenzene (FID)	93.1	56-137		%REC	1	1/21/2011 08:00 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
Benzene	ND	5.0		µg/Kg	1	1/21/2011 08:00 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 08:00 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 08:00 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S5,S6,S7,S8-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-047A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 08:00 PM
Toluene	ND	5.0		µg/Kg	1	1/21/2011 08:00 PM
Surr: Bromofluorobenzene (PID)	96.1	64-116		%REC	1	1/21/2011 08:00 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate:	1/21/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 01:47 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 01:47 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 01:47 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 01:47 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 01:47 PM
Surr: Decachlorobiphenyl	91.2	21-132		%REC	1	1/24/2011 01:47 PM
Surr: Tetrachloro-m-xylene	89.4	22-110		%REC	1	1/24/2011 01:47 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate:	1/21/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S5,S6,S7,S8-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-048A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / **EPA 6010B**						
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011		Analyst: **JSD**
Antimony	ND	2.0		mg/Kg	1	1/24/2011 04:52 PM
Arsenic	2.7	1.0		mg/Kg	1	1/24/2011 04:52 PM
Barium	98	1.0		mg/Kg	1	1/24/2011 04:52 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 04:52 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 04:52 PM
Chromium	18	1.0		mg/Kg	1	1/24/2011 04:52 PM
Cobalt	6.2	1.0		mg/Kg	1	1/24/2011 04:52 PM
Copper	12	2.0		mg/Kg	1	1/24/2011 04:52 PM
Lead	4.7	1.0		mg/Kg	1	1/24/2011 04:52 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 04:52 PM
Nickel	21	1.0		mg/Kg	1	1/24/2011 04:52 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 04:52 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 04:52 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 04:52 PM
Vanadium	19	1.0		mg/Kg	1	1/24/2011 04:52 PM
Zinc	20	1.0		mg/Kg	1	1/24/2011 04:52 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / **EPA 8015B(M)**						
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011		Analyst: **CBR**
DRO	ND	1.0		mg/Kg	1	1/20/2011 09:04 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 09:04 PM
Surr: p-Terphenyl	62.8	30-128		%REC	1	1/20/2011 09:04 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
GRO	ND	1.0		mg/Kg	1	1/21/2011 08:15 PM
Surr: Bromofluorobenzene (FID)	65.7	56-137		%REC	1	1/21/2011 08:15 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
Benzene	ND	5.0		µg/Kg	1	1/21/2011 08:15 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 08:15 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 08:15 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S5,S6,S7,S8-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-048A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 08:15 PM
Toluene	ND	5.0		µg/Kg	1	1/21/2011 08:15 PM
Surr: Bromofluorobenzene (PID)	65.6	64-116		%REC	1	1/21/2011 08:15 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate:	1/21/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 01:33 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 01:33 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 01:33 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 01:33 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 01:33 PM
Surr: Decachlorobiphenyl	84.1	21-132		%REC	1	1/24/2011 01:33 PM
Surr: Tetrachloro-m-xylene	82.7	22-110		%REC	1	1/24/2011 01:33 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate:	1/21/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:50 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S9,S10,S11,S12-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-049A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / **EPA 6010B**						
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011		Analyst: **JSD**
Antimony	ND	2.0		mg/Kg	1	1/24/2011 04:56 PM
Arsenic	2.1	1.0		mg/Kg	1	1/24/2011 04:56 PM
Barium	82	1.0		mg/Kg	1	1/24/2011 04:56 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 04:56 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 04:56 PM
Chromium	15	1.0		mg/Kg	1	1/24/2011 04:56 PM
Cobalt	12	1.0		mg/Kg	1	1/24/2011 04:56 PM
Copper	8.1	2.0		mg/Kg	1	1/24/2011 04:56 PM
Lead	11	1.0		mg/Kg	1	1/24/2011 04:56 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 04:56 PM
Nickel	12	1.0		mg/Kg	1	1/24/2011 04:56 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 04:56 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 04:56 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 04:56 PM
Vanadium	19	1.0		mg/Kg	1	1/24/2011 04:56 PM
Zinc	19	1.0		mg/Kg	1	1/24/2011 04:56 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / **EPA 8015B(M)**						
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011		Analyst: **CBR**
DRO	ND	1.0		mg/Kg	1	1/20/2011 09:51 PM
ORO	1.1	1.0		mg/Kg	1	1/20/2011 09:51 PM
Surr: p-Terphenyl	84.3	30-128		%REC	1	1/20/2011 09:51 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
GRO	ND	1.0		mg/Kg	1	1/20/2011 06:21 PM
Surr: Bromofluorobenzene (FID)	101	56-137		%REC	1	1/20/2011 06:21 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
Benzene	ND	5.0		µg/Kg	1	1/20/2011 06:21 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/20/2011 06:21 PM
m,p-Xylene	ND	10		µg/Kg	1	1/20/2011 06:21 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S9,S10,S11,S12-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-049A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/20/2011 06:21 PM
Toluene	ND	5.0		µg/Kg	1	1/20/2011 06:21 PM
Surr: Bromofluorobenzene (PID)	102	64-116		%REC	1	1/20/2011 06:21 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 02:00 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 02:00 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 02:00 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 02:00 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 02:00 PM
Surr: Decachlorobiphenyl	83.4	21-132		%REC	1	1/24/2011 02:00 PM
Surr: Tetrachloro-m-xylene	86.0	22-110		%REC	1	1/24/2011 02:00 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:52 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S9,S10,S11,S12-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-050A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011	Analyst: **JSD**	
Antimony	ND	4.0		mg/Kg	2	1/25/2011 08:54 AM
Arsenic	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Barium	87	2.0		mg/Kg	2	1/25/2011 08:54 AM
Beryllium	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Cadmium	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Chromium	15	2.0		mg/Kg	2	1/25/2011 08:54 AM
Cobalt	6.8	2.0		mg/Kg	2	1/25/2011 08:54 AM
Copper	5.3	4.0		mg/Kg	2	1/25/2011 08:54 AM
Lead	3.3	2.0		mg/Kg	2	1/25/2011 08:54 AM
Molybdenum	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Nickel	9.5	2.0		mg/Kg	2	1/25/2011 08:54 AM
Selenium	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Silver	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Thallium	ND	2.0		mg/Kg	2	1/25/2011 08:54 AM
Vanadium	14	2.0		mg/Kg	2	1/25/2011 08:54 AM
Zinc	9.2	2.0		mg/Kg	2	1/25/2011 08:54 AM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011	Analyst: **CBR**	
DRO	ND	1.0		mg/Kg	1	1/20/2011 09:14 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 09:14 PM
Surr: p-Terphenyl	99.0	30-128		%REC	1	1/20/2011 09:14 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:	Analyst: **TT**	
GRO	ND	1.0		mg/Kg	1	1/21/2011 08:29 PM
Surr: Bromofluorobenzene (FID)	96.7	56-137		%REC	1	1/21/2011 08:29 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:	Analyst: **TT**	
Benzene	ND	5.0		µg/Kg	1	1/21/2011 08:29 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 08:29 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 08:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc.
Lab Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0
Lab ID: 115854-050A

Client Sample ID: Composite-S9,S10,S11,S12-2
Collection Date: 1/17/2011
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 08:29 PM
Toluene	ND	5.0		µg/Kg	1	1/21/2011 08:29 PM
Surr: Bromofluorobenzene (PID)	100	64-116		%REC	1	1/21/2011 08:29 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_110124A	QC Batch: 69923			PrepDate:	1/21/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 12:22 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 12:22 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 12:22 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 12:22 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 12:22 PM
Surr: Decachlorobiphenyl	92.2	21-132		%REC	1	1/24/2011 12:22 PM
Surr: Tetrachloro-m-xylene	84.8	22-110		%REC	1	1/24/2011 12:22 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate:	1/21/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:54 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S13,S14-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-051A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011	Analyst: **JSD**	
Antimony	ND	2.0		mg/Kg	1	1/24/2011 05:03 PM
Arsenic	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Barium	55	1.0		mg/Kg	1	1/24/2011 05:03 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Chromium	11	1.0		mg/Kg	1	1/24/2011 05:03 PM
Cobalt	8.3	1.0		mg/Kg	1	1/24/2011 05:03 PM
Copper	4.6	2.0		mg/Kg	1	1/24/2011 05:03 PM
Lead	10	1.0		mg/Kg	1	1/24/2011 05:03 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Nickel	7.1	1.0		mg/Kg	1	1/24/2011 05:03 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 05:03 PM
Vanadium	13	1.0		mg/Kg	1	1/24/2011 05:03 PM
Zinc	9.8	1.0		mg/Kg	1	1/24/2011 05:03 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011	Analyst: **CBR**	
DRO	ND	1.0		mg/Kg	1	1/20/2011 09:41 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 09:41 PM
Surr: p-Terphenyl	91.2	30-128		%REC	1	1/20/2011 09:41 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
GRO	ND	1.0		mg/Kg	1	1/20/2011 06:50 PM
Surr: Bromofluorobenzene (FID)	95.0	56-137		%REC	1	1/20/2011 06:50 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
Benzene	ND	5.0		µg/Kg	1	1/20/2011 06:50 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/20/2011 06:50 PM
m,p-Xylene	ND	10		µg/Kg	1	1/20/2011 06:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S13,S14-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-051A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/20/2011 06:50 PM
Toluene	ND	5.0		µg/Kg	1	1/20/2011 06:50 PM
Surr: Bromofluorobenzene (PID)	97.1	64-116		%REC	1	1/20/2011 06:50 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC9_110124A	QC Batch: 69923			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 12:49 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 12:49 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 12:49 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 12:49 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 12:49 PM
Surr: Decachlorobiphenyl	81.0	21-132		%REC	1	1/24/2011 12:49 PM
Surr: Tetrachloro-m-xylene	72.6	22-110		%REC	1	1/24/2011 12:49 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	0.14	0.10		mg/Kg	1	1/24/2011 12:56 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S13,S14-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-052A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011	Analyst: **JSD**	
Antimony	ND	2.0		mg/Kg	1	1/24/2011 05:14 PM
Arsenic	1.1	1.0		mg/Kg	1	1/24/2011 05:14 PM
Barium	51	1.0		mg/Kg	1	1/24/2011 05:14 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 05:14 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 05:14 PM
Chromium	12	1.0		mg/Kg	1	1/24/2011 05:14 PM
Cobalt	1.6	1.0		mg/Kg	1	1/24/2011 05:14 PM
Copper	4.7	2.0		mg/Kg	1	1/24/2011 05:14 PM
Lead	3.6	1.0		mg/Kg	1	1/24/2011 05:14 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 05:14 PM
Nickel	6.1	1.0		mg/Kg	1	1/24/2011 05:14 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 05:14 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 05:14 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 05:14 PM
Vanadium	11	1.0		mg/Kg	1	1/24/2011 05:14 PM
Zinc	9.0	1.0		mg/Kg	1	1/24/2011 05:14 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011	Analyst: **CBR**	
DRO	ND	1.0		mg/Kg	1	1/20/2011 09:23 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 09:23 PM
Surr: p-Terphenyl	93.5	30-128		%REC	1	1/20/2011 09:23 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
GRO	ND	1.0		mg/Kg	1	1/20/2011 07:05 PM
Surr: Bromofluorobenzene (FID)	98.8	56-137		%REC	1	1/20/2011 07:05 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:	Analyst: **TT**	
Benzene	ND	5.0		µg/Kg	1	1/20/2011 07:05 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/20/2011 07:05 PM
m,p-Xylene	ND	10		µg/Kg	1	1/20/2011 07:05 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S13,S14-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-052A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110120A	QC Batch: E11VS025			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/20/2011 07:05 PM
Toluene	ND	5.0		µg/Kg	1	1/20/2011 07:05 PM
Surr: Bromofluorobenzene (PID)	101	64-116		%REC	1	1/20/2011 07:05 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 02:13 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 02:13 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 02:13 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 02:13 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 02:13 PM
Surr: Decachlorobiphenyl	86.1	21-132		%REC	1	1/24/2011 02:13 PM
Surr: Tetrachloro-m-xylene	86.3	22-110		%REC	1	1/24/2011 02:13 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:58 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S15,S16,S17,S18-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-053A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / **EPA 6010B**						
RunID: ICP8_110124D	QC Batch: 69907			PrepDate: 1/21/2011		Analyst: **JSD**
Antimony	ND	2.0		mg/Kg	1	1/24/2011 05:17 PM
Arsenic	ND	1.0		mg/Kg	1	1/24/2011 05:17 PM
Barium	100	1.0		mg/Kg	1	1/24/2011 05:17 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 05:17 PM
Chromium	20	1.0		mg/Kg	1	1/24/2011 05:17 PM
Cobalt	11	1.0		mg/Kg	1	1/24/2011 05:17 PM
Copper	6.4	2.0		mg/Kg	1	1/24/2011 05:17 PM
Lead	11	1.0		mg/Kg	1	1/24/2011 05:17 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 05:17 PM
Nickel	32	1.0		mg/Kg	1	1/24/2011 05:17 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 05:17 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 05:17 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 05:17 PM
Vanadium	18	1.0		mg/Kg	1	1/24/2011 05:17 PM
Zinc	16	1.0		mg/Kg	1	1/24/2011 05:17 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / **EPA 8015B(M)**						
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011		Analyst: **CBR**
DRO	ND	1.0		mg/Kg	1	1/20/2011 10:00 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 10:00 PM
Surr: p-Terphenyl	93.9	30-128		%REC	1	1/20/2011 10:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
GRO	ND	1.0		mg/Kg	1	1/21/2011 06:47 PM
Surr: Bromofluorobenzene (FID)	95.0	56-137		%REC	1	1/21/2011 06:47 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
Benzene	ND	5.0		µg/Kg	1	1/21/2011 06:47 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 06:47 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 06:47 PM
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 06:47 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S15,S16,S17,S18-0
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-053A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
Toluene	ND	5.0		µg/Kg	1	1/21/2011 06:47 PM
Surr: Bromofluorobenzene (PID)	97.7	64-116		%REC	1	1/21/2011 06:47 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 02:40 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 02:40 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 02:40 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 02:40 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 02:40 PM
Surr: Decachlorobiphenyl	74.8	21-132		%REC	1	1/24/2011 02:40 PM
Surr: Tetrachloro-m-xylene	70.0	22-110		%REC	1	1/24/2011 02:40 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124D	QC Batch: 69909			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 12:35 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S15,S16,S17,S18-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-054A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_110124C	QC Batch: 69908			PrepDate: 1/21/2011		Analyst: **JSD**
Antimony	ND	2.0		mg/Kg	1	1/24/2011 05:42 PM
Arsenic	ND	1.0		mg/Kg	1	1/24/2011 05:42 PM
Barium	110	1.0		mg/Kg	1	1/24/2011 05:42 PM
Beryllium	ND	2.0		mg/Kg	2	1/25/2011 09:11 AM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 05:42 PM
Chromium	15	1.0		mg/Kg	1	1/24/2011 05:42 PM
Cobalt	9.2	1.0		mg/Kg	1	1/24/2011 05:42 PM
Copper	6.3	2.0		mg/Kg	1	1/24/2011 05:42 PM
Lead	4.4	1.0		mg/Kg	1	1/24/2011 05:42 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 05:42 PM
Nickel	22	1.0		mg/Kg	1	1/24/2011 05:42 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 05:42 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 05:42 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 05:42 PM
Vanadium	17	1.0		mg/Kg	1	1/24/2011 05:42 PM
Zinc	15	1.0		mg/Kg	1	1/24/2011 05:42 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110120D	QC Batch: 69892			PrepDate: 1/20/2011		Analyst: **CBR**
DRO	ND	1.0		mg/Kg	1	1/20/2011 09:32 PM
ORO	ND	1.0		mg/Kg	1	1/20/2011 09:32 PM
Surr: p-Terphenyl	79.8	30-128		%REC	1	1/20/2011 09:32 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
GRO	ND	1.0		mg/Kg	1	1/21/2011 07:02 PM
Surr: Bromofluorobenzene (FID)	91.6	56-137		%REC	1	1/21/2011 07:02 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
Benzene	ND	5.0		µg/Kg	1	1/21/2011 07:02 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 07:02 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 07:02 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S15,S16,S17,S18-2
Lab Order: 115854 **Collection Date:** 1/17/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-054A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 07:02 PM
Toluene	ND	5.0		µg/Kg	1	1/21/2011 07:02 PM
Surr: Bromofluorobenzene (PID)	93.1	64-116		%REC	1	1/21/2011 07:02 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate: 1/21/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 02:53 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 02:53 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 02:53 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 02:53 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 02:53 PM
Surr: Decachlorobiphenyl	85.2	21-132		%REC	1	1/24/2011 02:53 PM
Surr: Tetrachloro-m-xylene	89.5	22-110		%REC	1	1/24/2011 02:53 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124E	QC Batch: 69910			PrepDate: 1/21/2011		Analyst: **VV**
Mercury	0.11	0.10		mg/Kg	1	1/24/2011 01:17 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S19,S20,S21,S22-0
Lab Order: 115854 **Collection Date:** 1/18/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-055A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_110124C	QC Batch: 69908			PrepDate: 1/21/2011	Analyst: **JSD**	
Antimony	ND	2.0		mg/Kg	1	1/24/2011 06:03 PM
Arsenic	2.6	1.0		mg/Kg	1	1/24/2011 06:03 PM
Barium	100	1.0		mg/Kg	1	1/24/2011 06:03 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 06:03 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 06:03 PM
Chromium	49	1.0		mg/Kg	1	1/24/2011 06:03 PM
Cobalt	13	1.0		mg/Kg	1	1/24/2011 06:03 PM
Copper	8.7	2.0		mg/Kg	1	1/24/2011 06:03 PM
Lead	19	1.0		mg/Kg	1	1/24/2011 06:03 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 06:03 PM
Nickel	55	1.0		mg/Kg	1	1/24/2011 06:03 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 06:03 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 06:03 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 06:03 PM
Vanadium	17	1.0		mg/Kg	1	1/24/2011 06:03 PM
Zinc	30	1.0		mg/Kg	1	1/24/2011 06:03 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110121C	QC Batch: 69901			PrepDate: 1/21/2011	Analyst: **CBR**	
DRO	2.4	1.0		mg/Kg	1	1/21/2011 04:13 PM
ORO	4.5	1.0		mg/Kg	1	1/21/2011 04:13 PM
Surr: p-Terphenyl	109	30-128		%REC	1	1/21/2011 04:13 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:	Analyst: **TT**	
GRO	ND	1.0		mg/Kg	1	1/21/2011 07:16 PM
Surr: Bromofluorobenzene (FID)	97.9	56-137		%REC	1	1/21/2011 07:16 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:	Analyst: **TT**	
Benzene	ND	5.0		µg/Kg	1	1/21/2011 07:16 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 07:16 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 07:16 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S19,S20,S21,S22-0
Lab Order: 115854 **Collection Date:** 1/18/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-055A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 07:16 PM
Toluene	ND	5.0		µg/Kg	1	1/21/2011 07:16 PM
Surr: Bromofluorobenzene (PID)	101	64-116		%REC	1	1/21/2011 07:16 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate:	1/21/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 03:06 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 03:06 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 03:06 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 03:06 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 03:06 PM
Surr: Decachlorobiphenyl	56.9	21-132		%REC	1	1/24/2011 03:06 PM
Surr: Tetrachloro-m-xylene	54.6	22-110		%REC	1	1/24/2011 03:06 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124E	QC Batch: 69910			PrepDate:	1/21/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 01:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S19,S20,S21,S22-2
Lab Order: 115854 **Collection Date:** 1/18/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-056A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / **EPA 6010B**						
RunID: ICP8_110124C	QC Batch: 69908			PrepDate: 1/21/2011		Analyst: **JSD**
Antimony	ND	2.0		mg/Kg	1	1/24/2011 06:07 PM
Arsenic	2.4	1.0		mg/Kg	1	1/24/2011 06:07 PM
Barium	95	1.0		mg/Kg	1	1/24/2011 06:07 PM
Beryllium	ND	1.0		mg/Kg	1	1/24/2011 06:07 PM
Cadmium	ND	1.0		mg/Kg	1	1/24/2011 06:07 PM
Chromium	68	1.0		mg/Kg	1	1/24/2011 06:07 PM
Cobalt	11	1.0		mg/Kg	1	1/24/2011 06:07 PM
Copper	9.0	2.0		mg/Kg	1	1/24/2011 06:07 PM
Lead	12	1.0		mg/Kg	1	1/24/2011 06:07 PM
Molybdenum	ND	1.0		mg/Kg	1	1/24/2011 06:07 PM
Nickel	70	1.0		mg/Kg	1	1/24/2011 06:07 PM
Selenium	ND	1.0		mg/Kg	1	1/24/2011 06:07 PM
Silver	ND	1.0		mg/Kg	1	1/24/2011 06:07 PM
Thallium	ND	1.0		mg/Kg	1	1/24/2011 06:07 PM
Vanadium	17	1.0		mg/Kg	1	1/24/2011 06:07 PM
Zinc	24	1.0		mg/Kg	1	1/24/2011 06:07 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / **EPA 8015B(M)**						
RunID: GC16_110121C	QC Batch: 69901			PrepDate: 1/21/2011		Analyst: **CBR**
DRO	ND	1.0		mg/Kg	1	1/21/2011 04:04 PM
ORO	ND	1.0		mg/Kg	1	1/21/2011 04:04 PM
Surr: p-Terphenyl	71.9	30-128		%REC	1	1/21/2011 04:04 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
GRO	ND	1.0		mg/Kg	1	1/21/2011 07:45 PM
Surr: Bromofluorobenzene (FID)	67.8	56-137		%REC	1	1/21/2011 07:45 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
Benzene	ND	5.0		µg/Kg	1	1/21/2011 07:45 PM
Ethylbenzene	ND	5.0		µg/Kg	1	1/21/2011 07:45 PM
m,p-Xylene	ND	10		µg/Kg	1	1/21/2011 07:45 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *26-Jan-11*

CLIENT: Geocon Consultants, Inc. **Client Sample ID:** Composite-S19,S20,S21,S22-2
Lab Order: 115854 **Collection Date:** 1/18/2011
Project: MSN SEGMENT B1 ADDTNL, E8469-06-0 **Matrix:** SOIL
Lab ID: 115854-056A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/PID				**EPA 8021B**		
RunID: GC2_110121B	QC Batch: E11VS028			PrepDate:		Analyst: **TT**
o-Xylene	ND	5.0		µg/Kg	1	1/21/2011 07:45 PM
Toluene	ND	5.0		µg/Kg	1	1/21/2011 07:45 PM
Surr: Bromofluorobenzene (PID)	70.5	64-116		%REC	1	1/21/2011 07:45 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110124A	QC Batch: 69924			PrepDate:	1/21/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
4,4´-DDE	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
4,4´-DDT	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
Aldrin	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
alpha-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
beta-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
Chlordane	ND	8.5		µg/Kg	1	1/24/2011 03:20 PM
delta-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
Dieldrin	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
Endosulfan I	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
Endosulfan II	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
Endrin	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
Endrin ketone	ND	2.0		µg/Kg	1	1/24/2011 03:20 PM
gamma-BHC	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
Heptachlor	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	1/24/2011 03:20 PM
Methoxychlor	ND	5.0		µg/Kg	1	1/24/2011 03:20 PM
Toxaphene	ND	50		µg/Kg	1	1/24/2011 03:20 PM
Surr: Decachlorobiphenyl	85.4	21-132		%REC	1	1/24/2011 03:20 PM
Surr: Tetrachloro-m-xylene	88.5	22-110		%REC	1	1/24/2011 03:20 PM
MERCURY BY COLD VAPOR TECHNIQUE				**EPA 7471A**		
RunID: AA5_110124E	QC Batch: 69910			PrepDate:	1/21/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	1/24/2011 01:23 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-69907** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **PBS** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/25/2011** SeqNo: **2093019**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	0.125	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-69907** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **LCSS** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2093026**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	49.156	2.0	50.00	0	98.3	80	120				
Arsenic	48.719	1.0	50.00	0	97.4	80	120				
Barium	52.276	1.0	50.00	0	105	80	120				
Beryllium	50.762	1.0	50.00	0	102	80	120				
Cadmium	51.251	1.0	50.00	0	103	80	120				
Chromium	48.248	1.0	50.00	0	96.5	80	120				
Cobalt	49.962	1.0	50.00	0	99.9	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-69907** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **LCSS** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2093026**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	49.661	2.0	50.00	0	99.3	80	120				
Lead	50.587	1.0	50.00	0	101	80	120				
Molybdenum	51.509	1.0	50.00	0	103	80	120				
Nickel	49.117	1.0	50.00	0.1254	98.0	80	120				
Selenium	46.291	1.0	50.00	0	92.6	80	120				
Silver	49.679	1.0	50.00	0	99.4	80	120				
Thallium	48.573	1.0	50.00	0	97.1	80	120				
Vanadium	51.041	1.0	50.00	0	102	80	120				
Zinc	51.213	1.0	50.00	0	102	80	120				

Sample ID: **115854-053A-DUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **Composite-S15,S16,** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2093036**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.459	2.0						0.3882	0	20	
Arsenic	1.276	1.0						0.8160	44.0	20	R
Barium	112.333	1.0						100.3	11.3	20	
Cadmium	0.345	1.0						0.2592	0	20	
Chromium	23.312	1.0						19.66	17.0	20	
Cobalt	10.955	1.0						11.18	2.01	20	
Copper	5.761	2.0						6.430	11.0	20	
Lead	13.484	1.0						10.56	24.3	20	R
Molybdenum	ND	1.0						0	0	20	
Nickel	39.857	1.0						31.61	23.1	20	R
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	22.576	1.0						18.10	22.0	20	R
Zinc	16.151	1.0						16.33	1.09	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **115854-053A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **Composite-S15,S16,** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2093037**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	88.031	2.0	125.0	0.3882	70.1	32	105				
Arsenic	95.435	1.0	125.0	0.8160	75.7	49	106				
Barium	207.586	1.0	125.0	100.3	85.8	31	133				
Cadmium	100.097	1.0	125.0	0.2592	79.9	51	103				
Chromium	123.517	1.0	125.0	19.66	83.1	45	114				
Cobalt	116.388	1.0	125.0	11.18	84.2	52	106				
Copper	112.188	2.0	125.0	6.430	84.6	54	125				
Lead	109.223	1.0	125.0	10.56	78.9	34	126				
Molybdenum	94.826	1.0	125.0	0	75.9	54	106				
Nickel	166.988	1.0	125.0	31.61	108	45	111				
Selenium	91.865	1.0	125.0	0	73.5	47	104				
Silver	100.556	1.0	125.0	0	80.4	56	112				
Thallium	94.358	1.0	125.0	0	75.5	46	101				
Vanadium	123.284	1.0	125.0	18.10	84.1	54	114				
Zinc	117.109	1.0	125.0	16.33	80.6	28	125				

Sample ID: **115854-053A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **Composite-S15,S16,** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2093038**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	87.216	2.0	125.0	0.3882	69.5	32	105	88.03	0.930	20	
Arsenic	93.786	1.0	125.0	0.8160	74.4	49	106	95.43	1.74	20	
Barium	212.511	1.0	125.0	100.3	89.8	31	133	207.6	2.34	20	
Cadmium	100.043	1.0	125.0	0.2592	79.8	51	103	100.1	0.0541	20	
Chromium	136.355	1.0	125.0	19.66	93.4	45	114	123.5	9.88	20	
Cobalt	121.537	1.0	125.0	11.18	88.3	52	106	116.4	4.33	20	
Copper	112.631	2.0	125.0	6.430	85.0	54	125	112.2	0.394	20	
Lead	106.354	1.0	125.0	10.56	76.6	34	126	109.2	2.66	20	
Molybdenum	94.987	1.0	125.0	0	76.0	54	106	94.83	0.170	20	
Nickel	217.056	1.0	125.0	31.61	148	45	111	167.0	26.1	20	SR

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **115854-053A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129099**
Client ID: **Composite-S15,S16,** Batch ID: **69907** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2093038**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Selenium	91.051	1.0	125.0	0	72.8	47	104	91.86	0.890	20	
Silver	100.263	1.0	125.0	0	80.2	56	112	100.6	0.292	20	
Thallium	93.246	1.0	125.0	0	74.6	46	101	94.36	1.18	20	
Vanadium	125.605	1.0	125.0	18.10	86.0	54	114	123.3	1.86	20	
Zinc	116.466	1.0	125.0	16.33	80.1	28	125	117.1	0.550	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-69908** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **PBS** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092983**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	0.111	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-69908** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **LCSS** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092984**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	48.995	2.0	50.00	0	98.0	80	120				
Arsenic	48.306	1.0	50.00	0	96.6	80	120				
Barium	51.569	1.0	50.00	0	103	80	120				
Beryllium	49.722	1.0	50.00	0	99.4	80	120				
Cadmium	50.517	1.0	50.00	0	101	80	120				
Chromium	46.208	1.0	50.00	0	92.4	80	120				
Cobalt	49.096	1.0	50.00	0	98.2	80	120				
Copper	48.631	2.0	50.00	0	97.3	80	120				
Lead	50.063	1.0	50.00	0	100	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-69908** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **LCSS** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092984**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	50.584	1.0	50.00	0	101	80	120				
Nickel	48.107	1.0	50.00	0.1111	96.0	80	120				
Selenium	46.115	1.0	50.00	0	92.2	80	120				
Silver	48.570	1.0	50.00	0	97.1	80	120				
Thallium	48.057	1.0	50.00	0	96.1	80	120				
Vanadium	49.954	1.0	50.00	0	99.9	80	120				
Zinc	50.524	1.0	50.00	0	101	80	120				

Sample ID: **115854-054A-DUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092986**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0.3738	0	20	
Arsenic	0.348	1.0						0.4382	0	20	
Barium	102.670	1.0						114.4	10.8	20	
Cadmium	0.207	1.0						0.2233	0	20	
Chromium	15.582	1.0						15.39	1.26	20	
Cobalt	7.274	1.0						9.215	23.5	20	R
Copper	5.736	2.0						6.303	9.41	20	
Lead	3.757	1.0						4.423	16.3	20	
Molybdenum	ND	1.0						0	0	20	
Nickel	24.272	1.0						21.93	10.1	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	15.983	1.0						17.13	6.94	20	
Zinc	12.860	1.0						14.69	13.3	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **115854-054A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092987**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	93.621	2.0	125.0	0.3738	74.6	32	105				
Arsenic	96.991	1.0	125.0	0.4382	77.2	49	106				
Barium	215.667	1.0	125.0	114.4	81.0	31	133				
Cadmium	104.675	1.0	125.0	0.2233	83.6	51	103				
Chromium	119.711	1.0	125.0	15.39	83.5	45	114				
Cobalt	113.675	1.0	125.0	9.215	83.6	52	106				
Copper	114.807	2.0	125.0	6.303	86.8	54	125				
Lead	107.203	1.0	125.0	4.423	82.2	34	126				
Molybdenum	101.674	1.0	125.0	0	81.3	54	106				
Nickel	138.746	1.0	125.0	21.93	93.4	45	111				
Selenium	94.690	1.0	125.0	0	75.8	47	104				
Silver	104.828	1.0	125.0	0	83.9	56	112				
Thallium	96.929	1.0	125.0	0	77.5	46	101				
Vanadium	124.806	1.0	125.0	17.13	86.1	54	114				
Zinc	118.482	1.0	125.0	14.69	83.0	28	125				

Sample ID: **115854-054A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092988**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	92.281	2.0	125.0	0.3738	73.5	32	105	93.62	1.44	20	
Arsenic	95.672	1.0	125.0	0.4382	76.2	49	106	96.99	1.37	20	
Barium	215.996	1.0	125.0	114.4	81.3	31	133	215.7	0.152	20	
Cadmium	103.504	1.0	125.0	0.2233	82.6	51	103	104.7	1.13	20	
Chromium	118.713	1.0	125.0	15.39	82.7	45	114	119.7	0.837	20	
Cobalt	108.658	1.0	125.0	9.215	79.6	52	106	113.7	4.51	20	
Copper	116.329	2.0	125.0	6.303	88.0	54	125	114.8	1.32	20	
Lead	105.691	1.0	125.0	4.423	81.0	34	126	107.2	1.42	20	
Molybdenum	100.559	1.0	125.0	0	80.4	54	106	101.7	1.10	20	
Nickel	133.635	1.0	125.0	21.93	89.4	45	111	138.7	3.75	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **115854-054A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/24/2011** SeqNo: **2092988**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Selenium	93.319	1.0	125.0	0	74.7	47	104	94.69	1.46	20	
Silver	105.508	1.0	125.0	0	84.4	56	112	104.8	0.646	20	
Thallium	96.630	1.0	125.0	0	77.3	46	101	96.93	0.309	20	
Vanadium	123.259	1.0	125.0	17.13	84.9	54	114	124.8	1.25	20	
Zinc	118.273	1.0	125.0	14.69	82.9	28	125	118.5	0.177	20	

Sample ID: **115854-054A-DUP** SampType: **DUP** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/25/2011** SeqNo: **2092999**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Beryllium	0.232	2.0						0.2312	0	20	

Sample ID: **115854-054A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/25/2011** SeqNo: **2093000**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Beryllium	109.262	2.0	125.0	0.2312	87.2	56	106				

Sample ID: **115854-054A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129097**
Client ID: **Composite-S15,S16,** Batch ID: **69908** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **1/25/2011** SeqNo: **2093001**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Beryllium	113.366	2.0	125.0	0.2312	90.5	56	106	109.3	3.69	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-69881A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **PBS** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091646**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.229	5.0									

Sample ID: **LCS-69881** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **LCSS** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091647**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	244.999	5.0	250.0	0.2286	97.9	80	120				

Sample ID: **115854-010A-DUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **S5-2** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091658**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.333	5.0						5.853	9.29	20	

Sample ID: **115854-010A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **S5-2** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091659**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	219.195	5.0	250.0	5.853	85.3	34	126				

Sample ID: **MB-69881B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **PBS** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091660**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **115854-020A-DUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **S10-2** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091671**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.565	5.0						4.759	15.6	20	

Sample ID: **115854-020A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **S10-2** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091672**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	225.292	5.0	250.0	4.759	88.2	34	126				

Sample ID: **115854-020A-MSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129032**
Client ID: **S10-2** Batch ID: **69881** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091673**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	194.162	5.0	250.0	4.759	75.8	34	126	225.3	14.8	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-69882A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **PBS** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091674**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-69882** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **LCSS** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091675**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	252.533	5.0	250.0	0	101	80	120				

Sample ID: **115854-030A-DUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **S15-2** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091686**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.112	5.0						5.724	11.3	20	

Sample ID: **115854-030A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **S15-2** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091687**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	178.225	5.0	250.0	5.724	69.0	34	126				

Sample ID: **MB-69882B** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **PBS** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091688**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **115854-040A-DUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **S20-2** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091699**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	23.561	5.0						23.39	0.715	20	

Sample ID: **115854-040A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **S20-2** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091700**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	247.499	5.0	250.0	23.39	89.6	34	126				

Sample ID: **115854-040A-MSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129033**
Client ID: **S20-2** Batch ID: **69882** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091701**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	238.127	5.0	250.0	23.39	85.9	34	126	247.5	3.86	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-69883A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129034**
Client ID: **PBS** Batch ID: **69883** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091702**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	5.0									

Sample ID: **LCS-69883** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129034**
Client ID: **LCSS** Batch ID: **69883** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091703**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	275.375	5.0	250.0	0	110	80	120				

Sample ID: **115854-044A-DUP** SampType: **DUP** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129034**
Client ID: **S22-2** Batch ID: **69883** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091708**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.391	5.0						4.920	9.13	20	

Sample ID: **115854-044A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129034**
Client ID: **S22-2** Batch ID: **69883** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091709**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	223.082	5.0	250.0	4.920	87.3	34	126				

Sample ID: **115854-044A-MSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129034**
Client ID: **S22-2** Batch ID: **69883** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **1/21/2011** SeqNo: **2091710**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	226.373	5.0	250.0	4.920	88.6	34	126	223.1	1.46	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-69909** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129062**
Client ID: **PBS** Batch ID: **69909** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092397**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-66909** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129062**
Client ID: **LCSS** Batch ID: **69909** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092398**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.965	0.10	0.8300	0	116	80	120				

Sample ID: **115854-053A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129062**
Client ID: **Composite-S15,S16,** Batch ID: **69909** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092399**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.067	0.10	0.8300	0.06212	121	70	130				

Sample ID: **115854-053A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129062**
Client ID: **Composite-S15,S16,** Batch ID: **69909** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092400**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.050	0.10	0.8300	0.06212	119	70	130	1.067	1.66	20	

Sample ID: **115854-053A-DUP** SampType: **DUP** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129062**
Client ID: **Composite-S15,S16,** Batch ID: **69909** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092402**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.063	0.10						0.06212	0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-69910** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129065**
Client ID: **PBS** Batch ID: **69910** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092468**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-66910** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129065**
Client ID: **LCSS** Batch ID: **69910** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092469**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.909	0.10	0.8300	0	109	80	120				

Sample ID: **115854-054A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129065**
Client ID: **Composite-S15,S16,** Batch ID: **69910** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092470**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.045	0.10	0.8300	0.1094	113	70	130				

Sample ID: **115854-054A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129065**
Client ID: **Composite-S15,S16,** Batch ID: **69910** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092471**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.045	0.10	0.8300	0.1094	113	70	130	1.045	0.0126	20	

Sample ID: **115854-054A-DUP** SampType: **DUP** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129065**
Client ID: **Composite-S15,S16,** Batch ID: **69910** TestNo: **EPA 7471A** Analysis Date: **1/24/2011** SeqNo: **2092473**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.110	0.10						0.1094	0.364	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-69892** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129145**
Client ID: **PBS** Batch ID: **69892** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/20/2011** SeqNo: **2093707**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.215		2.670		83.0	30	128				

Sample ID: **LCS-69892** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129145**
Client ID: **LCSS** Batch ID: **69892** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/20/2011** SeqNo: **2093708**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	21.811	1.0	33.00	0	66.1	35	118				
Surr: p-Terphenyl	2.431		2.670		91.0	30	128				

Sample ID: **115854-050AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129145**
Client ID: **Composite-S9,S10,** Batch ID: **69892** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/20/2011** SeqNo: **2093709**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	27.115	1.0	33.00	0	82.2	25	129				
Surr: p-Terphenyl	2.163		2.670		81.0	30	128				

Sample ID: **115854-050AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129145**
Client ID: **Composite-S9,S10,** Batch ID: **69892** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/20/2011** SeqNo: **2093710**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	18.919	1.0	33.00	0	57.3	25	129	27.12	35.6	20	R
Surr: p-Terphenyl	1.758		2.670		65.8	30	128		0	0	

Sample ID: **115854-050ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129145**
Client ID: **Composite-S9,S10,** Batch ID: **69892** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/20/2011** SeqNo: **2093711**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **115854-050ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/20/2011** RunNo: **129145**
Client ID: **Composite-S9,S10,** Batch ID: **69892** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **1/20/2011** SeqNo: **2093711**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0						0	0	20	
ORO	ND	1.0						0	0	20	
Surr: p-Terphenyl	2.426		2.670		90.8	30	128		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-69901** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129150**
Client ID: **PBS** Batch ID: **69901** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/21/2011** SeqNo: **2093762**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	3.155		2.670		118	30	128				

Sample ID: **LCS-69901** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129150**
Client ID: **LCSS** Batch ID: **69901** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/21/2011** SeqNo: **2093763**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	29.055	1.0	33.00	0	88.0	35	118				
Surr: p-Terphenyl	3.049		2.670		114	30	128				

Sample ID: **115854-055ADUP** SampType: **DUP** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129150**
Client ID: **Composite-S19,S20,** Batch ID: **69901** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/21/2011** SeqNo: **2093766**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	2.295	1.0						2.410	4.90	20	
ORO	3.997	1.0						4.528	12.5	20	
Surr: p-Terphenyl	2.754		2.670		103	30	128		0	0	

Sample ID: **115854-055AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129150**
Client ID: **Composite-S19,S20,** Batch ID: **69901** TestNo: **EPA 8015B(M** **EPA 3550B** Analysis Date: **1/21/2011** SeqNo: **2093767**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	28.466	1.0	33.00	2.410	79.0	25	129				
Surr: p-Terphenyl	2.925		2.670		110	30	128				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **115854-055AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **1/21/2011** RunNo: **129150**
Client ID: **Composite-S19,S20,** Batch ID: **69901** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **1/21/2011** SeqNo: **2093768**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	32.202	1.0	33.00	2.410	90.3	25	129	28.47	12.3	20	
Surr: p-Terphenyl	2.867		2.670		107	30	128		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E110120MB1MS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091471**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	5.022	1.0	5.000	0	100	40	121				
Surr: Bromofluorobenzene (FID)	89.835		100.0		89.8	56	137				

Sample ID: **E110120MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **PBS** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091473**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	93.678		100.0		93.7	56	137				

Sample ID: **115864-003AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091484**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	3.033	1.0	5.000	0	60.7	40	121				
Surr: Bromofluorobenzene (FID)	110.798		100.0		111	56	137				

Sample ID: **115864-003AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091485**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.030	1.0	5.000	0	80.6	40	121	3.033	28.2	20	R
Surr: Bromofluorobenzene (FID)	99.792		100.0		99.8	56	137		0	0	

Sample ID: **E110120MB1MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091486**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	5.032	1.0	5.000	0	101	40	121	5.022	0.199	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E110120MB1MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091486**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	95.330		100.0		95.3	56	137		0	0	

Sample ID: **115854-045ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **Composite-S1,S2,S** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091488**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	
Surr: Bromofluorobenzene (FID)	94.313		100.0		94.3	56	137		0	0	

Sample ID: **E110120LCS1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129025**
Client ID: **LCSS** Batch ID: **E11VS025** TestNo: **EPA 8015B(M** Analysis Date: **1/20/2011** SeqNo: **2091497**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.883	1.0	5.000	0	97.7	70	130				
Surr: Bromofluorobenzene (FID)	95.193		100.0		95.2	56	137				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E110121LCS3** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **LCSS** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092105**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.879	1.0	5.000	0	97.6	70	130				
Surr: Bromofluorobenzene (FID)	92.493		100.0		92.5	56	137				

Sample ID: **E110121MB2MS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092106**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.825	1.0	5.000	0	96.5	40	121				
Surr: Bromofluorobenzene (FID)	85.311		100.0		85.3	56	137				

Sample ID: **E110121MB2MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092107**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	5.032	1.0	5.000	0	101	40	121	4.825	4.20	20	
Surr: Bromofluorobenzene (FID)	90.554		100.0		90.6	56	137		0	0	

Sample ID: **E110121MB2** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **PBS** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092108**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	87.249		100.0		87.2	56	137				

Sample ID: **115869-016AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092113**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	2.304	1.0	5.000	0	46.1	40	121				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **115869-016AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092113**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	100.322		100.0		100	56	137				

Sample ID: **115869-016AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092114**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.120	1.0	5.000	0	82.4	40	121	2.304	56.5	20	R
Surr: Bromofluorobenzene (FID)	97.949		100.0		97.9	56	137		0	0	

Sample ID: **115854-055ADUP** SampType: **DUP** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **129049**
Client ID: **Composite-S19,S20,** Batch ID: **E11VS028** TestNo: **EPA 8015B(M** Analysis Date: **1/21/2011** SeqNo: **2092511**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	20	
Surr: Bromofluorobenzene (FID)	97.235		100.0		97.2	56	137		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E110120LCS2** SampType: **LCSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129025**
Client ID: **LCSS02** Batch ID: **E11VS025** TestNo: **EPA 8021B** Analysis Date: **1/20/2011** SeqNo: **2091515**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	96.898	5.0	100.0	0	96.9	70	130	100.8	3.99	20	
Ethylbenzene	97.032	5.0	100.0	0	97.0	70	130	99.86	2.87	20	
m,p-Xylene	193.810	10	200.0	0	96.9	70	130	198.6	2.43	20	
o-Xylene	97.063	5.0	100.0	0	97.1	70	130	99.13	2.11	20	
Toluene	97.325	5.0	100.0	0	97.3	70	130	100.8	3.52	20	
Surr: Bromofluorobenzene (PID)	91.798		100.0		91.8	64	116		0	0	

Sample ID: **E110120LCS2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129025**
Client ID: **LCSS** Batch ID: **E11VS025** TestNo: **EPA 8021B** Analysis Date: **1/20/2011** SeqNo: **2091517**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	100.846	5.0	100.0	0	101	70	130				
Ethylbenzene	99.858	5.0	100.0	0	99.9	70	130				
m,p-Xylene	198.578	10	200.0	0	99.3	70	130				
o-Xylene	99.128	5.0	100.0	0	99.1	70	130				
Toluene	100.810	5.0	100.0	0	101	70	130				
Surr: Bromofluorobenzene (PID)	92.967		100.0		93.0	64	116				

Sample ID: **E110120MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129025**
Client ID: **PBS** Batch ID: **E11VS025** TestNo: **EPA 8021B** Analysis Date: **1/20/2011** SeqNo: **2091518**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	94.774		100.0		94.8	64	116				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **115864-003AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8021B** Analysis Date: **1/20/2011** SeqNo: **2091529**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	34.304	5.0	22.15	0	155	41	112				S
Ethylbenzene	38.404	5.0	42.30	0	90.8	26	100				
m,p-Xylene	134.247	10	180.2	0	74.5	32	106				
o-Xylene	50.757	5.0	64.80	0	78.3	30	100				
Toluene	137.783	5.0	172.6	0	79.8	38	112				
Surr: Bromofluorobenzene (PID)	104.270		100.0		104	64	116				

Sample ID: **115864-003AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129025**
Client ID: **ZZZZZZ** Batch ID: **E11VS025** TestNo: **EPA 8021B** Analysis Date: **1/20/2011** SeqNo: **2091530**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	40.064	5.0	22.15	0	181	41	112	34.30	15.5	20	S
Ethylbenzene	42.754	5.0	42.30	0	101	26	100	38.40	10.7	20	S
m,p-Xylene	160.773	10	180.2	0	89.2	32	106	134.2	18.0	20	
o-Xylene	61.011	5.0	64.80	0	94.2	30	100	50.76	18.3	20	
Toluene	157.975	5.0	172.6	0	91.5	38	112	137.8	13.7	20	
Surr: Bromofluorobenzene (PID)	103.456		100.0		103	64	116		0	20	

Sample ID: **115854-045ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129025**
Client ID: **Composite-S1,S2,S** Batch ID: **E11VS025** TestNo: **EPA 8021B** Analysis Date: **1/20/2011** SeqNo: **2091533**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Surr: Bromofluorobenzene (PID)	95.171		100.0		95.2	64	116		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E110121LCS4** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129049**
Client ID: **LCSS** Batch ID: **E11VS028** TestNo: **EPA 8021B** Analysis Date: **1/21/2011** SeqNo: **2092516**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	91.023	5.0	100.0	0	91.0	70	130				
Ethylbenzene	90.389	5.0	100.0	0	90.4	70	130				
m,p-Xylene	180.384	10	200.0	0	90.2	70	130				
o-Xylene	90.890	5.0	100.0	0	90.9	70	130				
Toluene	89.701	5.0	100.0	0	89.7	70	130				
Surr: Bromofluorobenzene (PID)	89.303		100.0		89.3	64	116				

Sample ID: **E110121LCS4** SampType: **LCSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129049**
Client ID: **LCSS02** Batch ID: **E11VS028** TestNo: **EPA 8021B** Analysis Date: **1/21/2011** SeqNo: **2092517**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	98.533	5.0	100.0	0	98.5	70	130	91.02	7.92	20	
Ethylbenzene	98.723	5.0	100.0	0	98.7	70	130	90.39	8.81	20	
m,p-Xylene	197.917	10	200.0	0	99.0	70	130	180.4	9.27	20	
o-Xylene	99.435	5.0	100.0	0	99.4	70	130	90.89	8.98	20	
Toluene	99.101	5.0	100.0	0	99.1	70	130	89.70	9.96	20	
Surr: Bromofluorobenzene (PID)	94.587		100.0		94.6	64	116		0	0	

Sample ID: **E110121MB2** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129049**
Client ID: **PBS** Batch ID: **E11VS028** TestNo: **EPA 8021B** Analysis Date: **1/21/2011** SeqNo: **2092518**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	88.853		100.0		88.9	64	116				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **115854-055ADUP** SampType: **DUP** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129049**
Client ID: **Composite-S19,S20,** Batch ID: **E11VS028** TestNo: **EPA 8021B** Analysis Date: **1/21/2011** SeqNo: **2092522**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0						0	0	20	
Ethylbenzene	ND	5.0						0	0	20	
m,p-Xylene	ND	10						0	0	20	
o-Xylene	ND	5.0						0	0	20	
Toluene	ND	5.0						0	0	20	
Surr: Bromofluorobenzene (PID)	100.851		100.0		101	64	116		0	0	

Sample ID: **115869-016AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8021B** Analysis Date: **1/21/2011** SeqNo: **2092550**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	29.255	5.0	22.15	0	132	41	112				S
Ethylbenzene	34.098	5.0	42.30	0	80.6	26	100				
m,p-Xylene	118.927	10	180.2	0	66.0	32	106				
o-Xylene	44.328	5.0	64.80	0	68.4	30	100				
Toluene	125.270	5.0	172.6	0	72.6	38	112				
Surr: Bromofluorobenzene (PID)	102.525		100.0		103	64	116				

Sample ID: **115869-016AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **129049**
Client ID: **ZZZZZZ** Batch ID: **E11VS028** TestNo: **EPA 8021B** Analysis Date: **1/21/2011** SeqNo: **2092551**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	41.087	5.0	22.15	0	185	41	112	29.26	33.6	20	SR
Ethylbenzene	49.473	5.0	42.30	0	117	26	100	34.10	36.8	20	SR
m,p-Xylene	165.370	10	180.2	0	91.8	32	106	118.9	32.7	20	R
o-Xylene	62.509	5.0	64.80	0	96.5	30	100	44.33	34.0	20	R
Toluene	161.940	5.0	172.6	0	93.8	38	112	125.3	25.5	20	R
Surr: Bromofluorobenzene (PID)	103.591		100.0		104	64	116		0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-69923** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **PBS** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093417**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	12.758		16.67		76.5	22	110				
Surr: Decachlorobiphenyl	13.444		16.67		80.6	21	132				

Sample ID: **LCS-69923** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **LCSS** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093418**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	11.863	1.0	16.67	0	71.2	53	107				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-69923** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **LCSS** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093418**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	11.629	2.0	16.67	0	69.8	53	107				
Endrin	10.932	2.0	16.67	0	65.6	51	110				
gamma-BHC	12.019	1.0	16.67	0	72.1	52	107				
Heptachlor	11.596	1.0	16.67	0	69.6	50	108				
Surr: Tetrachloro-m-xylene	11.949		16.67		71.7	22	110				
Surr: Decachlorobiphenyl	12.554		16.67		75.3	21	132				

Sample ID: **115854-046AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **Composite-S1,S2,S** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093419**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	17.115	2.0	16.67	0	103	33	130				
Aldrin	16.460	1.0	16.67	0	98.7	39	121				
Dieldrin	16.367	2.0	16.67	0	98.2	29	140				
Endrin	16.069	2.0	16.67	0	96.4	36	130				
gamma-BHC	16.788	1.0	16.67	0	101	38	122				
Heptachlor	16.260	1.0	16.67	0	97.5	36	123				
Surr: Tetrachloro-m-xylene	13.190		16.67		79.1	22	110				
Surr: Decachlorobiphenyl	15.266		16.67		91.6	21	132				

Sample ID: **115854-046AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **Composite-S1,S2,S** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093420**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	17.047	2.0	16.67	0	102	33	130	17.12	0.401	20	
Aldrin	15.991	1.0	16.67	0	95.9	39	121	16.46	2.89	20	
Dieldrin	16.228	2.0	16.67	0	97.3	29	140	16.37	0.854	20	
Endrin	15.708	2.0	16.67	0	94.2	36	130	16.07	2.27	20	
gamma-BHC	16.402	1.0	16.67	0	98.4	38	122	16.79	2.32	20	
Heptachlor	15.734	1.0	16.67	0	94.4	36	123	16.26	3.28	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **115854-046AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **Composite-S1,S2,S** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093420**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	13.015		16.67		78.1	22	110		0	0	
Surr: Decachlorobiphenyl	15.314		16.67		91.9	21	132		0	0	

Sample ID: **115854-050ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **Composite-S9,S10,** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093424**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0	0	0	0	0	0				
4,4´-DDE	ND	2.0	0	0	0	0	0				
4,4´-DDT	ND	2.0	0	0	0	0	0				
Aldrin	ND	1.0	0	0	0	0	0				
alpha-BHC	ND	1.0	0	0	0	0	0				
alpha-Chlordane	ND	1.0	0	0	0	0	0				
beta-BHC	ND	1.0	0	0	0	0	0				
Chlordane	ND	8.5	0	0	0	0	0				
delta-BHC	ND	1.0	0	0	0	0	0				
Dieldrin	ND	2.0	0	0	0	0	0				
Endosulfan I	ND	1.0	0	0	0	0	0				
Endosulfan II	ND	2.0	0	0	0	0	0				
Endosulfan sulfate	ND	2.0	0	0	0	0	0				
Endrin	ND	2.0	0	0	0	0	0				
Endrin aldehyde	ND	2.0	0	0	0	0	0				
Endrin ketone	ND	2.0	0	0	0	0	0				
gamma-BHC	ND	1.0	0	0	0	0	0				
gamma-Chlordane	ND	1.0	0	0	0	0	0				
Heptachlor	ND	1.0	0	0	0	0	0				
Heptachlor epoxide	ND	1.0	0	0	0	0	0				
Methoxychlor	ND	5.0	0	0	0	0	0				
Toxaphene	ND	50	0	0	0	0	0				
Surr: Tetrachloro-m-xylene	14.367		16.67		86.2	25	115				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **115854-050ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129069**
Client ID: **Composite-S9,S10,** Batch ID: **69923** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2093424**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	15.524		16.67		93.1	20	142				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-69924** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **PBS** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092552**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	13.676		16.67		82.0	22	110				
Surr: Decachlorobiphenyl	12.800		16.67		76.8	21	132				

Sample ID: **LCS-69924** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **LCSS** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092553**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	13.458	1.0	16.67	0	80.7	53	107				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-69924** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **LCSS** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092553**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	13.970	2.0	16.67	0	83.8	53	107				
Endrin	13.868	2.0	16.67	0	83.2	51	110				
gamma-BHC	13.544	1.0	16.67	0	81.2	52	107				
Heptachlor	13.467	1.0	16.67	0	80.8	50	108				
Surr: Tetrachloro-m-xylene	12.838		16.67		77.0	22	110				
Surr: Decachlorobiphenyl	12.359		16.67		74.1	21	132				

Sample ID: **115854-048AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **Composite-S5,S6,S** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092554**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	19.109	2.0	16.67	0	115	33	130				
Aldrin	15.670	1.0	16.67	0	94.0	39	121				
Dieldrin	16.924	2.0	16.67	0	102	29	140				
Endrin	17.286	2.0	16.67	0	104	36	130				
gamma-BHC	17.016	1.0	16.67	0	102	38	122				
Heptachlor	17.585	1.0	16.67	0	105	36	123				
Surr: Tetrachloro-m-xylene	12.679		16.67		76.1	22	110				
Surr: Decachlorobiphenyl	13.620		16.67		81.7	21	132				

Sample ID: **115854-048AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **Composite-S5,S6,S** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092555**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	18.637	2.0	16.67	0	112	33	130	19.11	2.50	20	
Aldrin	15.520	1.0	16.67	0	93.1	39	121	15.67	0.964	20	
Dieldrin	16.394	2.0	16.67	0	98.3	29	140	16.92	3.18	20	
Endrin	17.099	2.0	16.67	0	103	36	130	17.29	1.09	20	
gamma-BHC	16.816	1.0	16.67	0	101	38	122	17.02	1.19	20	
Heptachlor	17.343	1.0	16.67	0	104	36	123	17.59	1.39	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **115854-048AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **Composite-S5,S6,S** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092555**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	12.725		16.67		76.3	22	110		0	0	
Surr: Decachlorobiphenyl	13.712		16.67		82.3	21	132		0	0	

Sample ID: **115854-052ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **Composite-S13,S14-** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092560**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0						0	0	20	
4,4´-DDE	ND	2.0						0	0	20	
4,4´-DDT	ND	2.0						0	0	20	
Aldrin	ND	1.0						0	0	20	
alpha-BHC	ND	1.0						0	0	20	
alpha-Chlordane	ND	1.0						0	0	20	
beta-BHC	ND	1.0						0	0	20	
Chlordane	ND	8.5						0	0	20	
delta-BHC	ND	1.0						0	0	20	
Dieldrin	ND	2.0						0	0	20	
Endosulfan I	ND	1.0						0	0	20	
Endosulfan II	ND	2.0						0	0	20	
Endosulfan sulfate	ND	2.0						0	0	20	
Endrin	ND	2.0						0	0	20	
Endrin aldehyde	ND	2.0						0	0	20	
Endrin ketone	ND	2.0						0	0	20	
gamma-BHC	ND	1.0						0	0	20	
gamma-Chlordane	ND	1.0						0	0	20	
Heptachlor	ND	1.0						0	0	20	
Heptachlor epoxide	ND	1.0						0	0	20	
Methoxychlor	ND	5.0						0	0	20	
Toxaphene	ND	50						0	0	20	
Surr: Tetrachloro-m-xylene	13.924		16.67		83.5	25	115		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **115854-052ADUP** SampType: **DUP** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/21/2011** RunNo: **129073**
Client ID: **Composite-S13,S14-** Batch ID: **69924** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **1/24/2011** SeqNo: **2092560**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	14.182		16.67		85.1	20	142		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **115854-040ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **129132**
Client ID: **S20-2** Batch ID: **R129132** TestNo: **EPA 9045C** Analysis Date: **1/25/2011** SeqNo: **2093498**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	6.010	0.10						6.130	1.98	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CHAIN OF CUSTODY RECORD

ADVANCED TECHNOLOGY LABORATORIES
3275 Walnut Ave., Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

P.O.#: _____ Quote #: _____

Logged By: _____ Date: 1/19/11

NOTE: Please include your Quote No. to ensure proper pricing of your project.

FOR LABORATORY USE ONLY:

Method of Transport
☐ Client ☐ ATL
☐ FedEx ☐ OnTrac
☑ GSO
☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED 3.8°C Y☐ N☐ 4. CUSTODY SEAL Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ N/A 5. # OF SPLS MATCH COC Y☑ N☐
3. CONTAINER INTACT Y☑ N☐ 6. PRESERVED Y☐ N☑

Client: **Geocon Consultants, Inc.** Address: 6671 Brisa Street TEL: (925) 371-5900
Attn: City Livermore State CA Zip Code 94550 FAX: (925) 371-5915

Project Name: MSN SEGMENT B1 ADDTNL Project #: E6464-06-016 Sampler: (Printed Name) C.M./D.W. (Signature) C.MERRITT

Relinquished by: (Signature and Printed Name) CHRIS MERRITT Date: 1-18-11 Time: 1700 Received by: (Signature and Printed Name) C. Hyun Date: 1/19/11 Time: 8:10
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
CM (Print Name) 1-18-11 (Date)
CM (Signature)

Send Report To:
Attn: A/A
Co:
Addr:
City: State: Zip:

Bill To:
Attn:
Co: A/A
Addr:
City: State: Zip:

Special Instructions/Comments:
COMPOSITE S1-0, S2-0, S3-0, S4-0 (4-PT) } FOR * SEE TABLE
S1-2, S2-2, S3-2, S4-2 }
COMPOSITE S5 THROUGH S8 (4 PT) AS ABOVE " "
pH – 10% RANDOM (LAB) – TOTAL PROJECT

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal) Pb	8015B (GRO) / 8021 (BTEX)	8015B (DRO) TPH	TITLE 22 / CAM 17 (6010 / 7000)	SEDIMENT	SOLID	SOIL	DRINKING WATER	GROUND WATER	WASTEWATER	STORMWATER	AQUEOUS	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	115834-01	S1-0	1-17-11	0925	*				X	*	*	#		X								1	T	M	C	
	02	S1-2		0935	*				X	*	*	*														
	03	S2-0		0940	*				X	*	*	*														
	04	S2-2		0950	*				X	*	*	*														
	05	S3-0		0955	*				X	*	*	*														
	06	S3-2		1005	*				X	*	*	*														
	07	S4-0		1015	*				X	*	*	*														
	08	S4-2		1020	*				X	*	*	*														
	09	S5-0		VAN	*				X	*	*	*														
	10	S5-2		↓	*				X	*	*	*														

QA/QC: RTNE ☐ CT ☒ Legal ☐ SWRCB ☐ Logcode ____ OTHER ____

· TAT starts 8 a.m. following day if samples received after 5 p.m.

TAT: ☐A= Overnight ≤ 24 hrs ☐B= Emergency Next workday ☐C= Critical 2 Workdays ☐D= Urgent 3 Workdays ☐E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

ADVANCED TECHNOLOGY LABORATORIES
3275 Walnut Ave., Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

P.O.#: _____ Quote #: _____

Logged By: _____ Date: _____

NOTE: Please include your Quote No. to ensure proper pricing of your project.

FOR LABORATORY USE ONLY:

Method of Transport
☐ Client ☐ ATL
☐ FedEx ☐ OnTrac
☐ GSO
☐ Other: _____

Sample Condition Upon Receipt

1. CHILLED	Y☐ N☐	4. CUSTODY SEAL	Y☐ N☐
2. HEADSPACE (VOA)	Y☐ N☐	5. # OF SPLS MATCH COC	Y☐ N☐
3. CONTAINER INTACT	Y☐ N☐	6. PRESERVED	Y☐ N☐

Client: **Geocon Consultants, Inc.**
Attn:
Address: 6671 Brisa Street
City Livermore State CA Zip Code 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

Project Name: MSN SEG B1 ADDITIONAL Project #: E8469-0601B Sampler: (Printed Name) CM/DW (Signature) C. MERRITT

Relinquished by: (Signature and Printed Name) CHRIS MERRITT	Date: 1-18-11	Time: 1700	Received by: (Signature and Printed Name) C. Aguilar	Date: 1/19/11	Time: 8:30
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
CM (Print Name) 1-18-11 (Date)
CM (Signature)

Send Report To:
Attn: A/A 1
Co:
Addr:
City: State: Zip:

Bill To:
Attn: A/A 1
Co:
Addr:
City: State: Zip:

Special Instructions/Comments:
S6 TO S8 SEE P1
S9-0, S10-0, S11-0, S12-0 — * 4 TO 1 COMPOSITE
S9-2, S10-2, S11-2, S12-2 * 4 TO 1 COMPOSITE
(SEE Pg 3)

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal) Pb	8015B (GRO) / 8021 (BTEX)	8015B (DRO)	TITLE 22 / CAM 17 (6010 / 7000)	SEDIMENT	SOLID	SOIL	DRINKING WATER	GROUND WATER	WASTEWATER	STORMWATER	AQUEOUS	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	115454-11	S6-0	1-18-11	1035					X					X							E	1	T M	C	
	12	S6-2		1040					X																
	13	S7-0							X																
	14	S7-2							X																
	15	S8-0							X																
	16	S8-2							X																
	17	S9-0							X																
	18	S9-2							X																
	19	S10-0							X																
	20	S10-2							X																

Q A / Q C
RTNE ☐
CT ☑
Legal ☐
SWRCB ☐ Logcode ____
OTHER ____

- TAT starts 8 a.m. following day if samples received after 5 p.m.

TAT: ☐A= Overnight ≤ 24 hrs ☐B= Emergency Next workday ☐C= Critical 2 Workdays ☐D= Urgent 3 Workdays ☐E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives:
H=Hcl N=HNO_3 S=H_2SO_4 C=4°C
Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

ADVANCED TECHNOLOGY LABORATORIES
3275 Walnut Ave., Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

P.O.#: _____ Quote #: _____

Logged By: _____ Date: _____

NOTE: Please include your Quote No. to ensure proper pricing of your project.

FOR LABORATORY USE ONLY:

Method of Transport
☐ Client ☐ ATL
☐ FedEx ☐ OnTrac
☐ GSO
☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. CUSTODY SEAL Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: **Geocon Consultants, Inc.** Address: 6671 Brisa Street TEL: (925) 371-5900
Attn: City Livermore State CA Zip Code 94550 FAX: (925) 371-5915

Project Name: MSW SEG B1 ADDITIONAL Project #: E581469-06-01B Sampler: (Printed Name) CM/DW (Signature) C. MERRITT

Relinquished by: (Signature and Printed Name) CHRIS MERRITT	Date: 1-18-11	Time: 1700	Received by: (Signature and Printed Name) C. Agustin	Date: 1/19/11	Time: 830
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
CM (Print Name) 1-18-11 (Date)
CM (Signature)

Send Report To:
Attn: A/A
Co: A/A
Addr:
City: State: Zip:

Bill To:
Attn: A/A
Co: A/A
Addr:
City: State: Zip:

Special Instructions/Comments:
S11, S12 COMPOSITES SEE P2
S13-0, S14-0 * 2 TO 1 COMPOSITE
S13-2, S14-2 * 2 TO 1 COMPOSITE
S15 TO S18 - SEE PAGE 4

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides), 8082 (PCB), 8260B (Volatiles), 8270C (BNA), 6010B (Total Metal) Pb, 8015B (GRO) / 8021 (BTEX), 8015B (DRO) + MO, TITLE 22 / CAM 17 (6010 / 7000)

SPECIFY APPROPRIATE MATRIX: SEDIMENT, SOLID, SOIL, DRINKING WATER, GROUND WATER, WASTEWATER, STORMWATER, AQUEOUS

PRESERVATION

Q A / Q C: RTNE ☐ CT ☐ Legal ☐ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	PRESERVATION	REMARKS
	115451-71	S11-0	1-17-11	VAR	E	1	T	C	
	72	S11-2							
	73	S12-0							
	74	S12-2							
	75	S13-0							
	76	S13-2							
	77	S14-0							
	78	S14-2							
	79	S15-0							
	80	S15-2							

• TAT starts 8 a.m. following day if samples received after 5 p.m.

TAT: ☐A= Overnight ≤ 24 hrs ☐B= Emergency Next workday ☐C= Critical 2 Workdays ☐D= Urgent 3 Workdays ☐E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

ADVANCED TECHNOLOGY LABORATORIES
3275 Walnut Ave., Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

P.O.#: _____ Quote #: _____

Logged By: _____ Date: _____

NOTE: Please include your Quote No. to ensure proper pricing of your project.

FOR LABORATORY USE ONLY:

Method of Transport
☐ Client ☐ ATL
☐ FedEx ☐ OnTrac
☐ GSO
☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED Y☐ N☐ 4. CUSTODY SEAL Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: **Geocon Consultants, Inc.**
Attn:
Address: 6671 Brisa Street
City Livermore State CA Zip Code 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

Project Name: MSN SEC B1 ADDITIONAL Project #: E8469-06-01B Sampler: (Printed Name) CM/DW (Signature) C. MERRITT

Relinquished by: (Signature and Printed Name) CHRIS MERRITT Date: 1-18-11 Time: 1700 Received by: (Signature and Printed Name) C. Argote Date: 1/19/11 Time: 830
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
CM 1-18-11
Print Name Date
CM
Signature

Send Report To:
Attn: A/A 1
Co:
Addr:
City: State: Zip:

Bill To:
Attn: A/A 1
Co:
Addr:
City: State: Zip:

Special Instructions/Comments:
*4-PT COMPOSITES: S15-0, S16-0, S17-0, S18-0
#4 TO 1 COMPOSITE
S19-0, S20-0, S21-0, S22-0
S19-2, S20-2, S21-2, S22-2
S15-2, S16-2, S17-2, S18-2

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal) - PT	8015B (GRO) / 8021 (BTEX)	8015B (DRO) / MO	TITLE 22 / CAM 17 (6010 / 7000)	SEDIMENT	SOLID	SOIL	DRINKING WATER	GROUND WATER	WASTEWATER	STORMWATER	AQUEOUS	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	115654- 31	S16-0	1-17-11	VAR				X	*	*	*			X								E	1	T	m	e	
	32	S16-2							*	*	*															
	33	S17-0							*	*	*															
	34	S17-2								*	*	*														
	35	S18-0								*	*	*														
	36	S18-2								*	*	*														
	37	S19-0	1-18-11	VAR						*	*	*														
	38	S19-2								*	*	*														
	39	S20-0								*	*	*														
	40	S20-2								*	*	*														

QA/QC: RTNE ☐ CT ☒ Legal ☐ SWRCB ☐ Logcode ____ OTHER ____

- TAT starts 8 a.m. following day if samples received after 5 p.m.

TAT: ☐A= Overnight ≤ 24 hrs ☐B= Emergency Next workday ☐C= Critical 2 Workdays ☐D= Urgent 3 Workdays ☐E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

ADVANCED TECHNOLOGY LABORATORIES
3275 Walnut Ave., Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

P.O.#: _____ Quote #: _____

Logged By: _____ Date: _____

NOTE: Please include your Quote No. to ensure proper pricing of your project.

FOR LABORATORY USE ONLY:

Method of Transport
☐ Client ☐ ATL
☐ FedEx ☐ OnTrac
☐ GSO
☐ Other: _____

Sample Condition Upon Receipt

1. CHILLED	Y☐ N☐	4. CUSTODY SEAL	Y☐ N☐
2. HEADSPACE (VOA)	Y☐ N☐	5. # OF SPLS MATCH COC	Y☐ N☐
3. CONTAINER INTACT	Y☐ N☐	6. PRESERVED	Y☐ N☐

Client: **Geocon Consultants, Inc.** Address: 6671 Brisa Street TEL: (925) 371-5900

Attn: SEE Pg 1 City Livermore State CA Zip Code 94550 FAX: (925) 371-5915

Project Name: SEE Pg 1 Project #: Sampler: (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) CHRIS MERRITT	Date: 1-15-11	Time: 1700	Received by: (Signature and Printed Name) C. Taylor	Date: 1/19/11	Time: 8:20
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: SEE Pg 1
Print Name Date
Signature

Send Report To:
Attn: _____
Co: _____
Addr: _____
City: State: Zip:

Bill To:
Attn: _____
Co: _____
Addr: _____
City: State: Zip:

Special Instructions/Comments: * SEE Pg 4 (RETURN COOLERS PLEASE)
pH - 10% RANDOM (LAB) - TOTAL PROJECT

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

PRESERVATION

Q A / Q C
RTNE ☐
CT ☒
Legal ☐
SWRCB ☐ Logcode ____
OTHER ____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal) – Pb	8015B (GRO) / 8021 (BTEX)	8015B (DRO) / mo	TITLE 22 / CAM 17 (6010 / 7000)	SEDIMENT	SOLID	SOIL	DRINKING WATER	GROUND WATER	WASTEWATER	STORMWATER	AQUEOUS	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	11885 41	S21 – 0	1/18/11	VAH	*			X	*	*	*			X							E	1	T	M	C
	42	↓ – 2	↓	↓	*			↓	*	*	*			↓							↓	↓	↓	↓	
	43	S22 – 0			*				*	*	*														
	44	↓ – 2	↓	↓	*			↓	*	*	*			↓							↓	↓	↓	↓	

• TAT starts 8 a.m. following day if samples received after 5 p.m.

TAT: ☐A= Overnight ≤ 24 hrs ☐B= Emergency Next workday ☐C= Critical 2 Workdays ☐D= Urgent 3 Workdays ☐E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

Sample Location	Sample Depth	Total Lead	CAM 17 Metals	TPHg/BTEX	TPHd/mo	Pesticides
EPA Method	(feet)	(6010)	(6010/7471)	(8015/8021)	(8015)	(8081)
SO1	0	1	---	---	---	---
SO1	2	1	---	---	---	---
SO2	0	1	---	---	---	---
SO2	2	1	---	---	---	---
SO3	0	1	---	---	---	---
SO3	2	1	---	---	---	---
SO4	0	1	---	---	---	---
SO4	2	1	---	---	---	---
Comp 1-4	0	---	1	1	1	1
Comp 1-4	2	---	1	1	1	1
SO5	0	1	---	---	---	---
SO5	2	1	---	---	---	---
SO6	0	1	---	---	---	---
SO6	2	1	---	---	---	---
SO7	0	1	---	---	---	---
SO7	2	1	---	---	---	---
SO8	0	1	---	---	---	---
SO8	2	1	---	---	---	---
Comp 5-8	0	---	1	1	1	1
Comp 5-8	2	---	1	1	1	1
SO9	0	1	---	---	---	---
SO9	2	---	---	---	---	---
SO10	0	1	---	---	---	---
SO10	2	---	---	---	---	---
SO11	0	1	---	---	---	---
SO11	2	---	---	---	---	---
SO12	0	1	---	---	---	---
SO12	2	---	---	---	---	---
Comp 9-12	0	---	1	1	1	1
Comp 9-12	2	---	1	1	1	1
SO13	0	1	---	---	---	---
SO13	2	---	---	---	---	---
SO14	0	1	---	---	---	---
SO14	2	---	---	---	---	---
Comp 13-14	0	---	1	1	1	1
Comp 13-14	2	---	1	1	1	1
SO15	0	1	---	---	---	---
SO15	2	---	---	---	---	---
SO16	0	1	---	---	---	---
SO16	2	---	---	---	---	---
SO17	0	1	---	---	---	---
SO17	2	---	---	---	---	---
SO18	0	1	---	---	---	---
SO18	2	---	---	---	---	---
Comp 15-18	0	---	1	1	1	1
Comp 15-18	2	---	1	1	1	1
SO19	0	1	---	---	---	---
SO19	2	---	---	---	---	---
SO20	0	1	---	---	---	---
SO20	2	---	---	---	---	---
SO21	0	1	---	---	---	---
SO21	2	---	---	---	---	---
SO22	0	1	---	---	---	---
SO22	2	---	---	---	---	---
Comp 19-22	0	---	1	1	1	1
Comp 19-22	2	---	1	1	1	1
	TOTAL	30	12	12	12	12

February 10, 2011

Chris Merritt
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 115854

RE: MSN SEGMENT B1 ADDTNL, E8469-06-01B

Attention: Chris Merritt

Enclosed are the results for sample(s) received on January 19, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories

Date: *10-Feb-11*

CLIENT: Geocon Consultants, Inc.
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B
Lab Order: 115854

CASE NARRATIVE

Analytical Comments for Method 6010

Dilution was necessary for sample 115854-056A, due to sample matrix.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *10-Feb-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	Composite-S19,S20,S21,S22-2
Lab Order:	115854	**Collection Date:**	1/18/2011
Project:	MSN SEGMENT B1 ADDTNL, E8469-06-0	**Matrix:**	SOIL
Lab ID:	115854-056A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS BY STLC						
		WET/ EPA 6010B				
RunID: ICP10_110210C	QC Batch: R129823			PrepDate:		Analyst: **JSD**
Chromium	ND	1.0		mg/L	20	2/10/2011 12:11 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **MB-70403** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **129823**
Client ID: **PBS** Batch ID: **R129823** TestNo: **WET/ EPA 60** Analysis Date: **2/10/2011** SeqNo: **2108008**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.050									

Sample ID: **MB-70403A ST** SampType: **MBLK** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **129823**
Client ID: **PBS** Batch ID: **R129823** TestNo: **WET/ EPA 60** Analysis Date: **2/10/2011** SeqNo: **2108009**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	1.0									

Sample ID: **LCS-70403** SampType: **LCS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **129823**
Client ID: **LCSS** Batch ID: **R129823** TestNo: **WET/ EPA 60** Analysis Date: **2/10/2011** SeqNo: **2108010**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.923	0.050	1.000	0	92.3	85	115				

Sample ID: **116006-046A-DUP** SampType: **DUP** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **129823**
Client ID: **ZZZZZZ** Batch ID: **R129823** TestNo: **WET/ EPA 60** Analysis Date: **2/10/2011** SeqNo: **2108013**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	0.073	1.0						0.06624	0	20	

Sample ID: **116006-046A-MS** SampType: **MS** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **129823**
Client ID: **ZZZZZZ** Batch ID: **R129823** TestNo: **WET/ EPA 60** Analysis Date: **2/10/2011** SeqNo: **2108014**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.309	1.0	2.500	0.06624	89.7	78	115				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 115854
Project: MSN SEGMENT B1 ADDTNL, E8469-06-01B

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_ST

Sample ID: **116006-046A-MSD** SampType: **MSD** TestCode: **6010_ST** Units: **mg/L** Prep Date: RunNo: **129823**
Client ID: **ZZZZZZ** Batch ID: **R129823** TestNo: **WET/ EPA 60** Analysis Date: **2/10/2011** SeqNo: **2108015**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	2.308	1.0	2.500	0.06624	89.7	78	115	2.309	0.0319	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Diane Galvan

From: Lauren Vigliotti [vigliotti@geoconinc.com]
Sent: Wednesday, February 02, 2011 2:25 PM
To: Diane Galvan
Subject: WO115854

Hi Diane:
Please analyze sample
Composite-
S19,S20,S21,S22-2 for WET
chromium, under a standard
TAT. thank you!

Lauren Vigliotti, PG | *Project Geologist*
Geocon Consultants, Inc.
6671 Brisa Street, Livermore, California 94550
Tel 925.371.5900 Fax 925.371.5915
www.geoconinc.com

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Lauren Vigliotti**
Geocon Consultants, Inc.
6671 Brisa Street

Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **M&N-B1/E8469-06-01B**

Customer ID: GECN21
Customer PO: E8469-06-01B
Received: 01/20/11 9:00 AM
EMSL Order: 091100584

EMSL Proj:
Analysis Date: 2/2/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
S1-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0001		Non-Fibrous Homogeneous			
S4-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0002		Non-Fibrous Homogeneous			
S6-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0003		Non-Fibrous Homogeneous			
S10-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0004		Non-Fibrous Homogeneous			
S13-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0005		Non-Fibrous Homogeneous			
S16-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0006		Non-Fibrous Homogeneous			
S19-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0007		Non-Fibrous Homogeneous			
S22-2		Brown		100.00% Non-fibrous (other)	**None Detected**
091100584-0008		Non-Fibrous Homogeneous			

Initial report from 02/02/2011 17:49:25

Analyst(s)
Rui Cindy Geng (8)

Baojia Ke, Laboratory Manager
or other approved signatory

This report relates only to the samples listed above and may not be reproduced except in full, without EMSL's written approval. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. EMSL is not responsible for sample collection activities or method limitations. Some samples may contain asbestos fibers below the resolution limit of PLM. EMSL recommends that samples reported as none detected or less than the limit of detection undergo additional analysis via TEM.Samples received in good condition unless otherwise noted.

Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San Leandro CA

THIS IS THE LAST PAGE OF THE REPORT.

091100584

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number (*Lab Use Only*): 091100584

EMSL ANALYTICAL, INC.
2235 POLVOROSA DR., STE. 230
SAN LEANDRO, CA 94577
PHONE: (510) 895-3675
FAX: (510) 895-3680

Company : GEOCON		**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments**	
Street: 6671 BRISA ST		*Third Party Billing requires written authorization from third party*	
City: LIVERMORE	**State/Province:** CA	**Zip/Postal Code:** 94550	**Country:** USA
Report To (Name): L. VIGLIOTTI		**Fax #:** 925-371-5915	
Telephone #: 925-371-5900		**Email Address:** VIGLIOTTI@GEOCONINC.COM	
Project Name/Number: MSN-B1/E8469-06-01B			
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order:** —	**U.S. State Samples Taken:** —	

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☒ 2 Week

**For TEM Air 3 hours/6 hours, please call ahead to schedule. *There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☐ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT** (AHERA only)
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☒ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: D. WATTS **Samplers Signature:** WATTS

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
S1-2	SOIL - NOA	NA	17 JAN 2011
S4-2			
S6-2			
S10-2			
S13-2			
S16-2			
S19-2			18 JAN 2011
S22-2			

Client Sample # (s): S1-2 - S22-2 **Total # of Samples:** 8

Relinquished (Client): WATTS **Date:** 18 JAN 2011 **Time:** 1600

Received (Lab): FED-EX **Date:** 18 JAN 2011 1/20/11 **Time:** 1600 0900

Comments/Special Instructions:

SOIL (NOA)