FINAL Noise Study Report

US 101 Express Lanes Project

Santa Clara County

District 4

04-SCL-101 PM 16.00/52.55

04-SCL-101 PM 23.0/R24.1

Project No. 0412000459/EA 2G7100

May 2013

FINAL Noise Study Report

US 101 Express Lanes Project

Santa Clara County

District 4

04-SCL-101 PM 16.00/52.55

04-SCL-101 PM 23.0/R24.1

Project No. 0412000459/EA 2G7100

May 2013

Prepared By: _____ Date: 5/2/13

Michael S. Thill, Senior Consultant

Phone Number (707) 766-7700

Office Name Illingworth and Rodkin, Inc.

District/Region

Approved By: _____ Date: 5/6/13

Glenn Kinoshita, Branch Chief, Noise

Phone Number (510) 286-5677

Office Name Caltrans

District/Region District 4

Summary

Santa Clara Valley Transportation Authority (VTA), in cooperation with the California Department of Transportation (Caltrans), proposes to convert the existing High-Occupancy Vehicle (HOV) lanes along the United States Highway 101 (US 101) to High-Occupancy Toll (HOT) lanes (hereafter known as express lanes). A second express lane would be added in each direction on US 101 within the overall project limits from the East Dunne Avenue interchange in Morgan Hill to just north of the Oregon Expressway/Embarcadero Road interchange in Palo Alto. The express lanes will allow HOVs and eligible clean air vehicles to continue to use the lanes for free and eligible single-occupant vehicles (SOVs) to pay a toll. The project would also convert the US 101/State Route (SR) 85 HOV direct connectors in Mountain View to express lane connectors, restripe the northern 1.1 mile of SR 85 to introduce a buffer separating the mixed flow lanes from the express lane, and connect the SR 85 express lanes to the US 101 express lanes.

The purpose of this Noise Study Report (NSR) is to document the assessment of existing and future (2035) traffic noise levels at noise sensitive receptors in the vicinity of the proposed project and identify whether or not preliminary noise abatement measures are necessary for the project to comply with state and federal noise abatement/mitigation requirements. The primary objective of this study is to identify noise sensitive receptors where noise levels would approach or exceed the noise abatement criteria (NAC; 67 A-weighted decibel equivalent sound level [dBA $L_{eq[h]}$]) with the project or receptors that would experience a substantial increase in noise levels as a result of the project.

The study included noise measurements, prediction of future noise levels with the construction and operation of the project, and identification of measures to reduce construction noise levels and to abate noise at adjacent receptors. This study follows Federal Highway Administration (FHWA) and Caltrans policies to address traffic noise impacts and noise abatement. This includes FHWA regulations (Title 23, Part 772 of the Code of Federal Regulations [23CFR772]) and the Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol or TNAP). The Protocol addresses both Federal and State environmental statutes with regard to noise.

The FHWA Traffic Noise Model, TNM 2.5, was used to predict future noise levels, analyze noise impacts, and assess potential abatement options for the project. The model was calibrated and adjusted based on measured noise and traffic conditions documented

during the field survey. Following calibration, noise levels were assessed in TNM based on future traffic conditions. Where the freeway mainline traffic would be congested in the future during the peak periods (i.e., demand exceeds capacity of the freeway), free-flowing conditions were used to generate the worst-case peak noise period. Ramp volumes were based on project traffic data provided by CDMSmith.

Typical noise increases resulting from the express lanes project were calculated to be 0 to 3 dBA $L_{eq[h]}$ higher than existing noise levels. Noise level increases predicted from the project would not be substantial; however, noise levels at many Category B receptors would continue to approach or exceed the NAC.

Noise abatement, in the form of new noise barriers, was assessed for receptors where noise levels would approach or exceed the NAC. A total of 47 potential barriers were evaluated for feasibility at Category B and Category C land uses where the NAC would be approached or exceeded. To be considered feasible, a noise barrier must achieve a minimum of a 5-dB reduction at a given receptor. Eighteen of the 47 barriers were found to be feasible, however, only twelve of the 47 barriers were found to be feasible and also achieve the Caltrans noise reduction design goal (minimum 7-dB reduction for at least one receptor), which is a reasonableness consideration. The total reasonable allowance for each feasible barrier that met the Caltrans noise reduction design goal ranged from $55,000 to $495,000 depending on the number of benefited receptors. This study did not include an analysis of barrier cost-effectiveness, which would be assessed by the project engineers and the project development team. The final decision to include noise barriers in the proposed project design must consider reasonableness factors, such as cost-effectiveness, as well as other feasibility considerations including topography, access requirements, and other noise sources, safety, and information developed during the design and public review process. Table ES-1 summarizes the feasibility of noise barriers and provides the results of the reasonableness allowance calculations.

Construction activities would result in temporary increases to noise levels at noise-sensitive receptor in the project vicinity. Construction activities would be conducted in compliance with applicable regulations and would be short-term and intermittent. Measures to reduce construction noise are included in this report.

Table ES-1: Summary of Barrier Feasibility and Reasonable Allowances

Sound Wall ID	Approximate Stationing / Location	Type of Analysis	Predicted Noise Level w/o Wall	Barrier Height (feet)	Insertion Loss (dBA)	Number of Benefited Receptors	Total Reasonable Monetary Allowance
SWA	SB 51+00 to 59+00	New Wall	69-70	12*	6 to 7	4	$220,000
				14*	7 to 8	4	$220,000
				16*	7 to 8	4	$220,000
SWC	SB 169+50 to 177+50	New Wall	74	10*	7 to 8	4	$220,000
				12*	9	4	$220,000
				14*	10	4	$220,000
				16*	11	4	$220,000
SW1	SB EOS, between Ellis Street on-ramp and SR 237 (3,150 feet)	New Wall	71-78	8	6 to 8	7	$385,000
				10*	7 to 10	7	$385,000
				12*	9 to 11	7	$385,000
				14*	9 to 12	7	$385,000
				16*	10 to 13	7	$385,000
SW3a	SB EOS, north of Montague Expwy (825 feet)	New Walls	75	12*	8	1	$55,000
				14*	8	1	$55,000
				16*	8	1	$55,000
SW3b	NB EOS, north of Montague Expwy (955 feet)	New Walls	74	12*	7	1	$55,000
				14*	8	1	$55,000
				16*	8	1	$55,000
SW5	SB EOS, west of East Taylor Street (675 feet)	New Wall	76	10	7	1	$55,000
				12	8	1	$55,000
				14*	9	1	$55,000
				16*	9	1	$55,000
SW6	SB EOS, east of East Taylor Street (1,600 feet)	New Wall	63-70	10*	5 to 7	6	$330,000
				12*	5 to 7	8	$440,000
				14*	5 to 8	8	$440,000
				16*	6 to 9	8	$440,000
SW18	NB EOS, commercial uses to Blossom Hill Road off-ramp (2,770 feet)	New Wall	75-78	8	5 to 7	2	$110,000
				10	6 to 8	2	$110,000
				12*	9 to 11	2	$110,000
				14*	10 to 12	2	$110,000
				16*	11 to 13	2	$110,000
SW11	SB EOS, north of Coyote Creek Golf Road (8,780 feet)	New Wall	66-69	14*	5 to 7	7	$385,000
				16*	5 to 8	7	$385,000
SW13	SB EOS, near Burnett Avenue (3,650 feet)	New Wall	64-75	8	5 to 8	8	$440,000
				10*	6 to 9	8	$440,000
				12*	5 to 9	9	$495,000
				14*	5 to 10	9	$495,000
				16*	6 to 11	9	$495,000
SW15	SB EOS, north of Dunne Avenue and Existing SB Wall 33 (3,130 feet)	New Wall	70-77	8	7	8	$440,000
				10	8 to 10	8	$440,000
				12*	5 to 11	9	$495,000
				14*	5 to 13	9	$495,000
				16*	6 to 13	9	$495,000
SW16	NB EOS, north of Main Street (1,120 feet)	New Wall	72	14*	7	2	$110,000
				16*	7	2	$110,000

*Barrier is calculated to break line-of-sight between truck stacks and receptors.

Table of Contents

List of Appendices

List of Tables

List of Abbreviated Terms

23CFR772	Title 23, Part 772 of the Code of Federal Regulations
ADT	Average Daily Traffic
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
dB	Decibel
dBA	A-Weighted Decibel
Department	California Department of Transportation
DNL	Day-Night Level
FHWA	Federal Highway Administration
HOT	High-occupancy toll lane, Express lane
HOV	High-occupancy vehicle lane
Hz	Hertz
kHz	Kilohertz
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
$L_{eq[h]}$	Equivalent Sound Level over one hour
L_{xx}	Percentile-Exceeded Sound Level
LT	Long-Term Reference Noise Measurement
L_{max}	Maximum Instantaneous Sound Level
L_{xx}	Percentile-Exceeded Sound Level
mPa	micro-Pascals
mph	miles per hour
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
NSR	Noise Study Report
Protocol	Caltrans Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
RCNM	FHWA Roadway Construction Noise Model v.1.0
SLM	Sound Level Meter
SOV	Single-occupancy vehicle
SPL	sound pressure level
SR	State Route
ST	Short-Term Noise Measurement
TeNS	Caltrans' Technical Noise Supplement
TNAP	Caltrans' Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
TNM	FHWA Traffic Noise Model Version 2.5
US 101	United States Highway 101
VTA	Santa Clara Valley Transportation Authority

Chapter 1. Introduction

1.1. Purpose of the Noise Study Report

This NSR evaluates noise impacts and noise abatement under the requirements of 23CFR772, "Procedures for Abatement of Highway Traffic Noise." 23CFR772 provides procedures for preparing noise studies and evaluating noise abatement for federal and federal-aid highway projects. According to 23CFR772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with FHWA noise standards.

The Protocol provides Caltrans policy for implementing 23CFR772 in California and outlines the requirements for preparing NSRs. Noise impacts associated with this project under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) are not evaluated in the NSR. The determination of CEQA significance and NEPA noise impacts are determined by the Project Development Team and will be disclosed in the project's environmental document.

The purpose of this NSR is to document the assessment of existing and future traffic noise levels at noise sensitive receptors in the vicinity of the proposed project and identify whether or not preliminary noise abatement measures are necessary for the project to comply with state and federal noise abatement/mitigation requirements. The primary objective of this study is to identify noise sensitive receptors where noise levels would approach or exceed the noise abatement criteria (NAC) with the project or receptors that would experience a substantial increase in noise levels as a result of the project.

Chapter 2. Project Description

2.1. Project Description

The project consists of converting the existing HOV lane along both northbound and southbound US 101 into an express lane and widening the freeway to add a second express lane for the majority of the corridor. The project also proposes to build new express lanes in the northbound direction between East Dunne Avenue and the existing HOV lane at Cochrane Road, and in the southbound direction between Burnett Avenue and Cochrane Road.

With these changes, there would be two express lanes on US 101 extending from approximately the Cochrane Road interchange in Morgan Hill to just south of the Oregon Expressway/ Embarcadero Road interchange in Palo Alto in the northbound direction, and from just south of the Oregon Expressway/Embarcadero Road interchange to just south of the Burnett Avenue overcrossing in the southbound direction.

The addition of the second express lane will involve a combination of inside and outside widening. The majority of the inside widening will occur within the US 101 segments south of the SR 85/US 101 interchange in southern Santa Clara County where a wide unpaved median exists. The project proposes to widen and pave the median to accommodate the additional lanes. The outside widening will occur in the remainder of the corridor to accommodate the additional lanes where needed.

The express lanes facility would be separated from the adjacent mixed-flow lanes by a striped buffer. The buffer zone, delineated with solid stripes, will have designated openings to provide access into and out of the express lanes facility.

The express lanes would allow use by HOVs, and SOVs with active FasTrak accounts and transponders. Single-occupant drivers who are willing to pay the posted toll can shift from the congested mixed-flow lanes into the toll lanes to take advantage of higher travel speeds.

The project proposes to construct and operate the express lane system with some non-standard cross sectional elements which will minimize the need for new right-of-way, outside widening, and structure reconstruction. The proposed project maximizes the use of the existing pavement cross section with a combination of inside and outside widening to create the additional pavement needed to accommodate the second express lane.

Chapter 3. Fundamentals of Traffic Noise

The following is a brief discussion of fundamental traffic noise concepts. For a detailed discussion, please refer to Caltrans' Technical Noise Supplement (TeNS), a technical supplement to the Protocol, which is available on the Caltrans Web site (http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf). A glossary of technical terms is provided in Appendix A.

3.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the transfer path between the two. Loudness of the noise source and obstructions or environmental factors affect the path of transfer from the source, and therefore, contribute to the measured sound levels, as well as other characteristics perceived by the receptor. The field of acoustics deals primarily with the propagation and control of sound.

3.2. Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound, for example, is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

3.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (mPa). One mPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 mPa. Due to the large range of values, sound is rarely expressed in terms of mPa. Instead, a logarithmic scale is used to describe sound pressure level

(SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 mPa.

3.4. Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted using ordinary arithmetic means. For the decibel scale, doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources are each producing sound of the same level, the resulting sound level for both sources at a given distance would be 3 dB higher than one source under the same conditions. For instance, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than a single source of the same type.

3.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear and may vary with user.

Human hearing is limited in the range of audible frequencies, as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range between 1,000 and 8,000 Hz, indicating sound perception within the range to be more critical than noise of equal amplitude occurring at frequencies below 1,000 Hz and/or above 8,000 Hz. Based on human sensitivity to such frequencies, an "A-weighted" filter has been developed to approximate the response of the human ear. A-weighted sound levels are expressed in units of dBA.

The A-weighting network approximates the frequency response of the average ear when listening to common sound. Relative loudness, or annoyance, of a sound, as determined by listeners, correlates fairly well with A-weighted sound levels. Other weighted filters have been formulated to address higher noise levels or other specialized situations (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with highway-traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted decibels or dBA. Table 3-1 describes typical A-weighted noise levels for various noise sources.

Table 3-1. Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower, 100 feet	**— 70 —**	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	**— 60 —**	
		Large business office
Quiet urban daytime	**— 50 —**	Dishwasher next room
Quiet urban nighttime	**— 40 —**	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	— 20 —	
		Broadcast/recording studio
	— 10 —	
	— 0 —	

Source: Caltrans 2009.

3.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a 3 dB increase in SPL. However, given a sound level change measured with precise instrumentation, the subjective human perception to doubling the loudness will usually be different than what was measured.

Under controlled conditions in an acoustics laboratory, the trained, healthy human ear is able to discern 1 dB changes in sound levels, when exposed to steady, single-frequency (i.e., ~~"p~~ure-tone") signals in the mid-frequency range (i.e., 1,000 Hz–8,000 Hz). In typical noisy environments, noise changes from 1 to 2 dB are generally not noticeable; however, in typical noisy environments, there is a general acceptance that increases as minor as 3 dB are detectable by the human ear. Furthermore, increases of 5 dB are generally considered to be distinctly noticeable, while a 10 dB increase is perceived as twice as loud as the original. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3 dB increase in sound would generally be perceived as barely detectable.

3.7. Noise Descriptors

Noise in our daily environment fluctuates over time. Some fluctuations are minor, while others can be substantial; some noise levels follow regular patterns or trends, and others

are random; some noise levels fluctuate rapidly, and others are slower; some noise levels vary widely, while others are relatively constant. Various noise metrics have been developed to describe time-varying noise levels. The following are those most commonly used in traffic noise analysis:

- **Equivalent Sound Level (L_{eq}) –** L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The one-hour A-weighted equivalent sound level ($L_{eq[h]}$) is the energy average of A-weighted sound levels occurring during a one-hour period and is the basis for NAC used by both Caltrans and FHWA. The noise levels in this report are based on the $L_{eq[h]}$ descriptor.

- **Percentile-Exceeded Sound Level (L_{xx}) –** L_{xx} represents the sound level exceeded for a given percentage of a specified period (e.g., L_{10} is the sound level exceeded 10% of the time, and L_{90} is the sound level exceeded 90% of the time).

- **Maximum Sound Level (L_{max}) –** L_{max} is the highest instantaneous sound level measured during a specified period.

- **Day-Night Level (L_{dn}) –** L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.

- **Community Noise Equivalent Level (CNEL) –** Similar to L_{dn}, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10 dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m., and a 5 dB penalty applied to the A-weighted sound levels occurring during evening hours between 7 p.m. and 10 p.m.

3.8. Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which noise reduces with distance depends on the factors described in this section of the report.

3.8.1. Geometric Spreading

Sound from a localized source (i.e., point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) 6 dB when the distance from the source to the receptor doubles. Highways consist of several localized noise sources on

a defined path, and hence, can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. In contrast to point sources, sound levels attenuate 3 dB as the distance from a line source to the receptor doubles.

3.8.2. Ground Absorption

The acoustical transfer path of noise from a highway to a receptor is usually very close, in proximity to the ground. Noise attenuation from ground absorption and reflective-wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficient for distances less than 200 feet. Difficulties can arise at sites with reflective surfaces between the source and the receptor (i.e., parking lots, bodies of water, etc.), and at such sites, no excess ground attenuation is assumed. For acoustically absorptive or soft sites, which have an absorptive ground surface between the source and the receptor (i.e., soft dirt, grass, scattered bushes/trees, etc.), an excess ground-attenuation value of 1.5 dB is assumed for each doubled distance from the source. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance.

3.8.3. Atmospheric Effects

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects on perceived noise.

3.8.4. Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels measured at the receptor. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor specifically to reduce noise. A barrier that breaks the line-of-sight between a source and a receptor will typically result in at least a 5 dB reduction in noise. Taller barriers provide increased noise reduction. Vegetation between the highway and receptor is rarely effective in reducing noise because it does not create a solid barrier.

Chapter 4. Federal Regulations and State Policies

This report focuses on the requirements of 23CFR772, as discussed below.

4.1. Federal Regulations

23CFR772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for federal and federal-aid highway projects. Under 23CFR772.7, projects are categorized as Type I, Type II or Type III projects. FHWA defines a Type I project as a proposed federal or federal-aid highway project for the construction of a highway on a new location, the physical alteration of an existing highway where there is either a substantial horizontal or substantial vertical alteration, or other activities discussed in the definition of a Type I project, below. A Type II project involves construction of noise abatement on an existing highway with no changes to highway capacity or alignment. Type III projects do not require a noise analysis.

23CFR772 defines a Type I project as a project that involves:

1. The construction of a highway on a new location or

2. The physical alteration of an existing highway where there is either:

   A. Substantial horizontal alteration. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition, or

   B. Substantial vertical alteration. A project that removes shielding thereby exposing the line-of-sight between the receptor and the traffic noise source. This is done by altering either the vertical alignment of the highway or the topography between the highway traffic noise source and the receptor; or

3. The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a high-occupancy vehicle (HOV) lane, high-occupancy toll (HOT) lane, bus lane, or truck climbing lane; or

4. The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or

5. The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or

6. Restriping existing pavement for the purpose of adding a through traffic lane or an auxiliary lane; or

7. The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza.

Under 23CFR772.13, noise abatement must be considered for Type I projects if the project is predicted to result in a traffic noise impact. In such cases, 23CFR772 requires that the project sponsor –consider" noise abatement before adoption of the final NEPA document. This process involves identification of noise abatement measures that are feasible, reasonable, and likely to be incorporated into the project, and noise impacts for which no noise abatement measures are feasible and reasonable.

Traffic noise impacts, as defined in 23CFR772.5, occur when the predicted noise level in the design year approaches or exceeds the NAC specified in 23CFR772, or a predicted noise level substantially exceeds the existing noise level (a –substantial" noise increase). 23CFR772 does not specifically define the terms –substantial increase" or –approach"; these criteria are defined in the Protocol, as described below.

Table 4-1 summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

In identifying noise impacts, primary consideration is given to exterior areas of frequent human use. In situations where there are no exterior activities, or where the exterior activities are far from the roadway or physically shielded in a manner that prevents an impact on exterior activities, the interior criterion (Activity Category D) is used as the basis for determining a noise impact. Indoor analysis is conducted at Category D land uses only after all outdoor analysis options have been exhausted and after a determination has been made that exterior abatement measures will not be feasible and reasonable.

Table 4-1. Activity Categories and Noise Abatement Criteria (23CFR772)

Activity Category	Activity $L_{eq[h]}$[1]	Evaluation Location	Description of Activities
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67	Exterior	Residential.
C[2]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F			Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G			Undeveloped lands that are not permitted.

Source: Caltrans, 2011.
[1] The $L_{eq[h]}$ activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dBA).
[2] Includes undeveloped lands permitted for this activity category.

4.2. State Regulations and Policies

4.2.1. Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects

The Protocol specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of federal or federal-aid highway projects. The NAC specified in the Protocol are the same as those specified in 23CFR772. The Protocol defines a noise increase as substantial when the predicted worst-hour design year noise levels exceed existing worst-hour noise levels by 12 dBA. The Protocol also states that a sound level is considered to approach an NAC level when the sound level is within 1 dBA of the NAC identified in 23CFR772 (e.g., 66 dBA is considered to approach the NAC of 67 dBA, but 65 dBA is not).

The TeNS and the Protocol provide detailed technical guidance for the evaluation of highway traffic noise. That technical guidance was followed for this study, including field measurement methods, noise modeling methods, and report preparation guidance.

4.2.2. Section 216 of the California Streets and Highways Code

Section 216 of the California Streets and Highways Code relates to the noise effects of a proposed freeway project on public and private elementary and secondary schools. Under

this code, a noise impact occurs if, as a result of a proposed freeway project, noise levels exceed 52 dBA $L_{eq[h]}$ in the interior of public or private elementary or secondary classrooms, libraries, multipurpose rooms, or spaces. This requirement does not replace the ~~"a~~pproach or exceed" NAC criterion for FHWA Activity Category D for classroom interiors, but it is a requirement that must be addressed in addition to the requirements of 23CFR772.

If a project results in a noise impact under this code, noise abatement must be provided to reduce classroom noise to a level that is at or below 52 dBA $L_{eq[h]}$. If the noise levels generated from freeway and nonfreeway sources exceed 52 dBA $L_{eq[h]}$ prior to the construction of the proposed freeway project, then noise abatement must be provided to reduce the noise to the level that existed prior to construction of the project.

Public and private elementary or secondary schools identified within the project limits where noise levels at classrooms, libraries, multipurpose rooms, or spaces may approach or exceed the NAC include:

- Emerson School – 2800 West Bayshore Road, Palo Alto
- The Girls' Middle School – 3400 West Bayshore Road, Palo Alto
- Ramblewood Elementary School – 1351 Lightland Road, San Jose

The remaining public and private elementary or secondary schools along the project corridor are located at sufficient distance from US 101 and are shielded by existing noise barriers or buildings such that exterior noise levels do not exceed the NAC, and therefore, would not have interior noise levels that exceed 52 dBA $L_{eq[h]}$.

4.2.3. Caltrans Highway Design Manual

Chapter 1100 of the Caltrans Highway Design Manual contains guidance regarding the relationship between barrier height and truck exhaust intercept. According to Caltrans, noise barriers should interrupt the line-of-sight between a truck exhaust stack (assumed to be 11.5 feet high) and the 5-foot-high receptor in the first tier of receptors adjoining the highway. This guideline is intended to reduce the visual and noise intrusiveness of truck exhaust stacks at the first-line receptors.

Chapter 5. Study Methods and Procedures

5.1. Methods for Identifying Land Uses and Selecting Noise Measurement and Modeling Receptor Locations

Receptor locations are described by different NAC activity categories (see Table 4-1). Noise receptor locations exposed to potential traffic noise impacts were identified along the project corridor through a review of project mapping, aerial photos, and field reconnaissance. Noise-sensitive Category B, Category C, Category D and Category E land uses border the project corridor. As stated in the Protocol, noise abatement is only considered for Category B and Category C areas of frequent human use that would benefit from a lowered noise level. Accordingly, this impact analysis focuses on locations with defined outdoor activity areas, such as residential outdoor use areas, parks and recreation areas, trails, etc. In situations where no exterior activity areas exist or are far from or shielded from the roadway, the interior NAC limit applies.

5.2. Field Measurement Procedures

Noise measurements were made with Larson Davis Model 700 or Model 820 Integrating Sound Level Meters (SLMs) set at ~~"s~~low" response. The sound level meters were equipped with G.R.A.S. Type 40AQ or Bruel & Kjaer Type 4176 ½-inch random incidence microphones fitted with windscreens. The sound level meters were calibrated prior to the noise measurements using a Larson Davis Model CAL200 or Model CA250 acoustical calibrator. The response of the system was checked after each measurement session and was always found to be within 0.2 dBA. No calibration adjustments were made to the measured sound levels. At the completion of each monitoring event, the measured interval noise level data were obtained from the SLM using the Larson Davis SLM utility software program.

5.2.1. Long-Term Reference Measurements

Long-term (LT) reference noise measurements were made at 14 locations along the US 101 corridor to quantify the daily trend in noise levels and to establish the peak traffic noise hour. The noise measurements were made in February, March, and April 2012, typically over periods ranging from three to five days. Long-term noise measurement locations were selected to generally represent human activity areas such as trails, parks, and residential rear yard areas adjoining US 101, or in areas considered to be acoustically equivalent to noise-sensitive exterior use areas. Care was taken to select sites that were primarily affected by highway traffic noise and to avoid those sites where extraneous

noise sources such as barking dogs, pool pumps, or air conditioning units could contaminate the noise data. After the data were downloaded from the sound level meter, the data were reviewed to identify any time periods possibly contaminated by local noise sources. Data points were excluded from the dataset where significant contamination was noted. The trends in ambient noise levels measured at locations LT-1 through LT-14 are summarized graphically in Appendix E.

5.2.2. Short-Term Measurements

One hundred fifty-three (153) short-term (ST) noise measurements were made along the US 101 corridor in concurrent time intervals with the data collected at the long-term reference measurement sites. This method facilitates a direct comparison between both the short-term and long-term noise measurements and allows for the identification of the worst-hour noise levels at Category B and C land uses in the project vicinity where long-term noise measurements were not made. Two consecutive 10-minute measurements were made at each noise measurement site. At all locations, noise levels were measured 5 feet above the ground surface and at least 10 feet from structures or barriers. Noise measurement locations were used as noise modeling receptors for the prediction of existing and future worst-hour traffic noise levels. Photographs of the measurement sites are provided in Appendix B.

Traffic counts and speed observation were also made during the short-term noise measurements for model calibration purposes. Traffic volumes were classified into five vehicle types: (1) light-duty autos and trucks, (2) medium-duty trucks (typically trucks with two axles and more than four wheels), (3) heavy-duty trucks (typically trucks with more than two axles), (4) buses, and (5) motorcycles.

5.2.3. Meteorology

Meteorological conditions were observed during the long-term and short-term noise measurements and generally consisted of clear to partly cloudy skies, calm to moderate winds, and seasonable temperatures. Noise monitoring did not occur if weather conditions consisted of rain or high winds (i.e., greater than 11 mph).

5.3. Traffic Noise Level Prediction Methods

Traffic noise levels were predicted using the Federal Highway Administration's Traffic Noise Model (TNM). Due to the reliability constraints of TNM to accurately calculate noise levels at great distances from the roadway, Caltrans limits noise assessments to within approximately 500 feet of the roadway source.

TNM calculates traffic noise levels based on the geometry of the site, which includes the positioning of travel lanes, receptors, barriers, terrain, ground type, buildings, etc. The noise source is the traffic flow, as defined by the user, in terms of hourly volumes of automobiles (autos), medium-duty trucks (medium), heavy-duty trucks (heavy), buses, and motorcycles. CDMSmith provided AM and PM peak hour traffic volume data for existing conditions and year 2035. Travel speeds were input into the model based on observations made during the noise monitoring surveys.

URS provided the geometric plans used to create the traffic noise model. The roadway, receptors, terrain lines, ground zones, and noise barriers were digitized and input into the traffic noise model.

TNM cannot accurately account for pavement types and conditions, atypical vehicle noise populations, transparent shielding (such as wood fences with shrinkage gaps), reflections from nearby buildings and structures, or meteorological conditions. For these reasons, noise measurements are conducted and traffic noise model adjustments and calibration factors are developed. For each measured condition, the corresponding observed traffic conditions are used in the model to calculate the noise level. The calculated and measured noise levels are compared to assess differences and validate the traffic noise model.

Traffic counts were adjusted to reflect one-hour conditions, assuming that the traffic volumes during the noise measurement interval (10 minutes) were equal during the six 10-minute intervals of an hour. These adjusted one-hour volumes were input into the model for calibration.

The calibration factors or model adjustments developed from this process were used to modify the model to more closely represent measured conditions. Modeled results that vary from measurements by more than 2 dB are adjusted after a careful review of all measurement and modeled data. The adjustments were calculated as follows:

- Where modeled levels are more than 2 dB lower than measured levels, the modeled results are adjusted to measured conditions: Adjustment = Measured – Modeled

- Where the modeled result is 0 to +2 dB lower than the measured level, no adjustment is made: Adjustment = 0

- Where the modeled result is 0 to +2 dB higher than the measured level, no adjustment is made: Adjustment = 0

- Where the modeled result is more than +2 dB higher than the measured level, an adjustment is made to bring the modeled result to within 2 dB of measured conditions: Adjustment = (Measured + 2) – Modeled.

5.4. Methods for Identifying Traffic Noise Impacts and Consideration of Abatement

The NAC, established by FHWA, for various land uses (known as activity categories) is shown in Table 4-1. The presented noise criteria are assigned to both exterior and interior activities. Caltrans has further defined the meaning of approaching the NAC to be 1 dBA below the NAC (e.g., 66 dBA is considered approaching the NAC for Category B activity areas). Caltrans defines a substantial noise increase to occur when predicted worst-hour noise levels exceed existing worst-hour noise levels by 12 dBA $L_{eq[h]}$.

Noise abatement is only considered where frequent human usage occurs and where a lowered noise level would be of benefit. Areas of frequent human usage are considered to occur at exterior locations where people are exposed to traffic noise for an extended period of time on a regular basis. Therefore, impacts are typically assessed at locations with defined outdoor activity areas, such as residential backyards, common exterior use areas, pools, patios, and parks (e.g., playfields, playgrounds, or picnic tables). Other examples are outdoor seating areas at restaurants or outdoor use areas at hotels.

Caltrans policies and procedures for traffic noise analysis are contained in the Protocol and TeNS. The feasibility of noise abatement is an engineering consideration. Noise abatement must be predicted to reduce noise by at least 5 dB at an impacted receptor to be considered feasible. Once all feasible noise abatement is identified, a procedure is conducted to assess the reasonableness of noise abatement. NSRs calculate the reasonable cost allowance for feasible noise barriers, but do not determine whether a feasible barrier would be reasonable.

The determination of the reasonableness of noise abatement is more subjective than the determination of its feasibility. As defined in Section 772.5 of the regulation, reasonableness is the combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

The overall reasonableness of noise abatement is determined by the following three factors.

- The noise reduction design goal (a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefited receptors).
- The cost of noise abatement (2011 allowance of $55,000 per benefited receptor).
- The viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

The Project Development Team will make the proposed noise abatement decisions that will be incorporated into the final environmental documentation. Any proposed changes to the noise abatement decision subsequent to adoption of the final environmental document must be reviewed with the Caltrans noise specialists to ensure adequate acoustic performance.

Chapter 6. Existing Noise Environment

6.1. Existing Land Uses

A field investigation was conducted to identify land uses that could be subject to traffic and construction noise impacts from the proposed project. Single- and multi-family residences (Category B land uses), active recreational areas (Category C land uses), schools (Activity Category D land uses), churches (Activity Category D land uses), and hotels/motels (Activity Category E land uses) are located along the project corridor. No other noise-sensitive land use types were identified.

6.2. Existing Noise Levels at Receptors

The existing noise environment varies by location throughout the project corridor depending on site characteristics such as proximity to US 101 and intersecting highways (i.e., State Routes 237, 85, 87, I-880 and I-280/680), the relative elevation of roadways and receptors, and any intervening structures or barriers. The project area was divided into 16 study segments. These segments were necessary to easily categorize study areas and receptors within each study area as well as to keep the traffic noise modeling computer files to manageable sizes. The results of the long- and short-term field measurements are summarized in Table 6-1 and Table 6-2. Existing worst-hour noise levels at long-term receptor locations were documented through noise monitoring. The estimated existing worst-hour noise levels at short-term receptor locations are based on TNM modeling results using existing traffic volumes provided in the project's traffic report.

Table 6-1. Summary of Long-Term Noise Measurements

Receptor ID	Segment Number	Location	Date	Time	Worst Hour $L_{eq[h]}$, dBA
LT-1	2	In front of 159 Fairchild Avenue (Fairchild Apartments), Mountain View.	2/8/2012	7:00 a.m.	68
			2/9/2012	7:00 p.m.	68
LT-2	3	Adjacent to 836 Ahwanee Avenue (Sun Ridge Apartments), Mountain View.	2/8/2012	11:00 a.m.	71
			2/9/2012	1:00 p.m.	72
LT-3	3	Rear yard of 856 San Ramon Avenue, Sunnyvale.	2/14/2012	9:00 am.	63
			2/15/2012	9:00 a.m.	64
			2/16/2012	8:00 a.m.	63
LT-4	4	San Tomas Aquino Creek Trail, Santa Clara.	2/14/2012	12:00 p.m.	71
			2/15/2012	12:00 p.m.	73
			2/16/2012	9:00 a.m.	71
LT-5	5	Pool area of La Quinta Inn, San Jose.	2/14/2012	6:00 a.m.	72
			2/15/2012	6:00 a.m.	71
			2/16/2012	6:00 a.m.	71
LT-6	8	Rear yard equivalent of 75 North 31st Street, San Jose.	2/22/2012	10:00 a.m.	71
			2/23/2012	9:00 a.m.	72
LT-7	8	Cul-de-sac of Sunny Court, San Jose.	2/22/2012	7:00 a.m.	63
			2/23/2012	7:00 a.m.	67
LT-8	9	Rear yard at 1442 Dornoch Avenue, San Jose.	2/22/2012	7:00 a.m.	66
			2/23/2012	7:00 a.m.	66
LT-9	11	Rear yard of 1337 Isengard Court, San Jose.	3/20/2012	4:00 p.m.	56
			3/21/2012	3:00 p.m.	58
			3/22/2012	3:00 p.m.	58
LT-10	12	Rear yard of 4885 Snow Drive, San Jose.	3/20/2012	12:00 p.m.	73
			3/21/2012	4:00 p.m.	67
			3/22/2012	10:00 a.m.	72
			3/8/2012	6:00 a.m.	66
LT-11	13	Rear yard of 139 Mosswell Court, San Jose.	3/20/2012	12:00 p.m.	73
			3/21/2012	4:00 p.m.	67
LT-12	13	Rear yard of 148 Flintwell Court, San Jose.	3/20/2012	9:00 a.m.	62
			3/21/2012	4:00 p.m.	61
			3/22/2012	4:00 p.m.	61
LT-13	14	Rear yard of 251 Crestridge Court, San Jose.	3/7/2012	7:00 a.m.	64
			3/8/2012	6:00 a.m.	66
LT-14	15	Coyote Creek Golf Course, San Jose.	3/8/2012	7:00 a.m.	71

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-1	2	Pool area of Ramada Inn, Mountain View.	E(72)	2/8/2012	12:20 p.m.	60	62
					12:30 p.m.	59	
ST-2	2	In front of 235 Fairchild Drive, Mountain View.	B(67)	2/8/2012	12:10 p.m.	68	**69**
					12:20 p.m.	68	
ST-3	2	Offices at 323 Fairchild Drive, Mountain View.	Calibration Point	2/8/2012	12:00 p.m.	67	**69**
					12:10 p.m.	66	
ST-4	2	Corner of Clyde Avenue and Fairchild Drive, Mountain View.	Calibration Point	2/8/2012	12:30 p.m.	76	**79**
					12:40 p.m.	75	
ST-5	3	Courtyard of Staybridge Suites, Sunnyvale.	E(72)	2/9/2012	10:00 a.m.	59	61
					10:10 a.m.	57	
ST-6	3	Pool area of Quality Inn & Suites, Sunnyvale.	E(72)	2/9/2012	11:00 a.m.	62	65
					11:10 a.m.	63	
ST-7	3	Pool area of Ahwanee Apartment Complex, Sunnyvale.	B(67)	2/9/2012	11:00 a.m.	53	54
					11:10 a.m.	53	
ST-8	3	Pool area of Weddell Apartments, Sunnyvale.	B(67)	2/9/2012	11:30 a.m.	58	59
					11:40 a.m.	57	
ST-9	3	Pool area of Florina Apartments, Sunnyvale.	B(76)	2/9/2012	11:30 a.m.	57	59
					11:40 a.m.	56	
ST-10	3	Common area of Eden Roc Apartments, Sunnyvale.	B(67)	2/9/2012	11:30 a.m.	60	63
					11:40 a.m.	59	
ST-11	3	5800 Ahwanee Avenue, Sunnyvale.	B(76)	2/9/2012	12:30 p.m.	60	62
					12:40 p.m.	59	
ST-12	3	Fair Oaks Mobile Lodge, Sunnyvale.	B(67)	2/9/2012	12:30 p.m.	59	62
					12:40 p.m.	59	
ST-13	3	Parking lot of Americas Best Value Inn, Sunnyvale.	E(72)	2/9/2012	12:00 p.m.	72	**74**
					12:10 p.m.	71	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-14	3	Pool area of Sunridge Apartments, Sunnyvale.	B(67)	2/9/2012	11:00 a.m.	52	52
					11:10 a.m.	52	
ST-15	3	Rear yard of 648 Lakewood Drive, Sunnyvale.	Calibration Point	2/9/2012	1:30 p.m.	61	64
					1:40 p.m.	61	
ST-16	3	In front of 662 North Ahwanee Terrace, Sunnyvale.	B(67)	2/9/2012	1:30 p.m.	63	64
					1:40 p.m.	63	
ST-17	3	Common area of 662 North Ahwanee Terrace, Sunnyvale.	B(67)	2/14/2012	10:10 a.m.	62	62
					10:20 a.m.	62	
ST-18	3	In front of 624 South Ahwanee Terrace, Sunnyvale.	B(67)	2/14/2012	10:10 a.m.	59	62
					10:20 a.m.	59	
ST-19	3	In front of 798 East Ahwanee Avenue, Sunnyvale.	B(67)	2/14/2012	10:50 a.m.	67	**66**
					11:00 a.m.	67	
ST-20	3	Adjacent to 880 San Mateo Court, Sunnyvale.	B(67)	2/14/2012	10:50 a.m.	66	65
					11:00 a.m.	66	
ST-21	3	Behind 835 San Pier Court, Sunnyvale.	B(67)	2/14/2002	11:30 a.m.	65	65
					11:40 a.m.	65	
ST-22	3	In front of 831 San Saba Court, Sunnyvale.	B(67)	2/14/2012	11:30 a.m.	62	65
					11:40 a.m.	62	
ST-23	3	In front of 1033 Amador Avenue, Sunnyvale.	B(67)	2/14/2012	12:00 p.m.	62	63
					12:10 p.m.	62	
ST-24	3	Rear yard of 672 Lakewood Drive, Sunnyvale.	B(67)	2/14/2012	10:10 a.m.	62	65
					10:20 a.m.	63	
ST-25	3	Rear yard of 742 Lakewood Drive, Sunnyvale.	B(67)	2/14/2012	10:40 a.m.	64	65
					10:50 a.m.	64	
ST-26	3	Rear yard of 794 Lakewood Drive, Sunnyvale.	B(67)	2/14/2012	11:10 a.m.	65	**67**
					11:20 a.m.	64	
ST-27	3	Rear yard of 848 Lakewood Drive, Sunnyvale.	B(67)	2/14/2012	11:40 a.m.	62	65
					11:50 a.m.	62	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-28	3	Rear yard of 216 Velvetlake Drive, Sunnyvale.	B(67)	2/14/2012	12:10 p.m.	57	60
					12:20 p.m.	57	
ST-29	4	Common area of Avalon Silicon Valley Apartments, Sunnyvale.	B(67)	2/14/2012	1:20 p.m.	51	53
					1:30 p.m.	53	
ST-30	4	East common area of Avalon Silicon Valley Apartments, Sunnyvale.	B(67)	2/14/2012	12:20 p.m.	67	**69**
					12:30 p.m.	67	
ST-31	4	Common area of 1235 Wildwood Avenue, Sunnyvale.	B(67)	2/14/2012	1:30 p.m.	54	57
					1:40 p.m.	55	
ST-32	4	Rear yard equivalent of 397 Socorro Avenue, Sunnyvale.	B(67)	2/15/2012	10:40 a.m.	66	**68**
					10:50 a.m.	66	
ST-33	4	Pool area of Residence Inn Marriot, Sunnyvale	E(72)	2/15/2012	10:20 a.m.	64	66
					10:30 a.m.	64	
ST-34	4	Courtyard of Plaza Suites, Santa Clara.	E(72)	2/15/2012	10:20 a.m.	65	66
					10:30 a.m.	64	
ST-35	4	Pool area of Ramada Inn, Sunnyvale.	E(72)	2/15/2012	10:10 a.m.	60	63
					10:20 a.m.	60	
ST-36	4	Adjacent to San Tomas Aquino Creek Trail, Santa Clara.	C(67)	2/15/2012	11:20 a.m.	59	61
					11:40 a.m.	58	
ST-37	5	Pool area of Biltmore Hotel, Santa Clara.	E(72)	2/15/2015	11:40 a.m.	61	61
					11:50 a.m.	61	
ST-38	5	Guadalupe River Trail, San Jose.	C(67)	2/16/2012	10:50 a.m.	65	**69**
					11:00 a.m.	66	
ST-39	6	Common area of office buildings on Gateway Place, San Jose.	E(72)	2/16/2012	10:40 a.m.	59	58
					10:50 a.m.	59	
ST-40	6	Pool area of Fairfield Inn and Suites, San Jose.	E(72)	2/16/2012	11:00 a.m.	57	58
					11:10 a.m.	57	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-41	6	Pool area of San Jose Airport Garden Hotel, San Jose.	E(72)	2/16/2012	11:40 a.m.	55	56
					11:50 a.m.	56	
ST-42	7	Common area of 723 Pavilion Loop, San Jose.	B(67)	2/16/2012	12:20 p.m.	64	64
					12:30 p.m.	64	
ST-43	7	Luna Park on Berryessa Road, San Jose.	B(67)	2/16/2012	12:20 p.m.	54	54
					12:30 p.m.	53	
ST-44	7	Common area of apartments on Luna Park Drive, San Jose.	B(67)	2/16/2012	12:20 p.m.	64	**67**
					12:30 p.m.	65	
ST-45	7	In front of 895 North Bayshore Road West, San Jose.	B(67)	2/16/2012	12:50 p.m.	62	65
					1:00 p.m.	63	
ST-46	7	Common area of 855 North Bayshore Road West, San Jose.	B(67)	2/16/2012	1:00 p.m.	56	60
					1:10 p.m.	57	
ST-47	7	Front yard of residences at North Bayshore Road West and East Mission, San Jose.	B(67)	2/16/2012	1:30 p.m.	64	**67**
					1:40 p.m.	64	
ST-48	7	Rear yard equivalent of 988 North 17th Street, San Jose.	B(67)	2/16/2012	12:50 p.m.	57	61
					1:00 p.m.	58	
ST-49	7	Pool area of Palm Court Apartments, San Jose.	B(67)	2/16/2012	1:30 p.m.	69	**76**
					1:50 p.m.	70	
ST-50	8	Watson Park, San Jose.	C(67)	2/21/2012	10:40 a.m.	60	64
					10:50 a.m.	60	
ST-51	8	Townhomes along Destino Circle, San Jose.	B(67)	2/21/2012	11:20 a.m.	64	65
					11:30 a.m.	65	
ST-52	8	Adjacent to Hacienda Creek Senior Apartments, San Jose.	B(67)	2/21/2012	10:50 a.m.	65	**67**
					11:00 a.m.	64	
ST-53	8	In front of 321	B(67)	2/21/2012	11:20 a.m.	66	**67**

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
		East Court, San Jose.			11:30 a.m.	66	
ST-54	8	Rear yard equivalent of 1494 View Drive, San Jose.	B(67)	2/21/2012	12:00 p.m.	65	**66**
					12:10 p.m.	66	
ST-55	8	Parking lot of Five Wounds School, San Jose.	C(67)	2/21/2012	12:10 p.m.	68	**70**
					12:20 p.m.	68	
ST-56	8	Rear yard equivalent of 1459 East San Fernando Street, San Jose.	B(67)	2/21/2012	12:50 p.m.	63	63
					1:00 p.m.	63	
ST-57	8	Rear yard equivalent of 1457 Whitton Avenue, San Jose.	B(67)	2/21/2012	1:20 p.m.	63	65
					1:30 p.m.	64	
ST-58	8	Rear yard equivalent of 1503 Shortridge Avenue, San Jose.	B(67)	2/21/2012	12:50 p.m.	64	**66**
					1:00 p.m.	64	
ST-59	8	Rear yard equivalent of 1490 South 31st Street, San Jose.	B(67)	2/21/2012	1:20 p.m.	67	**69**
					1:30 p.m.	67	
ST-60	8	Common area between 229 and 225 Rayos Del Sol Drive, San Jose.	B(67)	2/21/2012	1:00 p.m.	63	65
					1:10 p.m.	63	
ST-61	8	In front of 1463 Sunny Court, San Jose.	B(67)	2/21/2012	1:30 p.m.	59	63
					1:40 p.m.	58	
ST-62	8	Rear yard of 237 South 31st Street, San Jose.	B(67)	2/22/2012	10:20 a.m.	66	**68**
					10:30 a.m.	66	
ST-63	8	Common area of Fairway Apartments, San Jose.	B(67)	2/22/2012	11:00 a.m.	59	62
					11:10 a.m.	60	
ST-64	8	In front of 155 Virginia Place, San Jose.	B(67)	2/22/2012	10:50 a.m.	63	**67**
					11:00 a.m.	63	
ST-65	8	Common area of Bonita Place Townhomes, San Jose.	B(67)	2/22/2012	10:10 a.m.	63	63
					10:20 a.m.	64	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-66	9	Between 1388 and 1389 Sunbeam Circle, San Jose.	B(67)	2/22/2012	12:00 p.m.	56	59
					12:10 p.m.	56	
ST-67	9	Side yard of 1369 Sunbeam Circle, San Jose.	B(67)	2/22/2012	12:30 p.m.	58	62
					12:40 p.m.	59	
ST-68	9	Rear yard equivalent of 1121 Terilyn Avenue, San Jose.	B(67)	2/22/2012	11:50 a.m.	65	**67**
					12:10 p.m.	65	
ST-69	9	Rear yard equivalent of 1505 Scotty Street, San Jose.	B(67)	2/22/2012	12:20 p.m.	65	**68**
					12:30 p.m.	65	
ST-70	9	In front of 1334 Crucero Drive, San Jose.	B(67)	2/22/2012	12:00 p.m.	66	**67**
					12:10 p.m.	65	
ST-71	9	Common area of apartments at 1390 Crucero Drive, San Jose.	B(67)	2/22/2012	12:30 p.m.	64	**67**
					12:40 p.m.	65	
ST-72	9	Apartments at the end of Dubert Lane, San Jose.	B(67)	2/22/2010	1:30 p.m.	63	**66**
					1:40 p.m.	64	
ST-73	9	Front yard of 1634 Midfield Avenue, San Jose.	B(67)	2/22/2012	1:40 p.m.	63	**67**
					1:50 p.m.	63	
ST-74	9	In front of 1820 Midfield Avenue, San Jose.	B(67)	2/22/2012	1:20 p.m.	65	**67**
					1:30 p.m.	65	
ST-75	9	Rear yard of 1441 Taper Court, San Jose.	B(67)	2/22/2012	1:40 p.m.	63	62
					1:50 p.m.	63	
ST-76	9	In front of 1442 Joe Dimaggio Court, San Jose.	B(67)	2/23/2012	10:20 a.m.	59	**67**
ST-77	9	Common area of 1886 Midfield Avenue, San Jose.	B(67)	2/23/2012	11:50 a.m.	61	**67**
ST-78	9	Rear yard of 1382 Sunnycrest Circle, San Jose.	B(67)	2/23/2012	10:30 a.m.	58	62
ST-79	9	Common area of Valley Palms	B(67)	2/23/2012	10:40 a.m.	57	59

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
		Apartments at 2155 Lanai Avenue, San Jose.			10:50 a.m.	58	
ST-80	9	Rear yard of 1526 Denali Way, San Jose.	B(67)	2/23/2012	11:10 a.m.	60	64
					11:20 a.m.	60	
ST-81	9	Nisich Park, San Jose.	C(67)	2/23/2012	11:00 a.m.	56	60
					11:10 a.m.	55	
ST-82	10	Common area of 1430 Zachary Way, San Jose.	E(72)	2/23/2012	12:20 p.m.	62	66
					12:30 p.m.	62	
ST-83	10	Pool area of Motel 6 at 2560 Fontaine Road, San Jose.	E(72)	2/23/2012	12:20 p.m.	60	62
					12:30 p.m.	59	
ST-84	10	Rear yard of 1320 Mayhew Court, San Jose.	B(67)	2/23/2012	1:10 p.m.	58	64
					1:20 p.m.	59	
ST-85	10	Common area equivalent of Casa Real Apartments, San Jose.	B(67)	2/23/2012	1:00 p.m.	64	**67**
					1:10 p.m.	65	
ST-86	10	Rear yard equivalent of 1473 Freni Court, San Jose.	B(67)	2/23/2012	1:20 p.m.	64	**66**
					1:30 p.m.	64	
ST-87	10	Rear yard of 1318 Pellier Court, San Jose.	B(67)	2/23/2012	12:20 p.m.	60	64
					12:30 p.m.	60	
ST-88	10	Rear yard of 1326 Kane Court, San Jose.	B(67)	2/23/2012	1:00 p.m.	62	**67**
					1:10 p.m.	63	
ST-89	10	Park on Plumas Drive, San Jose.	C(67)	2/23/2012	1:40 p.m.	58	60
					1:50 p.m.	58	
ST-90	10	Rear yard of 1390 Delano Court, San Jose.	B(67)	2/23/2012	1:40 p.m.	62	**66**
					1:50 p.m.	62	
ST-91	10	Rear yard equivalent of 1540 Aldrich Way, San Jose.	B(67)	3/20/2012	10:20 a.m.	66	**67**
					10:30 a.m.	66	
ST-92	10	Rear yard equivalent of 1546 Barberry Court, San Jose.	B(67)	3/20/2012	10:40 a.m.	59	63
					10:50 a.m.	57	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-93	10	Rear yard equivalent of 1503 Aborn Road, San Jose.	B(67)	3/20/2012	10:20 a.m.	62	**68**
ST-94	10	Rear yard of 3070 Brandywine Drive, San Jose.	B(67)	3/20/2012	10:30 a.m.	60	65
					10:40 a.m.	61	
ST-95	11	Rear yard of 1331 Erinwood Court, San Jose.	B(67)	3/20/2012	11:30 a.m.	59	60
					11:40 a.m.	55	
ST-96	11	Rear yard equivalent of mobile homes along Rio De Plata, San Jose.	B(67)	3/20/2012	11:30 a.m.	59	61
					11:40 a.m.	58	
ST-97	11	Rear yard of 1365 Cotterell Drive, San Jose.	B(67)	3/20/2012	11:40 a.m.	54	58
					11:50 a.m.	59	
ST-98	11	Rear yard of 3787 Polton Place Way, San Jose.	B(67)	3/20/2012	1:20 p.m.	56	57
					1:30 p.m.	54	
ST-99	11	Rear yard of 1393 Crailford Court, San Jose.	B(67)	3/20/2012	1:40 p.m.	53	57
					1:50 p.m.	55	
ST-100	11	Ramblewood Elementary School, San Jose.	C(67)	3/20/2012	1:20 p.m.	59	63
					1:30 p.m.	59	
ST-101	11	Rear yard of 3615 Bridal Place Court, San Jose.	B(67)	3/20/2012	11:30 a.m.	59	62
					11:40 a.m.	58	
ST-102	11	Rear yard equivalent of 3689 Ivy Canyon Court, San Jose.	B(67)	3/20/2012	1:20 p.m.	61	63
					1:30 p.m.	60	
ST-103	11	Rear yard of 1260 Wentworth Way, San Jose.	B(67)	3/21/2012	10:20 a.m.	57	61
					10:30 a.m.	57	
ST-104	11	Equivalent to rear yard equivalent of 4062 McLaughlin Avenue, San Jose.	B(67)	3/21/2012	10:30 a.m.	56	59
					10:40 a.m.	55	
ST-105	11	Adjacent to 3812 Dove Hill Road, San Jose.	B(67)	3/21/2012	10:20 a.m.	72	**76**
					10:30 a.m.	72	
ST-106	11	Adjacent to 3700 Dove Road, San Jose.	B(67)	3/21/2012	10:50 a.m.	66	**71**
					11:00 a.m.	67	
ST-107	12	Picnic area of	C(67)	3/21/2012	10:20 a.m.	58	61

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
		Hellyer County Park, San Jose.			10:30 a.m.	57	
ST-108	12	Side yard equivalent of 4823 Nicole Court, San Jose.	B(67)	3/21/2012	11:30 a.m.	55	60
					11:40 a.m.	55	
ST-109	12	Rear yard of 4830 Snow Drive, San Jose.	B(67)	3/21/2012	11:40 a.m.	64	**67**
					11:50 a.m.	63	
ST-110	12	Front of 4898 Snow Drive, San Jose.	B(67)	3/21/2012	12:10 p.m.	58	61
					12:20 p.m.	59	
ST-111	12	Rear yard of 4947 Fontanelle Place, San Jose.	B(67)	3/21/2012	11:40 a.m.	57	61
					11:50 a.m.	57	
ST-112	12	Rear yard of 318 Fontanelle Place, San Jose.	B(67)	3/21/2012	12:30 p.m.	55	60
					12:40 p.m.	54	
ST-113	12	Rear yard of 5034 Snow Drive, San Jose.	B(67)	3/21/2012	11:50 a.m.	60	64
					12:00 p.m.	59	
ST-114	12	Rear yard of 5150 Snow Drive, San Jose.	B(67)	3/21/2012	12:20 p.m.	51	57
					12:30 p.m.	53	
ST-115	12	Backyard of 406 Fontanelle Drive, San Jose.	B(67)	3/21/2012	1:30 p.m.	--	65
					1:40 p.m.	--	
ST-116	12	Rear yard of 5157 Pebbletree Court, San Jose.	B(67)	3/21/2012	12:00 p.m.	50	56
					12:10 p.m.	52	
ST-117	12	Rear yard of 429 Lionwood Place, San Jose.	B(67)	4/3/2012	10:30 a.m.	60	64
					10:40 a.m.	59	
ST-118	12	Rear yard of 5273 Pebbletree Way, San Jose.	B(67)	4/3/2012	10:30 a.m.	61	65
					10:40 a.m.	60	
ST-119	12	Rear yard of residence on Great Oaks Drive, San Jose.	B(67)	4/3/2012	11:50 a.m.	60	64
					12:00 p.m.	59	
ST-120	12	Rear yard of 428 Century Oaks Way, San Jose.	B(67)	4/3/2012	11:00 a.m.	61	**66**
					11:10 a.m.	61	
					10:40 a.m.	60	
ST-121	12	Rear yard of 5360 Great Oaks Drive, San Jose.	B(67)	4/3/2012	11:40 a.m.	59	64
					11:50 a.m.	60	
ST-122	12	Adjacent to 54a	B(67)	4/3/2012	1:30 p.m.	56	61

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
		Calle Pintada, San Jose.			1:40 p.m.	57	
ST-123	12	Rear yard of 445 Century Cross Court, San Jose.	B(67)	4/3/2012	11:10 a.m.	57	62
					11:20 a.m.	57	
ST-124	12	Cul-de-sac of Calle Gaviota, San Jose.	B(67)	4/3/2012	1:30 p.m.	55	61
					1:40 p.m.	56	
ST-125	13	Rear yard of 5428 Demerest Lane, San Jose.	B(67)	4/4/2012	10:30 a.m.	54	58
					10:40 a.m.	56	
ST-126	13	Rear yard of 5476 Demerest Lane, San Jose.	B(67)	4/4/2012	10:30 a.m.	54	58
					10:40 a.m.	54	
ST-127	13	Rear yard of 133 Casswell Court, San Jose.	B(67)	4/4/2012	11:10 a.m.	58	63
					11:20 a.m.	57	
ST-128	13	Rear yard of 127 Dunwell Court, San Jose.	B(67)	4/4/2012	11:40 a.m.	63	65
					11:50 a.m.	63	
ST-129	13	Rear yard of 164 Southsun Court, San Jose.	B(67)	4/4/2012	11:40 a.m.	59	63
					11:50 a.m.	60	
ST-130	13	Rear yard of 121 Meadwell Court, San Jose.	B(67)	4/4/2012	11:10 a.m.	60	65
					11:20 a.m.	60	
ST-131	13	Rear yard equivalent of 109 Tennant Avenue, San Jose.	B(67)	4/4/2012	11:40 a.m.	57	62
					11:50 a.m.	58	
ST-132	14	Rear yard of 404 Birkhaven Place, San Jose.	B(67)	3/7/2012	10:10 a.m.	59	63
					10:20 a.m.	59	
ST-133	14	Pool area of 449 Danna Court, San Jose.	B(67)	3/7/2012	10:50 a.m.	54	55
					11:00 a.m.	54	
ST-134	14	Coyote Creek Trail near Parkway Lakes, San Jose.	C(67)	3/7/2012	11:20 a.m.	57	62
					11:30 a.m.	57	
ST-135	14	Rear yard of 7032 Basking Ridge Avenue, San Jose.	B(67)	3/7/2012	10:20 a.m.	60	64
					10:30 a.m.	60	
ST-136	14	Rear yard of 7406 Basking Ridge Avenue, San Jose.	B(67)	3/7/2012	10:10 a.m.	55	59
					10:20 a.m.	55	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-137	14	Parkway Fishing Lakes, San Jose.	C(67)	3/7/2012	10:20 a.m.	60	64
ST-138	14	Parkway Fishing Lakes, San Jose.	C(67)	3/7/2012	10:30 a.m.	62	60
ST-139	14	Setback of residence along Malech Road, San Jose.	Calibration Point	3/7/2012	12:10 p.m.	66	**69**
					12:20 p.m.	67	
ST-140	15	Coyote Creek Trail, south of Bailey Avenue on-ramp, San Jose.	C(67)	3/7/2012	12:30 p.m.	59	63
					12:40 p.m.	59	
ST-141	14	Coyote Creek Trail west of US 101, San Jose.	B(67)	3/8/2012	10:00 a.m.	51	53
					10:10 a.m.	51	
ST-142	15	Patio area of Coyote Creek Golf Course, San Jose.	C(67)	3/8/2012	10:30 a.m.	51	54
					10:40 a.m.	50	
ST-143	15	Rear yard equivalent of 19490 Vista De Lomas, Morgan Hill.	Calibration Point	3/8/2012	11:20 a.m.	65	**68**
					11:30 a.m.	65	
ST-144	15	Rear yard equivalent of 825 Burnett Avenue, Morgan Hill.	B(67)	3/8/2012	11:20 a.m.	63	**67**
					11:30 a.m.	63	
ST-145	15	Front of 740 Peebles Avenue, Morgan Hill.	B(67)	3/8/2012	11:20 a.m.	63	**67**
					11:30 a.m.	62	
ST-146	16	Rear yard of 17900 Laurel Road, Morgan Hill.	B(67)	3/8/2012	12:20 p.m.	65	**69**
					12:30 p.m.	65	
ST-147	16	Rear yard equivalent of 1790 Condit Road, Morgan Hill.	B(67)	3/8/2012	12:20 p.m.	67	**71**
					12:30 p.m.	67	
ST-148	16	Rear yard of 17406 Walnut Grove Drive, Morgan Hill.	B(67)	3/8/2012	12:30 p.m.	68	**70**
					12:40 p.m.	68	
ST-149	16	Adjacent to 1115 Diana Avenue, Morgan Hill.	B(67)	3/8/2012	12:50 p.m.	60	63
					1:00 p.m.	60	

Table 6-2. Summary of Short-Term Measurements and Existing Noise Levels

Receptor ID	Segment Number	Location	Activity Category (NAC)	Date	Time	10-minute L_{eq}, dBA	Worst Hour $L_{eq[h]}$, dBA
ST-150	16	Rear yard of 17382 Walnut Grove Drive, Morgan Hill.	B(67)	3/8/2012	1:00 p.m.	62	**68**
					1:10 p.m.	64	
ST-151	16	Front of 17355 Walnut Grove Drive, Morgan Hill.	B(67)	3/8/2012	1:00 p.m.	54	58
					1:10 p.m.	54	
ST-152	16	Pool area of Executive Inn Suites, Morgan Hill.	E(72)	3/8/2012	1:40 p.m.	63	66
					1:50 p.m.	62	
ST-153	16	Rear yard of 16370 Saint John Court, Morgan Hill.	B(67)	3/8/2012	1:40 p.m.	62	**67**
					1:50 p.m.	63	

Notes: N/A = Not applicable
BOLD font indicates noise levels approaching or exceeding NAC.
ST-115 data affected by local noise source (dog). TNM used to calculate existing noise level.

6.2.1 Segment 1 – Oregon Expressway to SR 85

Category B land uses (residences), Category C land uses (Greer Park), and Category D Land uses (Emerson School and the Girls' Middle School), are located southwest of US 101 from Oregon Expressway to San Antonio Road and from Rengstorff Avenue to Shoreline Boulevard. Ten-foot to 16-foot noise barriers currently shield the majority of these land uses. Noise barriers do not shield Greer Park, the Emerson School, or the Girls' Middle School.

Ambient traffic noise levels in the area were documented in April 2008 as part of the US 101 Auxiliary Lanes Project (EA 4A330K). Four short-term noise measurements (ST-a, ST-b, ST-c, and ST-d) were made in December 2011 to update the 2008 data. A comparison of the 2008 and 2011 data show that the data correlates well indicating that existing ambient noise levels have not measurably changed in the three year time period. Worst-hour noise levels were 56 to 58 dBA $L_{eq[h]}$ in areas representative of the outdoor use areas of the Emerson School, which are shielded from US 101 traffic noise by the intervening school building. Worst-hour noise levels were 62 to 64 dBA $L_{eq[h]}$ at the measurement locations selected in the central portion of Greer Park, and reached 69 dBA $L_{eq[h]}$ at the receptor representing the ball field nearest US 101. Measurements were attempted at the Girls' Middle School located at 3400 West Bayshore Road, but

permission to measure at the property was not granted. Measurements were made near the US 101 right-of-way fence adjacent to 1950 Leghorn Street at the request of VTA. Worst-hour noise levels at the right-of-way fence were 80 dBA $L_{eq[h]}$, and were consistent with 2008 measurements made approximately 25 feet from the right-of-way fence.

6.2.2 Segment 2 – SR 85 to SR 237

Category B land uses are residences located north and south of US 101. Category C land uses include baseball fields at Moffett Federal Airfield and the Sunnyvale Golf Course. One long-term noise measurement (LT-1) was made at the Fairchild Apartments on Fairchild Avenue. Four short-term noise measurements were made in Category B, C, and E land uses at Receptors ST-1 through ST-4. As indicated in Table 6-2, existing worst-hour noise levels at short-term measurement locations range from 62 to 79 dBA $L_{eq[h]}$. Currently, 8 to 15 foot high noise barriers shield many of these Category B and C land uses.

6.2.3 Segment 3 – SR 237 to Lawrence Expressway

Category B land uses are residences located north and south of US 101. Several Category E land uses (Hotels and Motels) are also located within this segment. Two long-term noise measurements (LT-2 and LT-3) were made, one adjacent to the Sun Ridge Apartments on Ahwanee Avenue, and the other in the rear yard of 856 San Ramon Avenue. Twenty-four short-term noise measurements were made in Category B and E land uses at Receptors ST-5 through ST-28. As shown in Table 6-2, existing worst-hour noise levels at ST measurement locations range from 52 to 74 dBA $L_{eq[h]}$. Currently, 7- to 15-foot-high noise barriers shield receptors within this segment.

6.2.4 Segment 4 – Lawrence Expressway to San Tomas/Montague Expressway

Category B land uses are residences located north and south of US 101. Category C land uses include San Tomas Aquino Creek Trail. One long-term noise measurement (LT-4) was made along the San Tomas Aquino Creek Trail, adjacent to US 101. Eight short-term noise measurements were made in Category B, C, and E land uses at Receptors ST-29 through ST-36. Existing worst-hour noise levels at short-term measurement locations range from 53 to 68 dBA $L_{eq[h],}$ as indicated in Table 6-2. Currently 12-foot-high noise barriers shield residences north and south of US 101.

6.2.5 Segment 5 – San Tomas/Montague Expressway to Guadalupe/SR 87

No Category B land uses are located within this segment of the project. One long-term noise measurement was made at the pool area of the La Quinta Inn off Channing Avenue (LT-5). Two short-term noise measurements were made in Category C and E land uses at Receptors ST-37 and ST-38. Existing worst-hour noise levels at short-term measurement locations range from 61 to 69 dBA $L_{eq[h]}$. No existing noise barriers were identified within this segment.

6.2.6 Segment 6 – SR 87 to I-880

Category E land uses include various airport hotels. No long-term noise measurements were made. Three short-term noise measurements were made in Category E land uses at Receptors ST-39 through ST-41. As indicated in Table 6-2, existing worst-hour noise levels at short-term measurement locations range from 55 to 58 dBA $L_{eq[h]}$. No noise barriers are located within this segment.

6.2.7 Segment 7 – I-880 to East Taylor Street

Category B land uses are residences located south of US 101. No long-term noise measurements were made. Eight short-term noise measurements were made in Category B land uses at Receptors ST-42 through ST-49. As shown in Table 6-2, existing worst-hour noise levels at short-term measurement locations range from 54 to 76 dBA $L_{eq[h]}$. Currently, 7 to 12-foot high noise barriers shield residences within this segment.

6.2.8 Segment 8 – East Taylor Street to I-280

US 101 generally traverses the area from the northwest to the southeast. Category B land uses are residences located northeast and southwest of US 101. There are also several Category C land uses, including a school and churches. Two long-term measurements were made, one in the rear yard equivalent of 75 North 31st Street and the other at the end of Sunny Court. Sixteen short-term noise measurements were made in Category B and C land uses at Receptors ST-50 through ST-65. Existing worst-hour noise levels at ST measurement locations range from 63 to 70 dBA $L_{eq[h],}$ as presented in Table 6-2. Existing 10 to 14-foot high noise barriers shield residences within this segment.

6.2.9 Segment 9 – I-280 to Tully Road

Category B land uses are residences located northeast and southwest of US 101. Category C land uses include the Fair Swim Center. There is also one Category E land use, a Best

Western. One long-term noise measurement (LT-8) was made in the rear yard of 1442 Dornoch Avenue. Sixteen short-term noise measurements were made in Category B and C land uses at Receptors ST-66 through ST-81. Existing worst-hour noise levels at ST measurement locations range from 59 to 68 dBA $L_{eq[h]}$. Currently, 12 to 13-foot high noise barriers shield residences within this segment.

6.2.10 Segment 10 – Tully Road to East Capitol Expressway

Category B land uses are residences located northeast and southwest of US 101. No long-term measurements were made. Thirteen short-term noise measurements were made in Category B, C, and E land uses at Receptors ST-82 through ST-94. Existing worst-hour noise levels at ST measurement locations range from 59 to 68 dBA $L_{eq[h],}$ shown in Table 6-2. Currently, 7 to 14-foot high noise barriers shield residences within this segment.

6.2.11 Segment 11 – East Capitol Expressway to Hellyer Avenue

Category B land uses are residences located northeast and southwest of US 101. Category C land uses include the Ramblewood Elementary School and Hellyer County Park. One long-term noise measurement (LT-9) was made at 1337 Isengard Court. Twelve short-term noise measurements were made in Category B land uses at Receptors ST-95 through ST-106. Existing worst-hour noise levels at ST measurement locations range from 57 to 76 dBA $L_{eq[h]}$. Existing 10 to 16-foot noise barriers shield residences and Hellyer County Park within this segment.

6.2.12 Segment 12 – Hellyer Avenue to Blossom Hill Road

US 101 generally traverses the area from north to south. Category B land uses are residences located west and east of US 101. Category C land uses include Samuel Stipe Elementary School and Hellyer County Park. One long-term noise measurement (LT-10) was made in the rear yard of 4885 Snow Drive. Eighteen short-term noise measurements were made in Category B and C land uses at Receptors ST-107 through ST-124. As indicated in Table 6-2, existing worst-hour noise levels at ST measurement locations range from 57 to 67 dBA $L_{eq[h]}$. Currently, 7 to 15-foot high barriers shield residences and Hellyer County Park within this segment.

6.2.13 Segment 13 – Blossom Hill Road to SR 85/Bernal Road

US 101 generally traverses the area from the northwest to the southeast. Category B land uses are residences located northeast and southwest of US 101. Two long-term noise measurements (LT-11 and LT-12) were made at 139 Mosswell Court and 148 Flintwell

Court, respectively. Seven short-term noise measurements were made in Category B land uses at Receptors ST-125 through ST-131. Existing worst-hour noise levels at ST measurement locations range from 58 to 65 dBA $L_{eq[h]}$. Existing 7 to 12-foot high barriers shield residences within this segment.

6.2.14 Segment 14 – SR 85/Bernal Road to Bailey Avenue

Category B land uses are residences located northeast and southwest of US 101. Category C land uses include the Coyote Creek Trail and the Parkway Fishing Lakes. One long-term reference noise measurement (LT-13) was made at 251 Crestridge Court. Nine short-term noise measurements were made in Category B and C land uses at Receptors ST-132 through ST-139, and ST-141. As indicated in Table 6-2, existing worst-hour noise levels at ST measurement locations range from 53 to 69 dBA $L_{eq[h]}$. Currently, a 12-foot noise barrier shields residences within this segment.

6.2.15 Segment 15 – Bailey Avenue to Cochrane Road

Category B land uses are located northeast and southwest of US 101. Category C land uses include the Coyote Creek Trail and Coyote Creek Golf Club. Large areas north of US 101 in this segment are undeveloped. One long-term reference noise measurement (LT-14) was made at the Coyote Creek Golf Club. Five short-term noise measurements were made in Category B and C land uses at Receptors ST-140 and ST-142 through ST-145. As shown in Table 6-2, existing worst-hour noise levels at ST measurement locations range from 54 to 68 dBA $L_{eq[h]}$. Currently, a 10-foot noise barrier shields residences within this segment. The trail and park areas are not shielded by noise barriers.

6.2.16 Segment 16 – Cochrane Road to Tennant Avenue

Category B land uses are located northeast and southwest of US 101. Category E land uses include the various hotels and motels. No long-term noise measurements were made. Eight short-term noise measurements were made in Category B land uses at Receptors ST-146 and ST-153. As indicated in Table 6-2, existing worst-hour noise levels at ST measurement locations range from 58 to 71 dBA $L_{eq[h]}$. Currently, a 7 to 9-foot high noise barrier shields residences within this segment.

6.3. Model Calibration to Existing Conditions

TNM was used to calculate existing noise levels at field measurement locations during those periods when the measurements were made and traffic was counted. Adjustments or ~~"K~~ factors" were then developed where the traffic noise model and the measured levels

varied by 2 dBA or greater. The development of each K factor followed the methodology detailed in Section 5.3. The adjustment is added to modeled results for existing and future worst-hour traffic conditions. The K factor for each receptor can be found in Table 6-3. As a conservative measure, when modeled traffic noise levels exceeded corresponding measured levels by 2 dBA or more, a K factor was developed to bring modeled noise level predictions 2 dBA higher (e.g., if measured was 60 dBA and modeled was 64 dBA, K factor = -2 dBA; whereas, if measured was 60 dBA and modeled was 56 dBA, K factor = 4 dBA). Measurement locations in which K factors were found to be (+/-) 5 dBA or greater were investigated for modeling error or data contamination. Field measurements and site surveying was repeated, as necessary. In many areas, the type of pavement on US 101 affected the modeling results. Per FHWA and Caltrans direction, only "average pavement" can be used in the TNM model. In some situations, however, existing concrete pavement, which typically results in higher sound-intensity levels as compared to average pavement or new "quiet pavement" substantially affected the measured noise levels. Appendix F details sound intensity measurements made along the corridor that were used to justify some of the larger K-factors. Locations at which K factors are still 5 dBA or greater have been field verified and are considered accurate.

Table 6-3. TNM Adjustment Factors

Receptor ID	10-min L_{eq} Noise Level, dBA			K Factor, dBA
	Measured Level	TNM Validation	Difference	
ST-1	59.3	60.8	1.5	0
R-1a	[a]	[a]	[a]	0
R-1b	[a]	[a]	[a]	0
ST-2	68.2	64	-4.2	4.2
R-2a	[a]	[a]	[a]	0
R-2b	[a]	[a]	[a]	0
ST-3	66.1	67.5	1.4	0
ST-3a	[a]	[a]	[a]	0
ST-4	75.6	77	1.4	0
R-4a	[a]	[a]	[a]	0
R-4b	[a]	[a]	[a]	0
LT-1	67.9	63.6	-4.3	4.3
ST-5	58.7	61.8	3.1	-1.1
ST-6	61.8	63.7	1.9	0
ST-7	53	48.9	-4.1	4.1
ST-8	58.1	55.4	-2.7	2.7
ST-9	56.7	52.2	-4.5	4.5
ST-10	59.9	62.4	2.5	-0.5
ST-11	60	60.6	0.6	0
ST-12	58.6	59.6	1	0
ST-13	71.7	76.3	4.6	-2.6
ST-14	52.2	51.2	-1	0
ST-15	60.8	65.4	4.6	-2.6
ST-16	63.1	63	-0.1	0
ST-17	61.8	60.7	-1.1	0
ST-18	58.5	60.3	1.8	0
ST-19	66.7	64.7	-2	0
ST-20	65.9	64.4	-1.5	0
ST-21	64.5	64	-0.5	0
ST-22	62.3	64	1.7	0
ST-23	61.7	62.4	0.7	0
ST-24	62	64.8	2.8	-0.8
ST-25	63.9	64.4	0.5	0
ST-26	64.8	65.5	0.7	0
ST-27	62.1	65.9	3.8	-1.8
ST-28	57	62.2	5.2	-3.2
LT-2	67	65.2	-1.8	0
LT-3	62.1	63	0.9	0
ST-29	51	51.4	0.4	0
ST-30	67	67.2	0.2	0
ST-31	53.7	54.9	1.2	0
ST-32	66.1	67	0.9	0
ST-33	63.8	65.2	1.4	0
ST-34	64.9	60.7	-4.2	4.2
ST-35	60.1	61.9	1.8	0
ST-36	58.3	65.6	7.3	-5.3
R-36a	[a]	[a]	[a]	0
LT-4	72.1	72.3	0.2	0
ST-37	60.9	56.4	-4.5	4.5
ST-38	65.3	68.1	2.8	-0.8
R-38a	[a]	[a]	[a]	-0.8
R-38b	[a]	[a]	[a]	-0.8
LT-5	63.7	63.2	-0.5	0
ST-39	58.6	56.9	-1.7	0

Receptor ID	10-min L_{eq} Noise Level, dBA			K Factor, dBA
	Measured Level	TNM Validation	Difference	
ST-40	57	54.2	-2.8	2.8
ST-41	55.4	54.4	-1	0
ST-42	64.3	62.5	-1.8	0
ST-43	53.1	52.3	-0.8	0
ST-44	65.3	65	-0.3	0
ST-45	62.4	62.9	0.5	0
ST-46	56.1	57.8	1.7	0
ST-47	64.4	66.2	1.8	0
ST-48	57.8	59.6	1.8	0
ST-49	71.9	75	3.1	-1.1
ST-50	60	65.3	5.3	-3.3
R-50a	[a]	[a]	[a]	-3.3
R-50b	[a]	[a]	[a]	-3.3
R-50c	[a]	[a]	[a]	-3.3
R-50d	[a]	[a]	[a]	-3.3
ST-51	64.4	62.6	-1.8	0
ST-52	64.5	64.9	0.4	0
ST-53	65.5	64.6	-0.9	0
ST-54	65.9	64	-1.9	0
ST-55	67.8	65	-2.8	2.8
ST-56	62.5	62	-0.5	0
ST-57	63.6	63.4	-0.2	0
ST-58	64	60.4	-3.6	3.6
ST-59	66.7	63.4	-3.3	3.3
ST-60	62.7	63.6	0.9	0
ST-61	59	64.4	5.4	-3.4
ST-62	66.4	66.2	-0.2	0
ST-62a	[a]	[a]	[a]	0
ST-63	59.2	60.4	1.2	0
ST-64	62.8	62.5	-0.3	0
R-64a	[a]	[a]	[a]	0
ST-65	63.6	62.6	-1	0
LT-6	69.8	65.6	-4.2	4.2
LT-7	60.3	64.7	4.4	-2.4
ST-66	55.8	57.5	1.7	0
ST-67	57.6	59.6	2	0
ST-68	64.7	65.4	0.7	0
ST-69	64.7	60.9	-3.8	3.8
ST-70	65.3	65.1	-0.2	0
ST-71	63.8	64.2	0.4	0
ST-72	63.3	62.7	-0.6	0
ST-73	63	63.3	0.3	0
ST-74	63.4	64	0.6	0
ST-75	58.9	59.6	0.7	0
ST-76	65.1	64.7	-0.4	0
ST-77	65.3	63.5	-1.8	0
ST-78	57.5	59.1	1.6	0
ST-79	57.6	57	-0.6	0
ST-80	60	61.8	1.8	0
ST-81	55.2	58.2	3	-1
LT-8	64.9	64.4	-0.5	0
ST-82	61.6	66.9	5.3	-3.3
ST-83	59.1	56.9	-2.2	2.2
ST-84	58.8	62.7	3.9	-1.9
ST-85	65.1	63.1	-2	0

Receptor ID	10-min L_{eq} Noise Level, dBA			K Factor, dBA
	Measured Level	TNM Validation	Difference	
ST-86	63.6	62.7	-0.9	0
ST-87	59.6	63.4	3.8	-1.8
ST-88	62.7	63.6	0.9	0
ST-89	58.1	56.4	-1.7	0
ST-90	61.5	61.9	0.4	0
ST-91	65.7	63.9	-1.8	0
ST-92	58.5	63.9	5.4	-3.4
ST-93	62.3	66.3	4	-2
ST-94	60.9	62.6	1.7	0
ST-95	55	60.5	5.5	-3.5
ST-96	58.4	54.9	-3.5	3.5
ST-97	54.3	61.5	7.2	-5.2
ST-98	53.5	61.2	7.7	-5.7
ST-99	53.1	61.5	8.4	-6.4
ST-100	59.3	60.8	1.5	0
ST-101	58.3	63.7	5.4	-3.4
ST-102	60.2	64	3.8	-1.8
ST-103	57.2	65.5	8.3	-6.3
ST-104	55.5	61.5	6	-4
R-104a	[a]	[a]	[a]	-4
ST-105	71.9	75.8	3.9	-1.9
R-105a	[a]	[a]	[a]	-1.9
R-105b	[a]	[a]	[a]	-1.9
R-105c	[a]	[a]	[a]	-1.9
ST-106	66.5	76.5	10	-8
R-106a	[a]	[a]	[a]	-8
LT-9	54.5	62.6	8.1	-6.1
ST-107	57.3	62.4	5.1	-3.1
R-107a	[a]	[a]	[a]	-3.1
ST-108	55.2	59.5	4.3	-2.3
ST-109	63.5	65	1.5	0
ST-110	58.4	58.9	0.5	0
ST-111	56.9	58.5	1.6	0
ST-112	55.2	62.4	7.2	-5.2
ST-113	60	62	2	0
ST-114	52.9	58.8	5.9	-3.9
ST-115	[a]	[a]	[a]	0
ST-116	51.5	56	4.5	-2.5
ST-117	60.1	61.3	1.2	0
R-117a	[a]	[a]	[a]	0
R-117b	[a]	[a]	[a]	0
R-117c	[a]	[a]	[a]	0
ST-118	61.2	62.1	0.9	0
ST-119	59.6	62.9	3.3	-1.3
ST-120	60.5	62.4	1.9	0
ST-121	59.9	61.7	1.8	0
ST-122	55.6	58.5	2.9	-0.9
ST-123	57	62.1	5.1	-3.1
ST-124	54.8	61	6.2	-4.2
LT-10	58.4	61.5	3.1	-1.1
ST-125	53.9	55.3	1.4	0
ST-126	53.7	55.7	2	0
ST-127	58.1	62.5	4.4	-2.4
R-127a	[a]	[a]	[a]	0
ST-128	62.9	62.6	-0.3	0

Receptor ID	10-min L_{eq} Noise Level, dBA			K Factor, dBA
	Measured Level	TNM Validation	Difference	
R-128a	[a]	[a]	[a]	0
ST-129	60.2	60.4	0.2	0
ST-130	60.3	63.5	3.2	-1.2
ST-131	57.5	59.3	1.8	0
LT-11	59	63.4	4.4	-2.4
LT-12	60.1	63.8	3.7	-1.7
ST-141	51	51	0	0
ST-132	58.7	59.3	0.6	0
LT-13	[a]	[a]	[a]	0
ST-133	54.3	54.1	-0.2	0
ST-134	56.8	61.1	4.3	-2.3
ST-135	60	61.5	1.5	0
ST-136	55	58.7	3.7	-1.7
R-137a	[a]	[a]	[a]	0
ST-137	[a]	[a]	[a]	0
ST-138	61.9	60.5	-1.4	0
ST-139	66.8	65.2	-1.6	0
R-139a	[a]	[a]	[a]	0
R-139b	[a]	[a]	[a]	0
R-139c	[a]	[a]	[a]	0
ST-140	58.7	62.7	4	-2
ST-142	50.7	55.7	5	-3
R-142a	[a]	[a]	[a]	0
R-142b	[a]	[a]	[a]	0
R-142c	[a]	[a]	[a]	0
R-142d	[a]	[a]	[a]	0
R-142e	[a]	[a]	[a]	0
R-142f	[a]	[a]	[a]	0
ST-143	65	65.3	0.3	0
R-143a	[a]	[a]	[a]	0
R-143b	[a]	[a]	[a]	0
ST-144	62.5	69.4	6.9	-4.9
R-144a	[a]	[a]	[a]	-4.9
ST-145	62.3	67.2	4.9	-2.9
R-145a	[a]	[a]	[a]	-2.9
LT-14	66.7	66.1	-0.6	0
ST-146	64.9	67.5	2.6	-0.6
R-146a	[a]	[a]	[a]	-0.6
ST-147	67.3	68.5	1.2	0
ST-148	68	68.2	0.2	0
R-148a	[a]	[a]	[a]	0
ST-149	59.8	61.2	1.4	0
R-149a	[a]	[a]	[a]	0
ST-150	66.3	66.1	-0.2	0
ST-151	53.7	60.7	7	-5
ST-152	62.8	64.1	1.3	0
ST-153	62	65.7	3.7	-1.7

[a] Non-measurement receptor added to the model. K-factor at modeled receptor based on K-factors of adjacent measurement receptors.

6.4. Future Undeveloped Land Uses

The Protocol requires that the NSR discuss the development of future land uses in the vicinity of the project. Most of the areas adjacent to US 101 are built-out. Lists of approved and proposed projects in the Cities of Palo Alto, Mountain View, Sunnyvale, San Jose, and Morgan Hill were reviewed to identify undeveloped lands for which development is planned, designed, and programmed so that it may be considered approved prior to project approval. According to the Protocol, future development would be considered planned, designed, and programmed once it has received final development approval. The review focused on projects within approximately 500 feet of the centerline of US 101 where traffic noise levels from the highway could dominate the noise environment. Projects located beyond this distance were excluded from further analysis.

Palo Alto

A review of the City of Palo Alto's new planning applications through October 2012 found no noise-sensitive projects proposed near US 101.

Mountain View

A review of the City of Mountain View Planning Division's project list identified two projects near US 101: 1) a 63-room hotel project located at 870 Leong Drive and 2) a project to construct six row houses at 115 Evandale Avenue.

The 63-room hotel project site is approximately 410 feet from the center of US 101 southbound and approximately 100 feet from a US 101 entrance ramp. Currently, there are no barriers to shield the noise from US 101. Noise levels measured and modeled at ST-1 could represent shielded land use areas at this proposed future project, while ST-2 represents noise levels from unshielded land use areas. From the results table in Chapter 6 of this report, the worst-hour noise levels would range from 62 dBA $L_{eq[h]}$ when shielded to 69 dBA $L_{eq[h]}$ or less when not shielded. Both approximations are below the NAC for Category E land uses.

The row houses located at 115 Evandale Avenue are approximately 550 feet from the centerline of US 101 southbound. This location is currently a vacant lot with a motor home lot and other residential land uses lying between the site and US 101. Additionally, an existing sound barrier, approximately 10 feet in height, shields the proposed future project from US 101 traffic noise. Noise levels measured and modeled at ST-2 are in the vicinity of this proposed future project and show the worst-hour noise levels to be

approximately 69 dBA $L_{eq[h]}$ or less. This exceeds the NAC for Category B residential land uses, but since the proposed future project site is several rows back from ST-2, providing at least 5 dBA of attenuation, the noise levels are expected to be below the NAC.

Sunnyvale

A review of the City of Sunnyvale's development update list found one noise-sensitive project proposed near US 101. A General Plan Amendment Initiation request has been approved to change the Industrial building designation to Residential Very High Density at 520 East Weddell Drive. Currently, the site is zoned for industrial use and is located approximately 150 feet from the centerline of US 101 northbound. Since this land use designation has been approved to change to residential land use, this location is considered to be noise-sensitive. This proposed future project is approximately 990 feet south of receptor ST-13; both noise-sensitive locations are within 500 feet of US 101. Therefore, the noise levels measured and modeled at ST-13 could represent the levels at the proposed future project site and show the worst-hour noise levels to be approximately 74 dBA $L_{eq[h]}$. There are no existing sound barriers along US 101 to shield the noise for the land use, but noise abatement measures would be required since the worst-hour noise levels exceed the NAC for Category B and Category E land uses.

Santa Clara

A review of the City of Santa Clara Approved Major Projects list from January 2008 through June 2012 found no noise-sensitive projects proposed near US 101.

San Jose

A review of the City of San Jose Department of Planning, Building, and Code Enforcement's Development Activity Highlights and Five-Year Forecast (2013-2017) found no noise-sensitive projects proposed near US 101.

Morgan Hill

A review of the City of Morgan Hill Planning Division Project Status Report resulted in identifying a single noise-sensitive project proposed near US 101. A project to build 49 single-family units on undeveloped land in the northwest corner of the intersection at Walnut Grove Drive and San Pedro Avenue has been approved. The size of the land is 460 feet by 775 feet and ranges from 450 to 930 feet from US 101. ST-153, located at 16370 Saint John Court, is the receptor in the closest proximity to this proposed future

project site. ST-153 is approximately 169 feet from the centerline of US 101 southbound and approximately 1,490 feet south of the proposed future project site. The worst-hour noise level was determined to be approximately 67 dBA $L_{eq[h]}$ or less. Since ST-153 is less than half the distance from US 101 than the proposed future project site, the actual levels measured at the site should be less than 67 dBA $L_{eq[h]}$, and therefore, within the Category B NAC requirement for residential land use.

Chapter 7. Future Noise Environment, Impacts, and Considered Abatement

7.1. Traffic Inputs Used for Noise Modeling

Once the traffic noise model was calibrated, baseline, future No Build (2035), and future Build (2035) worst hour traffic noise levels were calculated. The noisiest hour is not necessarily the hour with peak traffic volumes. Congestion results in slower speeds, which substantially reduces traffic noise levels. The worst hour is typically an hour where traffic flows freely at or near capacity conditions.

Traffic volume inputs for the traffic noise model were taken from the traffic projections provided by CDM Smith. Free-flowing capacity traffic conditions were used for the traffic noise modeling of existing and future noise levels where demand volumes exceeded capacity. Under this assumption, Level-of-Service C traffic volumes were used, which correspond with the following traffic volumes:

- 1,800 vehicles per hour per lane for mixed-flow lanes
- 1,500 vehicles per hour per lane for high occupancy vehicle lanes
- 1,400 vehicles per hour per lane for express lanes
- 1,000 vehicles per hour per lane for auxiliary lanes
- 1,000 vehicles per hour per lane for freeway ramps

Traffic mix information reported by the California Department of Transportation was used for both existing and future scenarios expected by 2035. All freeway traffic was modeled at 65 miles per hour (mph) for autos and light trucks, 60 mph for medium trucks and heavy trucks, and 45 mph for all on and off-ramps.

7.2. Noise Level Calculations and Assessment of Noise Impacts

Noise levels were predicted within sixteen segments along US 101, between Oregon Expressway in Palo Alto, California and Tennant Avenue in Morgan Hill, California. Table 7-1 summarizes the traffic noise modeling results for Segment 1 of the project, which corresponds to Segment A of the SR 85 Express Lanes Project. The traffic noise modeling results for the remainder of the study area (Segments 2-16) are summarized in Table 7-2. The modeling results for each of the 16 study area segments are discussed. Impacted receptors within each segment were identified by Activity Category and the number of impacted receptors was summarized to calculate reasonableness monetary

allowances for feasible noise barriers that also met the 7 dB noise reduction design goal. Noise levels discussed in this section are based on the adjusted model results, using worst-case traffic conditions (in terms of noise generation) for the 2035 No Build as well as the 2035 Build scenarios.

Table 7-1. Modeled Noise Levels: Segment 1

Receptor ID	Segment Number	Worst-Hour Noise Levels, $L_{eq[h]}$ dBA			Noise Increase Over Existing		Activity Category (NAC)	Impact[3]
		Existing	2035 No Build[1]	2035 Build[2]	2035 No Build	2035 Build		
R20	1	69	70	70	1	1	C(67)	A/E
R21	1	67	69	69	2	2	C(67)	A/E
R22 [4]	1	76	77	77	1	1	D(52)	A/E
R24[5]	1	66	66	66	0	0	B(67)	None
R25[5]	1	61	61	61	0	0	B(67)	None
R27	1	73	74	74	1	1	B(67)	A/E
R27A	1	73	74	74	1	1	B(67)	A/E
R29	1	67	68	68	1	1	B(67)	A/E
R34	1	68	68	68	0	0	B(67)	A/E
R35	1	68	68	68	0	0	B(67)	A/E
R36	1	67	68	68	1	1	B(67)	A/E

[1] Assumes construction of US 101 Auxiliary Lanes Project (EA 4A330K.)
[2] Assumes construction of US 101 Auxiliary Lanes Project (EA 4A330K) and SR 85 Express Lanes Project (EA 04-4A7900).
[3] Impact Type: S = Substantial Increase (12 dBA or more), A/E = Approach or Exceed NAC.
[4] Represents exterior façade of Category D land uses.
[5] Noise levels assume the presence of a 14-foot noise barrier constructed as part of the Classics at Sterling Park Residential Development along the southbound right-of-way for US 101, extending from approximately Station 77+50 to 89+25

Table 7-2. Modeled Noise Levels: Segments 2-16

Receptor ID	Segment Number	Worst-Hour Noise Levels, Leq[h] dBA			Noise Increase Over Existing		Activity Category (NAC)	Impact[1]
		Existing	2035 No Build	2035 Build	2035 No Build	2035 Build		
ST-1	2	62	63	65	1	3	E(72)	None
R-1a	2	60	60	61	0	1	B(67)	None
R-1b	2	60	61	62	1	2	B(67)	None
ST-2	2	69	70	71	1	2	B(67)	A/E
R-2a	2	65	66	68	1	3	C(67)	A/E
R-2b	2	65	65	67	0	2	C(67)	A/E
ST-3	2	69	69	71	0	2	Calibration Point	None
ST-3a	3	59	60	61	1	2	E(72)	None
ST-4	2	79	79	80	0	1	Calibration Point	None
R-4a	2	76	77	78	1	2	C(67)	A/E
R-4b	2	68	68	71	0	3	C(67)	A/E
LT-1	2	69	70	70	1	1	B(67)	A/E
ST-5	3	61	62	62	1	1	E(72)	None
ST-6	3	65	65	66	0	1	E(72)	None

Table 7-2. Modeled Noise Levels: Segments 2-16

Receptor ID	Segment Number	Worst-Hour Noise Levels, Leq[h] dBA			Noise Increase Over Existing		Activity Category (NAC)	Impact[1]
		Existing	2035 No Build	2035 Build	2035 No Build	2035 Build		
ST-7	3	54	54	55	0	1	B(67)	None
ST-8	3	59	59	60	0	1	B(67)	None
ST-9	3	58	58	59	0	1	B(67)	None
ST-10	3	63	63	64	0	1	B(67)	None
ST-11	3	62	62	63	0	1	B(76)	None
ST-12	3	62	62	63	0	1	B(67)	None
ST-13	3	74	75	75	1	1	E(72)	A/E
ST-14	3	52	52	53	0	1	B(67)	None
ST-15	3	64	64	65	0	1	B(67)	None
ST-16	3	64	64	66	0	2	Calibration Point	None
ST-17	3	62	62	64	0	2	B(67)	None
ST-18	3	61	62	64	1	3	B(67)	None
ST-19	3	66	66	67	0	1	B(67)	A/E
ST-20	3	65	66	66	1	1	B(67)	A/E
ST-21	3	65	65	66	0	1	B(67)	A/E
ST-22	3	65	65	66	0	1	B(67)	A/E
ST-23	3	63	64	64	1	1	B(67)	None
ST-24	3	65	65	66	0	1	B(67)	A/E
ST-25	3	65	65	66	0	1	B(67)	A/E
ST-26	3	67	67	68	0	1	B(67)	A/E
ST-27	3	65	65	66	0	1	B(67)	A/E
ST-28	3	60	60	61	0	1	B(67)	None
LT-2	3	66	67	68	1	2	B(67)	A/E
LT-3	3	64	64	65	0	1	B(67)	None
ST-29	4	53	53	54	0	1	B(67)	None
ST-30	4	69	69	70	0	1	B(67)	A/E
ST-31	4	57	57	58	0	1	B(67)	None
ST-32	4	68	68	69	0	1	B(67)	A/E
ST-33	4	66	67	68	1	2	E(72)	None
ST-34	4	66	66	68	0	2	E(72)	None
ST-35	4	63	63	65	0	2	E(72)	None
ST-36	4	61	62	63	1	2	C(67)	None
ST-36a	4	73	73	74	0	1	C(67)	A/E
LT-4	4	74	74	75	0	1	C(67)	A/E
ST-37	5	61	61	62	0	0	E(72)	None
ST-38	5	69	69	70	0	1	C(67)	A/E
R-38a	5	65	65	66	0	1	C(67)	A/E
R-38b	5	64	64	65	0	1	C(67)	None
LT-5	5	65	66	67	1	2	E(72)	None
ST-39	6	58	58	60	0	2	E(72)	None
ST-40	6	58	59	60	0	1	E(72)	None
ST-41	6	56	56	57	0	1	E(72)	None
ST-42	7	64	64	65	0	1	B(67)	None
ST-43	7	54	54	55	0	1	B(67)	None
ST-44	7	67	67	68	0	1	B(67)	A/E
ST-45	7	65	65	66	0	1	B(67)	A/E
ST-46	7	60	60	61	0	1	B(67)	None
ST-47	7	67	67	68	0	1	B(67)	A/E
ST-48	7	61	61	62	0	1	B(67)	None
ST-49	7	76	76	76	0	0	B(67)	A/E

Table 7-2. Modeled Noise Levels: Segments 2-16

Receptor ID	Segment Number	Worst-Hour Noise Levels, Leq[h] dBA			Noise Increase Over Existing		Activity Category (NAC)	Impact[1]
		Existing	2035 No Build	2035 Build	2035 No Build	2035 Build		
ST-50	8	64	64	65	0	1	C(67)	None
R-50a	8	69	69	69	0	0	C(67)	A/E
R-50b	8	70	70	70	0	0	C(67)	A/E
R-50c	8	64	64	66	0	2	C(67)	A/E
R-50d	8	62	62	63	0	1	C(67)	None
ST-51	8	65	66	66	1	1	B(67)	A/E
ST-52	8	67	67	67	0	0	B(67)	A/E
ST-53	8	67	67	68	0	1	B(67)	A/E
ST-54	8	66	66	67	0	1	B(67)	A/E
ST-55	8	70	70	71	0	1	C(67)	A/E
ST-56	8	63	63	65	0	2	B(67)	None
ST-57	8	65	65	66	0	1	B(67)	A/E
ST-58	8	66	66	68	0	2	B(67)	A/E
ST-59	8	69	69	70	0	1	B(67)	A/E
ST-60	8	65	65	66	0	1	B(67)	A/E
ST-61	8	63	63	64	0	1	B(67)	None
ST-62	8	68	68	69	0	1	B(67)	A/E
R-62a	8	67	67	68	0	1	B(67)	A/E
ST-63	8	62	62	63	0	1	B(67)	None
ST-64	8	67	67	68	0	1	B(67)	A/E
R-64a	8	69	69	70	0	1	C(67)	A/E
ST-65	8	63	63	64	0	1	B(67)	None
LT-6	8	72	72	73	0	1	B(67)	A/E
LT-7	8	64	64	65	0	1	B(67)	None
ST-66	9	59	60	60	1	1	B(67)	None
ST-67	9	62	62	63	0	1	B(67)	None
ST-68	9	67	67	67	0	0	B(67)	A/E
ST-69	9	68	68	68	0	0	B(67)	A/E
ST-70	9	67	67	68	0	1	B(67)	A/E
ST-71	9	67	67	68	0	1	B(67)	A/E
ST-72	9	66	66	67	0	1	B(67)	A/E
ST-73	9	67	67	68	0	1	B(67)	A/E
ST-74	9	67	67	68	0	1	B(67)	A/E
ST-75	9	62	62	62	0	0	B(67)	None
ST-76	9	67	67	68	0	1	B(67)	A/E
ST-77	9	67	67	68	0	1	B(67)	A/E
ST-78	9	62	62	62	0	0	B(67)	None
ST-79	9	59	59	60	0	1	B(67)	None
ST-80	9	64	64	65	0	1	B(67)	None
ST-81	9	60	60	61	0	1	C(67)	None
LT-8	9	66	66	67	0	1	B(67)	A/E
ST-82	10	66	66	67	0	1	E(72)	None
ST-83	10	62	62	63	0	1	E(72)	None
ST-84	10	64	64	65	0	1	B(67)	None
ST-85	10	67	67	67	0	0	B(67)	A/E
ST-86	10	66	66	67	0	1	B(67)	A/E
ST-87	10	64	64	65	0	1	B(67)	None
ST-88	10	67	67	68	0	1	B(67)	A/E
ST-89	10	60	60	61	0	1	C(67)	None
ST-90	10	66	66	66	0	0	B(67)	A/E
ST-91	10	67	67	68	0	1	B(67)	A/E

Table 7-2. Modeled Noise Levels: Segments 2-16

Receptor ID	Segment Number	Worst-Hour Noise Levels, Leq[h] dBA			Noise Increase Over Existing		Activity Category (NAC)	Impact[1]
		Existing	2035 No Build	2035 Build	2035 No Build	2035 Build		
ST-92	10	63	63	63	0	0	B(67)	None
ST-93	10	68	68	68	0	0	B(67)	A/E
ST-94	10	65	65	66	0	1	B(67)	A/E
ST-95	11	60	60	61	0	1	B(67)	None
ST-96	11	61	62	63	1	2	B(67)	None
ST-97	11	58	59	60	1	2	B(67)	None
ST-98	11	57	57	58	0	1	B(67)	None
ST-99	11	57	57	58	0	1	B(67)	None
ST-100	11	63	63	64	0	1	C(67)	None
ST-101	11	62	63	63	1	1	B(67)	None
ST-102	11	63	63	64	0	1	B(67)	None
ST-103	11	61	62	63	1	2	B(67)	None
ST-104	11	59	60	61	1	2	B(67)	None
R-104a	11	59	60	61	1	2	C(67)	None
ST-105	11	76	77	77	1	1	B(67)	A/E
R-105a	11	74	75	76	1	2	B(67)	A/E
R-105b	11	70	70	71	0	1	B(67)	A/E
R-105c	11	74	75	75	1	1	B(67)	A/E
ST-106	11	71	71	72	0	1	Calibration Point	None
R-106a	11	65	66	66	1	1	B(67)	A/E
LT-9	11	59	59	60	0	1	B(67)	None
ST-107	12	61	62	63	1	2	C(67)	None
R-107a	12	59	60	61	1	2	C(67)	None
ST-108	12	60	60	61	0	1	B(67)	None
ST-109	12	67	68	68	1	1	B(67)	A/E
ST-110	12	61	62	63	1	2	B(67)	None
ST-111	12	61	62	62	1	1	B(67)	None
ST-112	12	60	60	61	0	1	B(67)	None
ST-113	12	64	65	66	1	2	B(67)	A/E
ST-114	12	57	58	58	1	1	B(67)	None
ST-115	12	65	66	66	1	1	B(67)	A/E
ST-116	12	56	57	57	1	1	B(67)	None
ST-117	12	64	65	66	1	2	B(67)	A/E
R-117a	12	63	63	64	0	1	B(67)	None
R-117b	12	61	61	62	0	1	B(67)	None
R-117c	12	59	59	60	0	1	B(67)	None
ST-118	12	65	66	66	1	1	B(67)	A/E
ST-119	12	64	65	66	1	2	B(67)	A/E
ST-120	12	66	66	67	0	1	B(67)	A/E
ST-121	12	64	65	66	1	2	B(67)	A/E
ST-122	12	61	61	62	0	1	B(67)	None
ST-123	12	62	63	64	1	2	B(67)	None
ST-124	12	61	61	62	0	1	B(67)	None
LT-10	12	62	63	64	1	2	B(67)	None
ST-125	13	58	60	61	2	3	B(67)	None
ST-126	13	58	60	61	2	3	B(67)	None
ST-127	13	63	64	65	1	2	B(67)	None
R-127a	13	73	74	75	1	2	C(67)	A/E
ST-128	13	65	67	67	2	2	B(67)	A/E
R-128a	13	76	78	78	2	2	C(67)	A/E

Table 7-2. Modeled Noise Levels: Segments 2-16

Receptor ID	Segment Number	Worst-Hour Noise Levels, Leq[h] dBA			Noise Increase Over Existing		Activity Category (NAC)	Impact[1]
		Existing	2035 No Build	2035 Build	2035 No Build	2035 Build		
ST-129	13	63	64	65	1	2	B(67)	None
ST-130	13	65	66	67	1	2	B(67)	A/E
ST-131	13	62	64	64	2	2	B(67)	None
LT-11	13	64	65	66	1	2	B(67)	A/E
LT-12	13	65	66	67	1	2	B(67)	A/E
ST-132	14	63	63	64	0	1	B(67)	None
ST-133	14	55	56	57	1	2	B(67)	None
ST-134	14	62	62	62	0	0	C(67)	None
ST-135	14	64	64	65	0	1	B(67)	None
ST-136	14	59	60	61	1	2	B(67)	None
R-137a	14	63	63	64	0	1	B(67)	None
ST-137	14	64	64	65	0	1	C(67)	None
ST-138	14	60	61	62	1	2	C(67)	None
ST-139	14	69	69	70	0	1	Calibration Point	None
R-139a	14	66	66	68	0	2	E(72)	None
R-139b	14	67	67	68	0	1	B(67)	A/E
R-139c	14	66	66	67	0	1	B(67)	A/E
LT-13	14	64	64	64	0	0	B(67)	None
ST-140	15	63	64	65	1	2	C(67)	None
ST-141	14	53	54	55	1	2	B(67)	None
ST-142	15	54	55	56	1	2	C(67)	None
R-142a	15	65	66	66	1	1	C(67)	A/E
R-142b	15	65	66	67	1	2	C(67)	A/E
R-142c	15	67	68	69	1	2	C(67)	A/E
R-142d	15	68	69	70	1	2	C(67)	A/E
R-142e	15	63	64	65	1	2	C(67)	None
R-142f	15	59	60	60	1	1	C(67)	None
ST-143	15	68	69	70	1	2	Calibration Point	None
R-143a	15	67	68	69	1	2	B(67)	A/E
R-143b	15	71	72	73	1	2	B(67)	A/E
ST-144	15	67	68	69	1	2	B(67)	A/E
R-144a	15	74	74	75	0	1	B(67)	A/E
ST-145	15	67	67	68	0	1	B(67)	A/E
R-145a	15	62	63	64	1	2	B(67)	None
LT-14	15	68	68	69	0	1	C(67)	A/E
ST-146	16	69	69	70	0	1	B(67)	A/E
R-146a	16	77	77	77	0	0	B(67)	A/E
ST-147	16	71	71	72	0	1	B(67)	A/E
ST-148	16	70	71	71	1	1	B(67)	A/E
R-148a	16	77	77	77	0	0	B(67)	A/E
ST-149	16	63	64	64	1	1	B(67)	None
R-149a	16	70	71	71	1	1	B(67)	A/E
ST-150	16	68	68	69	0	1	B(67)	A/E
ST-151	16	58	58	58	0	0	B(67)	None
ST-152	16	66	67	67	1	1	E(72)	None
ST-153	16	67	67	67	0	0	B(67)	A/E

[1] Impact Type: S = Substantial Increase (12 dBA or more), A/E = Approach or Exceed NAC.

7.2.1. Segment 1 - Oregon Expressway to SR 85

Conversion of the HOV lanes into single express lanes on US 101 in Palo Alto and Mountain View would not change the roadway geometry as the project would only include restriping and installation of overhead signs and tolling devices in the median. Traffic noise modeling results, as summarized in the US 101 Auxiliary Lanes Project NSR (EA 4A330K), would continue to credibly represent future conditions, as the only difference between the modeling scenarios would be the number of vehicles anticipated per hour in the express lanes. The traffic noise modeling completed for the US 101 Auxiliary Lanes Project assumed capacity conditions during the peak traffic hour with 1,500 vehicles per hour per lane assumed for HOV lanes. The express lanes proposed by the project are projected to have a slightly reduced capacity of 1,400 vehicles per hour per lane; therefore, the US 101 Auxiliary Lanes Project's traffic noise modeling results slightly overestimate traffic noise levels along US 101. The change in predicted noise levels would be less than 1 dBA $L_{eq[h]}$, well within the accuracy of the traffic noise model itself.

Table 7-1 summarizes the traffic noise modeling results for Category B, and C land uses located along US 101 between Oregon Expressway and SR 85 (Segment 1) exposed to noise levels above the NAC. Noise levels are expected to increase by 0 to 2 dBA $L_{eq[h]}$ throughout the project corridor under future Build conditions. The projected noise level increase is not considered substantial as it does not exceed 12 dBA $L_{eq[h]}$.

Category D land uses in this segment include the Emerson School located at 2800 West Bayshore Avenue and the Girls' Middle School located at 3400 West Bayshore Road. The construction of a noise barrier to benefit a single receptor would not be reasonable based only on cost of construction. A visual inspection of these Category D land uses was made to estimate the noise reduction provided by the building structure. The visual inspection revealed that both schools have mechanical ventilation and fixed windows. This type of construction provides a minimum noise reduction of 30 dBA indoors. Traffic noise modeling results show that exterior noise levels at the façade of the two schools would reach 77 dBA $L_{eq[h]}$ under the Build scenario. Interior noise levels would be expected to be a minimum of 30 dBA lower, or 47 dBA $L_{eq[h]}$, which is at least 5 dBA below the interior criterion of 52 dBA $L_{eq[h]}$. Category D land uses along the segment of US 101 between Oregon Expressway and SR 85 are not impacted as noise levels do not approach or exceed the NAC.

7.2.2. Segment 2 – SR 85 to SR 237

One long-term measurement (LT-1) and four short-term measurements (ST-1, ST-2, ST-3, and ST-4) were made. In addition, there are seven additional modeled receptor locations (R-1a, R-1b, R-2a, R-2b, R-3a, R-4a, and R-4b). Two existing noise barriers, with heights of 8 and 15-feet, shield noise sensitive receptors.

As shown in Table 7-2, the existing worst-hour noise level ranges from 59 to 79 dBA $L_{eq[h]}$. Under the 2035 No Build conditions, noise levels at receptor locations are calculated to range from 60 to 79 dBA $L_{eq[h]}$. Noise levels under the 2035 Build condition are calculated to range from 61 to 80 dBA $L_{eq[h]}$. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at single-family residences located south of US 101 between SR 85 and Ellis Street (ST-2 and LT-1), at the Sunnyvale Municipal Golf Course (R-4a and R-4b) and at the baseball fields at Moffett Federal Airfield located north of US 101 (R-2a and R-2b).

The existing noise barrier that currently shields residences located south of US 101 between SR 85 and Ellis Street is already at the maximum allowable height. As a result, additional noise abatement was not considered for residences represented by receptors ST-2 and LT-1. However, noise abatement in the form of new barriers was considered to shield the golf course and baseball fields.

7.2.3. Segment 3 –SR 237 to Lawrence Expressway

Two long-term measurements (LT-2 and LT-3) and twenty-four short-term measurements (ST-5 through ST-28) were made. There are six existing barriers, ranging in height from 7 to 15 feet high.

The worst-hour noise levels are calculated to range from 52 to 74 dBA $L_{eq[h]}$ under Existing conditions, from 52 to 75 dBA $L_{eq[h]}$ under 2035 No Build conditions, and from 53 to 75 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at the America's Best Value Inn (ST-13), single and multi-family residences located north and south of US 101 between North Fair Oaks Avenue and Lawrence Expressway (ST-19 through ST-22, and ST-24 through ST-27), and at the Sun Ridge Apartments located south of US 101 between SR 237 and Fair Oaks Avenue (LT-2).

No exterior uses were identified at the America's Best Value Inn (ST-13); therefore, noise abatement was not considered for this location.

The existing noise barriers that shield residences located south of US 101 between Mathilda Avenue and Lawrence Expressway (SB Walls 2 and 3) are already at the maximum allowable heights. As a result, additional noise abatement was not considered at impacted receptors (LT-2, ST-19, ST-20, ST-21, and ST-22) in these areas. Single and multi-family residences located north of US 101 between North Fair Oaks Avenue and Lawrence Expressway are shielded by an existing 12-foot high wall. Noise abatement in the form of a replacement sound wall was considered.

Several Category D land uses (places of worship) are located along E. Weddell Drive, east of Morse Avenue. No exterior uses were identified at these land uses; therefore, the Category D NAC would apply. A visual inspection of these Category D land uses was made to estimate the noise reduction provided by the building structures. The visual inspection revealed that the buildings are mechanically ventilated and have fixed windows. This type of construction provides a minimum noise reduction of 30 dBA indoors. Based on the noise modeling results and building attenuation estimates, interior noise levels at these Category D land uses would not be expected to approach or exceed the NAC of 52 dBA $L_{eq[h]}$. As a result, noise abatement was not considered.

7.2.4. Segment 4 - Lawrence Expressway to San Tomas/Montague Expressway

One long-term measurement (LT-4) and 8 short-term measurements (ST-29 through ST-36) were made. In addition, there is one modeled receptor location (R-36a). There are two existing barriers.

As shown in Table 7-2, worst-hour noise levels range from 53 to 74 dBA $L_{eq[h]}$ under Existing and 2035 No Build conditions and from 54 to 75 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at the Avalon Silicon Valley Apartments (ST-30), at first-row single-family residences along Wildwood Avenue, north of US 101 (ST-32), and at the San Tomas Aquino Creek Trail (LT-4 and R-36a).

Existing 12-foot high noise barriers currently shield the Avalon Silicon Valley Apartments (SB Wall 4) and the residences along Wildwood Avenue (NB Wall 20). A barrier does not currently shield the San Tomas Aquino Creek Trail. Noise abatement in the form of new and replacement sound walls was considered.

7.2.5. Segment 5 – San Tomas/Montague Expressway to SR 87

No Category B land uses are located within this segment. One long-term measurement (LT-5) and two short-term measurements (ST-37 and ST-38) were made at Category C

and E land uses. In addition, there are two modeled receptor locations (R-38a and R-38b). There are no existing barriers.

Worst-hour noise levels range from 61 to 69 dBA $L_{eq[h]}$ under Existing and 2035 No Build conditions and from 62 to 70 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at the Guadalupe River Trail, represented by ST-38 and R-38a, which are not currently shielded by barriers. Noise abatement in the form of new sound walls was considered for the trail area.

7.2.6. Segment 6 –SR 87 to Interstate 880

No Category B land uses or existing barriers are located within this segment. Three short-term measurements (ST-39, ST-40, and ST-41) were made at pool and common use areas of various Category E hotel uses.

As shown in Table 7-2, worst-hour noise levels range from 56 to 58 dBA $L_{eq[h]}$ under Existing conditions, from 56 to 59 dBA $L_{eq[h]}$ under 2035 No Build conditions and from 57 to 60 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are not predicted to approach or exceed the NAC at any of the land uses, and noise abatement was not considered.

7.2.7. Segment 7 – Interstate 880 to East Taylor Street

Eight short-term measurements (ST-42 through ST-49) were made at Category B land uses. There are five existing barriers, ranging in height from 7 to 12 feet.

Table 7-2 shows the results of the traffic noise modeling. The worst-hour noise levels are calculated to range from 54 to 76 dBA $L_{eq[h]}$ under Existing and 2035 No Build conditions, and from 55 to 76 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at some first row residences south of US 101 between Oakland Road and Taylor Street (ST-44, ST-45, ST-47, and ST-49). Many of these noise sensitive uses are currently shielded by existing 8- to 12-foot-high sound walls. Noise abatement in the form of new and replacement sound walls was considered.

7.2.8. Segment 8 – East Taylor Street to Interstate 280

Two long-term measurements (LT-6 and LT-7) and 16 short-term measurements (ST-50 through ST-65) were made at Category B and C land uses. There are six additional modeled receptor locations (R-50a, R-50b, R-50c, R-50d, R-62a, and R-64a). Modeled receptors R-50a, R-50b, R-50c, and R-50d were added to represent different activity

areas at Watson Park. Receptor R-62a represents single-family residences along S. 31st Street, and R-64a represents the nearest green at Rancho Del Pueblo Golf Course. There are twelve existing barriers, ranging in height from 10 to 14 feet.

As shown in Table 7-2, worst-hour noise levels range from 62 to 72 dBA $L_{eq[h]}$ under Existing and 2035 No Build conditions and from 63 to 73 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at Watson Park (R-50a, R-50b, and R-50c), at Five Wounds School (ST-55), at the golf course (R-64a), and at most first-row single and multi-family residences on both the northbound and southbound sides of US 101 (ST-51, ST-52, ST-53, ST-54, ST-57, ST-58, ST-59, ST-60, ST-62, ST-64, LT-6, and R-62a). Watson Park is not currently shielded by an existing barrier. The remaining Category B and C land uses are shielded by existing 10 to 14-foot high barriers. Noise abatement in the form of new and replacement sound walls was considered for impacted receptors.

7.2.9. Segment 9 – Interstate 280 to Tully Road

One long-term measurement (LT-8) and sixteen short-term measurements (ST-66 through ST-81) were made at Category B and C land uses. Noise sensitive land uses are shielded by five existing barriers, ranging in height from 12 to 16 feet.

As shown in Table 7-2, worst-hour noise levels are calculated to range from 59 to 68 dBA $L_{eq[h]}$ under Existing and 2035 No Build conditions, and from 60 to 68 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at most first row residences (ST-68, ST-69, ST-70, ST-71, ST-72, ST-73, ST-74, ST-76, ST-77, and LT-8). With the exception of ST-68, which is representative of single family residences located along the northbound off-ramp to Story Road, all of these noise sensitive uses are currently shielded by existing 12 to 16-foot high sound walls. Noise abatement in the form of new and replacement sound walls was considered.

7.2.10. Segment 10 – Tully Road to East Capitol Expressway

Thirteen short-term measurements (ST-82 through ST-94) were made at Category B, C, and E land uses. Four existing noise barriers, with heights ranging from 7 to 13 feet, shield noise sensitive receptors.

As shown in Table 7-2, worst-hour noise levels are calculated to range from 60 to 68 $L_{eq[h]}$ for the Existing and 2035 No Build conditions, and from 61 to 68 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build

noise levels are predicted to approach or exceed the NAC at some first-row single-family residences located southwest of US 101, represented by ST-88, ST-90, and ST-94 and at single and multi-family residences located northeast of US 101, represented by ST-85, ST-86, ST-91, and ST-93. Noise abatement in the form of replacement barriers was considered.

7.2.11. Segment 11 – East Capitol Expressway to Hellyer Avenue

One long-term measurement (LT-9) and twelve short-term measurements (ST-95 through ST-106) were made at Category B and C land uses. In addition, there are five modeled receptor locations R-104a, R-105a, R-105b, R-105c, and R-106a). There are eight existing noise barriers, with heights ranging from 10 to 16 feet, shielding noise sensitive receptors along both the northbound and southbound sides of US 101.

As shown in Table 7-2, the worst-hour noise levels range from 57 to 76 dBA $L_{eq[h]}$ under Existing conditions, from 57 to 77 dBA $L_{eq[h]}$ under 2035 No Build conditions, and from 58 to 77 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at low-density single-family residences located east of US 101 between Yerba Buena Road and Hellyer Avenue (ST-105, R-105a, R-105b, R-105c, and R-106a). These residences are elevated above the freeway and are not shielded by an existing noise barrier. Noise abatement in the form of new noise barriers was evaluated.

Ramblewood Elementary School is a Category D land use located west of US 101 at 1351 Lightland Road. The elementary school overlooks US 101 and a noise barrier cannot be constructed at the US 101 right-of-way in order to provide a feasible noise reduction. Illingworth & Rodkin, Inc. evaluated interior noise levels for this project in 2003 prior to construction. Mitigation measures contained in the CEQA document prepared for the project and additional acoustical review during detailed design confirmed that the proposed building elements would sufficiently reduce interior noise levels below 45 dBA DNL. Worst-hour interior noise levels were designed to not exceed 42 dBA $L_{eq[h]}$, which is at least 10 dBA below the interior criterion of 52 dBA $L_{eq[h]}$. Category D land uses along the segment of US 101 between East Capitol Expressway and Hellyer Avenue are not impacted as noise levels do not approach or exceed the NAC.

7.2.12. Segment 12 – Hellyer Avenue to Blossom Hill Road

One long-term measurement (LT-10) and 18 short-term measurements (ST-107 to ST-124) were made at Category B and C land uses. Four additional receptor locations were

modeled (R-107a, R-117a, R-117b, and R-117c). Ten existing noise barriers, with heights ranging from 7 to 15 feet, shield noise sensitive receptors.

As shown in Table 7-2, worst-hour noise levels range from 56 to 67 dBA $L_{eq[h]}$ under Existing conditions, and from 57 to 68 dBA $L_{eq[h]}$ under 2035 No Build and 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at some first-row single-family residences located along Snow Drive, west of US 101 and south of Hellyer County Park (ST-109 and ST-113), at first-row single-family residences located west of US 101 along Great Oaks Drive (ST-119 and ST-121), and at first-row single-family residences located east of US 101 between Fullerton Drive and the on-ramp from Silver Creek Valley Road (ST-115, ST-117, ST-118, and ST-120). These residences are shielded by existing barriers that are already at the maximum allowable height. Therefore, noise abatement was not considered.

7.2.13. Segment 13 – Blossom Hill Road to SR 85/Bernal Road

Two long-term measurements (LT-11 and LT-12) and seven short-term measurements (ST-125 to ST-131) were made at Category B receptors. In addition, there are two modeled receptor locations (R-127a and R-128a). Two existing noise barriers, with heights of 7 and 12 feet, shield noise sensitive receptors.

As shown in Table 7-2, the worst-hour noise levels in this segment range from 58 to 76 dBA $L_{eq[h]}$ under Existing conditions, from 61 to 78 dBA $L_{eq[h]}$ under 2035 No Build conditions, and from 55 to 78 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at some first-row single-family residences located west of US 101 along Silver Leaf Road (ST-128, ST-130, LT-11, and LT-12) and at the Coyote Creek Trail (R-127a and R-128a). The residences are shielded by an existing 12-foot high sound wall. Coyote Creek Trail is not currently shielded by an existing barrier. Noise abatement, in the form of new and replacement barriers was considered for impacted receptors.

7.2.14. Segment 14 – SR 85/Bernal Road to Bailey Avenue

One long-term measurement (LT-13) and nine short-term measurements (ST-132 to ST-139 and ST-141) were made at Category B and C land uses. Four additional receptor locations are modeled (R-137a, R-139a, R-139b, and R-139c). There is one existing 14-foot-high noise barrier.

Worst-hour noise levels in this segment range from 53 to 69 dBA $L_{eq[h]}$ under Existing conditions, from 54 to 69 dBA $L_{eq[h]}$ under 2035 No Build conditions, and from 55 to 70 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at some low-density single-family residences located east of US 101 and north of Bailey Road (R-139b, and R-139c). Noise abatement was considered for impacted residences.

7.2.15. Segment 15 – Bailey Avenue to Cochrane Road

One long-term measurement (LT-14) and five short-term measurements (ST-140 and ST-142 to ST-145) were made at Category B and C land uses. There are also ten additional modeled receptor locations (R-142a, R-142b, R-142c, R-142d, R-142e, R-142f, R-143a, R-143b, R-144a and R-145a). There are no existing noise barriers.

As shown in Table 7-2, worst-hour noise levels in this segment range from 54 to 74 dBA $L_{eq[h]}$ under Existing conditions, 55 to 74 under 2035 No Build conditions and 56 to 75 dBA $L_{eq[h]}$ under 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at the Coyote Creek Golf Course (LT-14, R-142a, R-142b, R-142c, and R-142d) and at low-density single-family residences located on both sides of US 101 near Burnett Avenue (R-143a, R-143b, ST-144, R-144a, and ST-145). These noise sensitive areas are not shielded by existing barriers. Noise abatement was considered in the form of new noise barriers.

7.2.16. Segment 16 – Cochrane Road to Tennant Avenue

Eight short-term measurements (ST-146 to ST-153) and three modeled receptors (R-146a, R-148a, and R-149a) are located at Category B and E land uses. There are two existing noise barriers, with barrier heights of 7 and 9 feet.

As shown in Table 7-2, worst-hour noise levels in this segment range from 58 to 77 dBA $L_{eq[h]}$ under Existing, 2035 No Build, and 2035 Build conditions. The noise level increase is not considered substantial. 2035 Build noise levels are predicted to approach or exceed the NAC at single-family residences throughout this segment (ST-146, R-146a, ST-147, ST-148, R-148a, R-149a, ST-150, and ST-153). Noise abatement in the form of new or replacement noise barriers was considered for these residences.

7.3. Assessment of Noise Impacts and Abatement Options

Receptors that exceed either state or federal thresholds must be evaluated for potential abatement/mitigation measures. Noise abatement is considered only where frequent

human use occurs and where a lowered noise level would be of benefit. Noise abatement must be predicted to provide at least a 5 dB minimum reduction at an impacted receptor to be considered feasible by Caltrans (i.e., the barrier would provide a noticeable noise reduction). Additionally, the Traffic Noise Analysis Protocol acoustical design goal states that the noise barrier must provide at least 7 dB of noise reduction at one or more benefited receptors. Noise abatement measures that provide noise reduction of more than 5 dB are encouraged as long as they meet the reasonableness guidelines.

Potential noise abatement measures identified in the Protocol include:

- Avoiding the project impact by using design alternatives, such as altering the horizontal and vertical alignment of the project;
- Constructing noise barriers;
- Using traffic management measures to regulate types of vehicles and speeds;
- Acquiring property to serve as a buffer zone; and/or
- Acoustically insulating Activity Category D land uses.

The chosen abatement type for this project would be the construction of noise barriers. A preliminary noise abatement analysis was conducted that identified the feasibility of constructing or replacing noise barriers to reduce traffic noise levels.

Traffic noise modeling and impact assessment were conducted only at land uses where frequent human usage occurs and a lowered noise level would be of benefit to receptors. The primary focus of this study is on NAC activity Category B land uses that are not protected by Caltrans noise barriers. The noise barriers within the State right-of-way are typically constructed to meet the criteria in Chapter 1100 of the Highway Design Manual. The manual states that noise barriers should not be higher than 14 feet above the pavement when located within 15 feet of the edge of traveled way and 16 feet above ground when located more than 15 feet from the edge of traveled way.

Noise barriers were evaluated at the most acoustically effective location within the State right-of-way. Where US 101 is at, or elevated above receptors, the most acoustically effective location for a barrier is near the edge of shoulder, either on structure or at the top of slope. Where US 101 is located in a cut-section, the most acoustically effective location for a barrier is typically at the right-of-way. In many locations, receptors located behind existing noise barriers experience, or would experience in the future, worst-hour

noise levels at that approach or exceed the NAC. Increasing the height of the existing barriers (or replacement with larger noise barriers) was assessed in this analysis. Because all existing walls within the project area are structurally in fair or good condition, a replacement wall of equal height to the existing wall would not be anticipated to change the noise environment behind the wall. Therefore, the insertion loss for these sound walls was calculated based on wall height increases over the existing wall height.

Potential noise barriers are discussed below in detail by study area segment. Once a noise barrier achieved the minimum of a 5-dB reduction at a given receptor and achieved the 7 dB noise reduction design goal for at least one receptor, the reasonableness allowance was determined. Tables 7-3 through 7-49 show the predicted future Build worst-hour noise levels and insertion loss for each barrier at various design heights. Table 7-50 summarizes the insertion loss, benefited receptors, and reasonable allowances for each feasible barrier that also met the 7 dB noise reduction design goal. Feasible barrier locations, as well as measured and modeled receptor locations, are indicated in Appendices C and D for receptors along the US 101 corridor.

7.3.1. Segment 1 – Oregon Expressway to SR 85

Five noise barriers (SW1-SW5) were evaluated in 2008 to abate noise impacts as part of the US 101 Auxiliary Lanes Project NSR (EA 4A330K). These same five noise barriers have been re-labeled for clarification purposes (SWA through SWE). The noise barriers were calculated to reduce noise levels by 0 to 12 dB at noise-impacted receptors. Tables 7-3 to 7-7 show the 2035 Build worst-hour noise levels and insertion loss (I.L.) for each barrier at various design heights.

Sound Wall SWA: SWA would be located along the southbound US 101 right-of-way from approximately Station 51+00 to 59+00. This wall would feasibly abate traffic noise for Greer Park (4 benefited receptors), represented by Receptors R20 and R21. A minimum barrier height of 10 feet would be necessary to be considered feasible, and a minimum height of 12 feet would be required to meet the noise reduction design goal of 7 dBA for at least one receptor and provide a break in the line-of-sight to truck exhaust stacks. The reasonable allowance calculated for barriers of 12, 14, and 16 feet is $220,000.

Table 7-3. SWA Insertion Loss

Receptor ID	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R20	70	67	3	65	5	64	6	63	7	63	7
R21	69	65	4	64	5	62	7	61	8	61	8

Sound Wall SWB: A 14-foot sound wall was constructed as part of the Classics at Sterling Park Residential Development along the southbound right-of-way for US 101, extending from approximately Station 77+50 to 89+25. Even with construction of the 14-foot noise barrier constructed as part of the Classics at Sterling Park Residential Development along the southbound right-of-way for US 101, extending from approximately Station 77+50 to 89+25, some receptors behind the wall are calculated to experience noise levels that would approach or exceed the NAC. SWB analyzes increasing the height of this sound wall to provide a feasible noise reduction. Traffic noise modeling indicates that increasing the wall height from 14 to 16 feet would not further reduce noise levels. SWB would not achieve a feasible noise reduction.

Table 7-4. SWB Insertion Loss

Receptor ID	Noise Level With Planned Wall H=14 feet	With Wall H=16 feet	
		$L_{eq[h]}$	I.L.
R24	66	66	0
R25	61	61	0

Sound Wall SWC: SWC would be located along the southbound US 101 right-of-way south of N. Rengstorff Avenue from approximately Station 169+50 to 177+50. This wall would feasibly abate traffic noise for four single-family homes represented by Receptors R27 and R27A. A minimum barrier height of 8 feet would be required to achieve a feasible noise reduction. A 10-foot barrier would provide at least 7 dBA of noise reduction, meeting the reasonableness design goal, and would provide a break in the line-of-sight to truck exhaust stacks. The reasonable allowance calculated for barrier heights of 10 to 16 feet in height is $220,000.

Table 7-5. SWC Insertion Loss

Receptor ID	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R27	74	68	6	67	7	65	9	64	10	63	11
R27A	74	68	6	66	8	65	9	64	10	63	11

Sound Wall SWD: SWD would be located at the southbound US 101 right-of-way south of N. Rengstorff Avenue from approximately station 183+50 to 188+50. An existing 12-foot wall shields multi-family residences. Receptors behind the existing wall experience noise levels that exceed the NAC; therefore increasing the height of this wall was studied. It was determined that an increase in height would only reduce noise levels by up to 2 dB; consequently this barrier was not considered to be feasible.

Table 7-6. SWD Insertion Loss

Receptor ID	Noise Level With Existing Wall H=12 feet	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R29	68	67	1	66	2

Sound Wall SWE: SWE would be located at the right-of-way along the SB US 101 on-ramp from Old Middlefield Road from approximately station 195+00 to 214+00. An existing 10-foot barrier shields a residential neighborhood. Receptors behind the existing wall experience noise levels that exceed the NAC; therefore increasing the height of this wall was studied. It was determined that an increase in the height of the barrier would reduce noise levels by up to an additional 4 dB. Consequently, SWE was not considered to be feasible.

Table 7-7. SWE Insertion Loss

Receptor ID	Noise Level With Existing Wall H=10 feet	With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R30	60	58	2	57	3	56	4
R31	60	58	2	57	3	56	4
R32	62	60	2	59	3	59	3
R33	65	64	1	62	3	61	4
R34	68	66	2	65	3	64	4
R35	68	66	2	65	3	64	4
R36	68	67	1	65	3	64	4
R37	57	57	0	56	1	56	1
R38	58	57	1	57	1	56	2
R39	60	60	0	59	1	59	1
R40	60	60	0	60	0	60	0
R41	64	63	1	62	2	61	3

7.3.2. Segment 2 – SR 85 to SR 237

Two new barriers, SW1 and SW2, were assessed to abate noise impacts at the baseball fields at Moffett Federal Airfield, represented by R-2a and R-2b, and at the Sunnyvale Municipal Golf Course, represented by R-4a and R-4b.

Sound Wall SW1: The Sunnyvale Municipal Golf Course, located south of US 101, has been identified for noise abatement because 2035 Build noise levels exceed the NAC and

the golf course is not shielded by an existing noise barrier. Potential issues complicating the evaluation of noise abatement at this site include the presence of other significant noise sources in the immediate vicinity (i.e., Moffett Federal Airfield and State Route 237). SW1 was analyzed at the southbound US 101 edge of shoulder between the Ellis Street on ramp to US 101 and SR 237 over an approximate distance of 3,150 feet. This wall would feasibly abate traffic noise at the golf course, as represented by the 7 holes closest to US 101 that are anticipated to exceed the NAC, and would meet the 7 dB noise reduction goal at a minimum height of 8 feet. The barrier would break line-of-sight between truck stacks and the golf course at a minimum height of 10 feet. The reasonableness allowance calculated for barrier heights of 8 to 16 feet is $385,000. Table 7-8 summarizes the barrier insertion loss calculations.

Table 7-8. SW1 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-4a	4	78	70	8	68	10	67	11	66	12	65	13
R-4b	3	71	65	6	64	7	62	9	62	9	61	10

Sound Wall SW2: The baseball fields at Moffett Federal Airfield, located north of US 101 and west of Ellis Street, have been identified for noise abatement because 2035 Build noise levels exceed the NAC and the fields are not shielded by an existing noise barrier. SW2 was analyzed at the edge of shoulder of northbound US 101 from the end of the existing 7-foot-high barrier (NB Wall 24) continuing along the Ellis Street on ramp to US 101. Construction of this wall would feasibly abate traffic noise at the baseball fields, but would not meet the 7 dB noise reduction goal, even at a height of 16 feet. SW2 is feasible (achieving a 5 dBA reduction), but not reasonable because it does not achieve the noise reduction design goal. Table 7-9 summarizes the barrier insertion loss calculations.

Table 7-9. SW2 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-2a	1	68	66	2	65	3	65	3	64	4	63	5
R-2b	1	67	66	1	66	1	65	2	65	2	64	3

7.3.3. Segment 3 – SR 237 to Lawrence Expressway

Wall height increases were assessed to abate noise impacts at single and multi-family residences located north of US 101 between North Fair Oaks Avenue and Lawrence Expressway.

Height Increases for Existing Barriers: Wall height increases were assessed for the existing 12-foot barrier located along northbound US 101 between North Fair Oaks Avenue and Lawrence Expressway. Table 7-10 summarizes the barrier insertion loss calculations. Increasing the height of this 12-foot barrier would not be considered feasible because only a maximum of 3 dB of additional attenuation can be achieved.

Table 7-10. Existing NB Wall 21 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-15	65	63	2	62	3
ST-24	66	65	1	64	2
ST-25	66	65	1	64	2
ST-26	68	67	1	66	2
ST-27	66	65	1	63	3
ST-28	61	60	1	59	2

7.3.4. Segment 4 – Lawrence Expressway to San Tomas/Montague Expwy

Noise abatement in the form of new and replacement sound walls was considered to abate noise impacts at the Avalon Silicon Valley Apartments (ST-30), at first-row single-family residences along Wildwood Avenue, north of US 101 (ST-32), and at the San Tomas Aquino Creek Trail (LT-4).

Sound Wall SW3: The San Tomas Aquino Creek Trail, located north and south of US 101, has been identified for noise abatement because 2035 Build noise levels exceed the NAC and the trail is not shielded by an existing noise barrier. Potential issues complicating the evaluation of noise abatement at this site include the trail continuation on both sides of the freeway. The reasonableness of noise abatement will likely be affected by the limited number of benefitted receptors. SW3a and SW3b were analyzed at both the southbound and northbound US 101 edge of shoulder over an approximate distance of 825 and 955 feet, respectively. These walls would feasibly abate traffic noise at the trail and would meet the 7 dB noise reduction goal at a minimum height of 12 feet. The barriers would break line-of-sight between truck stacks and the trail at a minimum height of 12 feet. The reasonableness allowance calculated for barrier heights of 12 to 16 feet is $55,000 for each barrier. Tables 7-11 and 7-12 summarize the barrier insertion loss calculations.

Table 7-11. SW3a Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
LT-4	1	75	69	6	69	6	67	8	67	8	67	8

Table 7-12. SW3b Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-36a	1	74	69	5	68	6	67	7	66	8	66	8

Height Increases for Existing Barriers: Wall height increases were assessed for the existing 12-foot high barriers located along northbound and southbound US 101, east of Lawrence Expressway (NB Wall 20 and SB Wall 4). Tables 7-13 and 7-14 summarize the barrier insertion loss calculations. Increasing the height of these walls would reduce noise levels by 0 to 3 dB; therefore, these barriers are not considered to be feasible.

Table 7-13. Existing NB Wall 20 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-31	58	56	2	55	3
ST-32	69	68	1	67	2

Table 7-14. Existing SB Wall 4 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-29	54	54	0	53	1
ST-30	70	69	1	69	1

7.3.5. Segment 5 – San Tomas/Montague Expressway to SR 87

Noise abatement in the form of a new sound wall was considered to abate noise impacts at the Guadalupe River Trail (ST-38).

Sound Wall SW4: The Guadalupe River Trail, located north and south of US 101, has been identified for noise abatement because 2035 Build noise levels exceed the NAC and the trail is not shielded by an existing noise barrier. Potential issues complicating the evaluation of noise abatement at this site include the trail continuation on both sides of the freeway. The reasonableness of noise abatement will likely be affected by the limited number of benefitted receptors and the freeway elevation above the trail. SW4a and SW4b were analyzed at both the southbound and northbound US 101 edge of shoulder over an approximate distance of 1,065 feet each. Construction of the southbound wall (SW4a) would feasibly abate traffic noise at the Guadalupe River Trail, but would not meet the 7 dB noise reduction goal, even at a height of 16 feet. Construction of the northbound wall (SW4b) would not feasibly abate traffic noise. SW4a is feasible (achieving a 5 dBA reduction), but not reasonable because it does not achieve the noise

reduction design goal. Tables 7-15 and 16 summarize the barrier insertion loss calculations.

Table 7-15. SW4a Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-38	1	70	67	3	67	3	66	4	65	5	65	5

Table 7-16. SW4b Insertion Loss

Receptor ID	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-38a	66	66	0	66	0	66	0	66	0	66	0
R-38b	65	65	0	65	0	65	0	65	0	65	0

7.3.6. Segment 6 –SR 87 to Interstate 880

2035 Build noise levels are not predicted to approach or exceed the NAC at any of the land uses in this segment, and noise abatement was not considered.

7.3.7. Segment 7 – Interstate 880 to East Taylor Street

Noise abatement in the form of one new and two replacement sound walls was considered to abate noise impacts at the Palm Court Apartments (ST-49), at the common use area for the apartments on Luna Park Drive (ST-44), and at first-row single-family residences south of US 101 between East Hedding Street and East Taylor Street (ST-45 and ST-47).

Sound Wall SW5: The Palm Court Apartments, located south of US 101 and west of East Taylor Street, have been identified for noise abatement because 2035 Build noise levels exceed the NAC and the common area is not shielded by an existing noise barrier. Some acoustical shielding is provided by the apartment building structure. SW5 was analyzed at the southbound US 101 edge of shoulder over an approximate distance of 675 feet. This wall would feasibly abate traffic noise at the common use area and would meet the 7 dB noise reduction goal at a minimum height of 10 feet. A minimum barrier height of 14 feet would be necessary to break the line-of sight between truck stacks and receptors in the common area. The reasonableness allowance calculated for barrier heights of 10 to 16 feet is $55,000. Table 7-17 summarizes the barrier insertion loss calculations.

Table 7-17. SW5 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-49	1	76	70	6	69	7	68	8	67	9	67	9

Height Increases for Existing Barriers: Wall height increases were assessed for the existing 7 to 12-foot high barriers located along southbound US 101, between Oakland Road and Hedding Street (SB Walls 5 and 6) and between Hedding Street and East Taylor Street (SB Walls 7 and 8). Tables 7-18 and 7-19 summarize the barrier insertion loss calculations. Increasing the height of these walls would reduce noise levels by 0 to 4 dB; therefore, these barriers are not considered to be feasible.

Table 7-18. Existing SB Walls 5 and 6 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-42	65	63	2	62	3	62	3
ST-44	68	65	3	64	4	64	4
ST-48	62	62	0	62	0	61	1

Table 7-19. Existing SB Walls 7 and 8 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-45	66	66	0	65	1	64	2
ST-46	61	61	0	60	1	59	2
ST-47	68	68	0	67	1	66	2

7.3.8. Segment 8 – East Taylor Street to Interstate 280

Noise abatement in the form of a new sound wall was considered to abate noise impacts at Watson Park (R-50a, R-50b, and R-50c). Height increases were assessed for nine existing walls to abate noise impacts at single and multi-family residences on both the northbound and southbound sides of US 101 (ST-51, ST-52, ST-53, ST-54, ST-57, ST-58, ST-59, ST-60, ST-62, ST-64, LT-6, and R-62a).

Sound Wall SW6: 2035 Build noise levels exceed the NAC at Watson Park, located south of US 101 and east of East Taylor Street. SW6 was analyzed at the southbound US 101 edge of shoulder, east of East Taylor Street. SW6 is planned as an approximate 1,600 foot noise barrier and would feasibly abate traffic noise for Watson Park, as represented by ST-50, R-50a, R-50b, R-50c, and R-50d. The 7 dB noise reduction goal would be met at a minimum height of 10 feet. SW6 would break the line-of-sight between truck stacks and first row receptors at a minimum height of 8-feet. The reasonableness allowance

calculated for SW6 at barrier heights of 10 to 16 feet is $330,000 to $440,000. Table 7-20 summarizes the barrier insertion loss calculations.

Table 7-20. SW6 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-50	1	65	61	4	61	4	59	6	59	6	59	6
R-50a	3	69	64	5	63	6	63	6	62	7	61	8
R-50b	1	70	65	5	63	7	63	7	62	8	61	9
R-50c	2	66	62	4	61	5	60	6	60	6	60	6
R-50d	1	63	60	3	59	4	58	5	58	5	57	6

Height Increases for Existing Barriers: Wall height increases were assessed for nine existing 10 to 14-foot high barriers located along northbound and southbound US 101, between Hacienda Creek and Interstate 280 (SB Walls 9, 10, 11, and 13, and NB Walls 14, 15, 16, 17, and 18). Tables 7-21 through 7-29 summarize the barrier insertion loss calculations. Increasing the height of these walls would reduce noise levels by 0 to 4 dB; therefore, increased height barriers are not feasible.

Table 7-21. Existing SB Wall 9 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-52	67	67	0	67	0
ST-53	68	67	1	66	2

Table 7-22. Existing SB Wall 10 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-55	71	70	1	69	2	68	3

Table 7-23. Existing SB Wall 11 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-56	65	63	2	62	3
ST-57	66	65	1	64	2

Table 7-24. Existing SB Wall 13 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-60	66	64	2	63	3

Table 7-25. Existing NB Wall 14 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-64	68	66	2	65	3	64	4
R-64a	70	68	2	67	3	66	4

Table 7-26. Existing NB Wall 15 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-62	69	68	1	67	2	66	3
R-62a	68	66	2	65	3	64	4

Table 7-27. Existing NB Wall 16 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-58	68	67	1	67	1
ST-59	70	70	0	69	1

Table 7-28. Existing NB Wall 17 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-54	67	66	1	65	2
LT-6	73	71	2	69	4

Table 7-29. Existing NB Wall 18 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet	
		$L_{eq[h]}$	I.L.
ST-51	66	65	1

7.3.9. Segment 9 – Interstate 280 to Tully Road

Noise abatement in the form of a new sound wall was considered to abate noise impacts at single-family residences located along the northbound off-ramp to Story Road (ST-68). In addition, noise wall height increases were assessed for four existing walls to abate noise impacts at single and multi-family residences adjoining US 101 (ST-69, ST-70, ST-71, ST-72, ST-73, ST-74, ST-76, ST-77, and LT-8).

Sound Wall SW7: Noise abatement was considered for single-family residences located northeast of US 101 and the connector ramp from northbound US 101 to westbound and eastbound I-280 because 2035 Build noise levels exceed the NAC. SW7 was analyzed at the edge of shoulder of the off ramp from northbound US 101 to Story Road. The evaluation of noise abatement is complex at this site because of the presence of the northbound US 101 connector ramp to I-280. The wall would not feasibly abate traffic

noise for the 4 residences represented by ST-68. Table 7-30 summarizes the barrier insertion loss calculations.

Table 7-30. SW7 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-68	4	67	65	2	65	2	65	2	65	2	65	2

Height Increases for Existing Barriers: Wall height increases were assessed for four existing 12 to 13-foot high barriers located along northbound and southbound US 101, between Interstate 280 and Tully Road (SB Walls 16 and 17 and NB Walls 11 and 12). Tables 7-31 and 7-32 summarize the barrier insertion loss calculations. Increasing the height of these walls would reduce noise levels by 0 to 2 dB; therefore, these barriers are not considered to be feasible.

Table 7-31. Existing SB Walls 16 and 17 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-66	60	59	1	59	1
ST-67	63	62	1	61	2
ST-70	68	67	1	66	2
ST-71	68	67	1	66	2
ST-72	67	67	0	65	2
ST-74	68	67	1	67	1
ST-75	62	62	0	62	0
ST-78	62	62	0	62	0
ST-81	61	60	1	59	2
LT-8	67	66	1	65	2

Table 7-32. Existing NB Walls 11 and 12 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-69	68	68	0	67	1
ST-73	68	67	1	66	2
ST-76	68	67	1	66	2
ST-77	68	68	0	67	1
ST-79	60	59	1	59	1
ST-80	65	65	0	64	1

7.3.10. Segment 10 – Tully Road to East Capitol Expressway

Height increases were assessed for four existing walls to abate noise impacts at single and multi-family residences on both the northbound (ST-86, ST-91, and ST-93) and southbound sides (ST-85, ST-88, ST-90, and ST-94) of US 101.

Height Increases for Existing Barriers: Wall height increases were assessed for four existing 7 and 13-foot high barriers located along northbound and southbound US 101, between Tully Road and East Capitol Expressway (SB Walls 18 and 19 and NB Walls 9 and 10). Tables 7-33 through 7-35 summarize the barrier insertion loss calculations. Increasing the height of these walls would reduce noise levels by 0 to 4 dB. Therefore, these barriers are not considered to be feasible.

Table 7-33. Existing NB Wall 9 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-93	68	67	1	66	2	65	3	64	4	64	4

Table 7-34. Existing NB Wall 10 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-85	67	67	0	66	1
ST-86	67	66	1	66	1
ST-91	68	67	1	66	2
ST-92	63	63	0	62	1

Table 7-35. Existing SB Walls 18 and 19 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-82	67	66	1	66	1
ST-84	65	64	1	63	2
ST-87	65	64	1	63	2
ST-88	68	67	1	66	2
ST-89	61	61	0	60	1
ST-90	66	66	0	65	1
ST-94	66	65	1	64	2

7.3.11. Segment 11 – East Capitol Expressway to Hellyer Avenue

Noise abatement in the form of two new sound walls was evaluated to abate noise impacts at single-family residences located east of US 101 between Yerba Buena Road and Hellyer Avenue (ST-105, R-105a, R-105b, R-105c, and R-106a).

Sound Wall SW8: Single-family residences located east of US 101 and south of East Capitol Expressway are anticipated to experience 2035 Build noise levels exceeding the NAC. These residences are not currently shielded by an existing barrier and SW8 was analyzed at the northbound US 101 edge of shoulder. Residences are elevated by 50 to 100 feet above US 101 and the construction of a wall at the edge of shoulder would reduce noise levels by only 0 to 4 dB. Therefore, this barrier is not considered to be feasible. Table 7-36 summarizes the barrier insertion loss calculations.

Table 7-36. SW8 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-105	1	77	77	0	77	0	77	0	77	0	77	0
R-105a	1	76	75	1	75	1	74	2	73	3	72	4
R-105b	1	71	71	0	70	1	70	1	70	1	69	2
R-105c	1	75	75	0	75	0	75	0	75	0	74	1

Sound Wall SW9: Noise abatement, in the form of a new sound wall, was evaluated at single-family residences located east of US 101 and north of Hellyer Avenue because 2035 Build noise levels exceed the NAC and the residences are not shielded by an existing noise barrier. SW9 was analyzed at the northbound US 101 edge of shoulder, north of Hassler Parkway. Residences are elevated above the highway at this location and a sound wall located at the edge of shoulder of US 101 was found to be feasible, but would not achieve the Caltrans 7 dB noise reduction design goal. SW9 is not reasonable because it does not achieve the noise reduction design goal. Table 7-37 summarizes the barrier insertion loss calculations.

Table 7-37. SW9 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-106a	4	66	65	1	63	3	62	4	61	5	60	6

7.3.12. Segment 12 – Hellyer Avenue to Blossom Hill Road

Receptors where 2035 Build noise levels are predicted to approach or exceed the NAC are shielded by existing barriers that are already at the maximum allowable height. Therefore, noise abatement was not considered in this segment.

7.3.13. Segment 13 –Blossom Hill Road to SR 85/ Bernal Road

Noise abatement in the form of a new sound wall was considered to abate noise impacts at Coyote Creek Trail located along northbound US 101 (R-127a and R-128a). In addition, noise wall height increases were assessed for existing SB Wall 31 to abate noise impacts at single-family residences on the southbound side of US 101 (ST-128, ST-130, LT-11, and LT-12).

Sound Wall SW18: 2035 Build noise levels exceed the NAC at Coyote Creek Trail, located north of US 101 throughout this segment. SW18 was analyzed at the northbound US 101 edge of shoulder, between commercial uses located off Enzo Drive and the off-ramp to Blossom Hill Road. The reasonableness of noise abatement will likely be affected by the limited number of benefitted receptors. SW18 is planned as an

approximate 2,770 foot long noise barrier and would feasibly abate traffic noise for this portion of Coyote Creek Trail, as represented by R-127a and R-128a. The 7 dB noise reduction goal would be met at a minimum height of 8 feet. The barrier would break line-of-sight between truck stacks and the trail at a minimum height of 12 feet. The reasonableness allowance calculated for SW18 at barrier heights of 8 to 16 feet is $110,000. Table 7-38 summarizes the barrier insertion loss calculations.

Table 7-38. SW18 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-127a	1	75	70	5	69	6	66	9	65	10	64	11
R-128a	1	78	71	7	70	8	67	11	66	12	65	13

Height Increases for Existing Barrier: Wall height increases were assessed for the existing 12-foot barrier located along southbound US 101 between Blossom Hill Road and SR 85 (SB Wall 31). Table 7-39 summarizes the barrier insertion loss calculations. Increasing the height of this wall would only reduce noise levels by 1 to 3 dB; therefore, this barrier is not considered to be feasible.

Table 7-39. Existing SB Wall 31 Insertion Loss

Receptor ID	Noise Level w/ Existing Wall	With Wall H=14 feet		With Wall H=16 feet	
		$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-127	65	64	1	63	2
ST-128	67	66	1	65	2
ST-129	65	64	1	63	2
ST-130	67	66	1	66	1
ST-131	64	63	1	62	2
LT-11	66	64	2	63	3
LT-12	67	66	1	64	3

7.3.14. Segment 14 – SR 85/Bernal Road to Bailey Avenue

A new sound wall was considered to abate noise impacts at single-family residences located east of US 101 and north of Bailey Road (R-139b, and R-139c).

Sound Wall SW10: Single-family residences located east of US 101 and north of Bailey Road are not shielded by an existing barrier. SW10 was analyzed along northbound US 101, east of the highway shoulder. Impacted residences are located above the elevation of US 101. The insertion loss provided by SW10 is calculated to range from 2 to 4 dB, below the feasible noise reduction threshold of 5 dB. Table 7-40 summarizes the barrier insertion loss calculations.

Table 7-40. SW10 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-139b	2	68	65	3	65	3	65	3	64	4	64	4
R-139c	1	67	65	2	65	2	64	3	64	3	63	4

7.3.15. Segment 15 – Bailey Avenue to Cochrane Road

Four new noise barriers were assessed to abate noise impacts at the Coyote Creek Golf Course and at rural residences on both sides of US 101 near Burnett Avenue.

Sound Walls SW11 and SW12: The Coyote Creek Golf Course has been identified for noise abatement because 2035 Build noise levels exceed the NAC and the golf course is not shielded by an existing noise barrier. SW11 and SW12 were analyzed at the edge of shoulder of the north- and southbound sides of US 101, north of Coyote Creek Golf Road. The portion of the golf course located east of US 101 is elevated above the highway and a sound wall located at the edge of shoulder of US 101 (Potential SW12) was not found to be feasible, reducing noise levels by 1 to 3 dB. SW11 would be approximately 8,780 feet in length and would feasibly abate traffic noise for the portion of the golf course on the west side of US 101. The 7 dB noise reduction goal would be met at a minimum height of 14 feet. SW11 would break the line-of-sight between truck stacks and the golf course at a minimum height of 12 feet. The reasonableness allowance calculated for SW11 at barrier heights of 14 to 16 feet is $385,000.

Table 7-41. SW11 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-142	1	56	55	1	54	2	54	2	53	3	53	3
R-142a	2	66	63	3	63	3	62	4	61	5	61	5
R-142b	2	67	66	1	65	2	63	4	62	5	62	5
R-142c	2	69	65	4	64	5	63	6	62	7	61	8
LT-14	1	69	68	1	66	3	64	5	63	6	63	6

Table 7-42. SW12 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-142d	1	70	69	1	68	2	68	2	68	2	67	3
R-142e	1	65	64	1	64	1	63	2	62	3	62	3
R-142f	1	60	59	1	59	1	59	1	58	2	58	2

Sound Walls SW13 and SW14: Two new barriers were assessed to abate noise levels for rural-type residences located in the vicinity of Burnett Avenue in Morgan Hill. 2035

Build noise levels exceed the NAC at these locations, although the receptors are partially shielded by terrain. SW13 and SW14 were analyzed at the edge of shoulder of the north- and southbound sides of US 101 in the vicinity of Burnett Avenue. SW13 would be approximately 3,650 feet in length and would feasibly abate traffic noise for residences on the western side of US 101. The 7 dB noise reduction design goal would be met at a minimum height of 8 feet. SW13 would break the line-of-sight between truck stacks and first row residences at a minimum height of 10 feet. The reasonableness allowance calculated for SW13 at barrier heights of 8 to 16 feet is $440,000 to $495,000. Residences located east of US 101 are elevated above the highway and a sound wall located at the edge of shoulder of US 101 (SW14) resulted in noise reductions of 2 to 5 dB. This barrier was found to be feasible, but is not reasonable because it does not achieve the noise reduction design goal. Tables 7-43 and 7-44 summarize the barrier insertion loss calculations.

Table 7-43: SW13 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-144	4	69	64	5	63	6	62	7	61	8	60	9
R-144a	1	75	67	8	66	9	66	9	65	10	64	11
ST-145	3	68	63	5	62	6	61	7	61	7	60	8
R-145a	1	64	61	3	60	4	59	5	59	5	58	6

Table 7-44. SW14 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
R-143a	1	69	67	2	67	2	67	2	67	2	67	2
R-143b	3	73	70	3	70	3	69	4	68	5	68	5

7.3.16. Segment 16 – Cochrane Road to Tennant Avenue

Three new noise barriers and two replacement barriers were assessed to abate noise impacts at single-family residences throughout this segment (ST-146, R-146a, ST-147, ST-148, R-148a, R-149a, ST-150, and ST-153).

Sound Walls SW15, SW16, SW17, and Existing SB Wall 33: Rural-type residences and a single-family subdivision, located west and east of US 101 in Morgan Hill, between approximately Condit Road on the north and East Dunne Avenue on the south, exceed the NAC. Receptors are not shielded by existing noise barriers or are not shielded by barriers of sufficient height. Individual noise barriers were evaluated at the edge of shoulder of US 101 for groups of benefitted receptors where applicable.

SW15, SW16, and SW17 would be located at the edge of shoulder of the north- and southbound sides of US 101, north of Dunne Avenue. SW15 would be approximately 3,130 feet in length and would feasibly abate traffic noise for residences on the western side of US 101, meeting up with Existing SB Wall 33 (discussed below). The 7 dB noise reduction goal would be met at a minimum height of 8 feet. SW15 would break the line-of-sight between truck stacks and residences at a minimum height of 12 feet. The reasonableness allowance calculated for SW15 at barrier heights of 8 to 16 feet is $440,000 to $495,000. SW16 would be approximately 1,120 feet in length and would feasibly abate traffic noise for residences on the eastern side of US 101, north of E. Main Street. SW16 would break the line-of-sight between truck stacks and residences and achieve the 7 dB noise reduction design goal at a minimum height of 14 feet. The reasonableness allowance calculated for SW16 at barrier heights of 14 to 16 feet is $110,000. Residences located east of US 101 and south of E. Main Street are partially shielded by terrain and a sound wall analyzed at the edge of shoulder of US 101 (SW17) was not found to be feasible. Calculated noise reductions for SW17 ranged from 1 to 4 dB. Tables 7-45 through 7-48 summarize the barrier insertion loss calculations.

Residences located west of US 101 and south of East Main Street are currently shielded by SB Wall 33, an approximate 9 foot noise barrier along US 101. Increasing the height of this noise barrier resulted in noise reductions of 1 to 5 dB. The replacement of the existing noise barrier with a larger noise barrier was found to be feasible but would not achieve the Caltrans noise reduction design goal of 7 dB. SB Wall 33 is not reasonable because it does not achieve the noise reduction design goal.

Table 7-45. SW15 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-146	1	70	68	2	67	3	65	5	65	5	64	6
R-146a	2	77	70	7	67	10	66	11	64	13	64	13
R-148a	6	77	70	7	69	8	67	10	66	11	65	12

Table 7-46. SW16 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-147	2	72	69	3	68	4	67	5	65	7	65	7

Table 7-47. SW17 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-149	2	64	63	1	63	1	62	2	61	3	61	3
R-149a	1	71	69	2	68	3	67	4	67	4	67	4

Table 7-48. Existing SB Wall 33 Insertion Loss

Receptor ID	Units Represented	Noise Level w/ Existing Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-148	7	71	70	1	69	2	68	3	68	3
ST-150	6	69	68	1	66	3	65	4	64	5

Existing SB Wall 34: Residences located west of US 101 and south of E. Dunne Avenue are shielded by SB Wall 34, which is a 7-foot high noise barrier. The replacement of the existing noise barrier with a larger noise barrier was found to be feasible but would not achieve the Caltrans noise reduction design goal of 7 dB. The replacement of SB Wall 34 is not reasonable because the noise reduction design goal cannot be met even with a barrier 16-feet high.

Table 7-49. Existing SB Wall 34 Insertion Loss

Receptor ID	Units Represented	Noise Level w/o Wall	With Wall H=8 feet		With Wall H=10 feet		With Wall H=12 feet		With Wall H=14 feet		With Wall H=16 feet	
			$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.	$L_{eq[h]}$	I.L.
ST-153	14	67	66	1	65	2	63	4	62	5	61	6

7.4. Reasonable Criteria

The determination of the reasonableness of noise abatement is more subjective than the determination of its feasibility. As defined in Section 772.5 of the regulation, reasonableness is the combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure.

The overall reasonableness of noise abatement is determined by the following three factors.

- The noise reduction design goal (a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefited receptors).
- The cost of noise abatement (2011 allowance of $55,000 per benefited receptor).

- The viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

The Project Development Team will make the proposed noise abatement decisions that will be incorporated into the final environmental documentation. The final decision to include noise barriers in the proposed project design must consider reasonableness factors, such as cost effectiveness, as well as other feasibility considerations including topography, access requirements, other noise sources, safety, and information developed during the design and public review process. Furthermore, the views of impacted residents will be a major consideration in reaching a decision on the reasonableness of abatement measures to be provided. A Noise Abatement Decision Report (NADR) will be prepared for the project and recommendations of this report will be incorporated into the draft environmental document for public review. Any proposed changes to the noise abatement decision subsequent to adoption of the final environmental document must be reviewed with the Caltrans noise specialists to ensure adequate acoustic performance. The final decision on the noise barriers will be made after completion of the public involvement process during the final project design process.

Table 7-50 lists the feasible barriers and summarizes the reasonable allowance calculations made for each feasible noise barrier that met the 7 dB noise reduction design goal.

Table 7-50. Summary of Barrier Feasibility and Reasonable Allowances

Sound Wall ID	Approximate Stationing / Location	Type of Analysis	Predicted Noise Level w/o Wall	Barrier Height (feet)	Insertion Loss (dBA)	Number of Benefited Receptors	Total Reasonable Monetary Allowance
SWA	SB 51+00 to 59+00	New Wall	69-70	12*	6 to 7	4	$220,000
				14*	7 to 8	4	$220,000
				16*	7 to 8	4	$220,000
SWC	SB 169+50 to 177+50	New Wall	74	10*	7 to 8	4	$220,000
				12*	9	4	$220,000
				14*	10	4	$220,000
				16*	11	4	$220,000
SW1	SB EOS, between Ellis Street on-ramp and SR 237 (3,150 feet)	New Wall	71-78	8	6 to 8	7	$385,000
				10*	7 to 10	7	$385,000
				12*	9 to 11	7	$385,000
				14*	9 to 12	7	$385,000
				16*	10 to 13	7	$385,000
SW3a	SB EOS, north of Montague Expwy (825 feet)	New Walls	75	12*	8	1	$55,000
				14*	8	1	$55,000
				16*	8	1	$55,000
SW3b	NB EOS, north of Montague Expwy (955 feet)	New Walls	74	12*	7	1	$55,000
				14*	8	1	$55,000
				16*	8	1	$55,000
SW5	SB EOS, west of East Taylor Street (675 feet)	New Wall	76	10	7	1	$55,000
				12	8	1	$55,000
				14*	9	1	$55,000
				16*	9	1	$55,000
SW6	SB EOS, east of East Taylor Street (1,600 feet)	New Wall	63-70	10*	5 to 7	6	$330,000
				12*	5 to 7	8	$440,000
				14*	5 to 8	8	$440,000
				16*	6 to 9	8	$440,000
SW18	NB EOS, commercial uses to Blossom Hill Road off-ramp (2,770 feet)	New Wall	75-78	8	5 to 7	2	$110,000
				10	6 to 8	2	$110,000
				12*	9 to 11	2	$110,000
				14*	10 to 12	2	$110,000
				16*	11 to 13	2	$110,000
SW11	SB EOS, north of Coyote Creek Golf Road (8,780 feet)	New Wall	66-69	14*	5 to 7	7	$385,000
				16*	5 to 8	7	$385,000
SW13	SB EOS, near Burnett Avenue (3,650 feet)	New Wall	64-75	8	5 to 8	8	$440,000
				10*	6 to 9	8	$440,000
				12*	5 to 9	9	$495,000
				14*	5 to 10	9	$495,000
				16*	6 to 11	9	$495,000
SW15	SB EOS, north of Dunne Avenue and Existing SB Wall 33 (3,130 feet)	New Wall	70-77	8	7	8	$440,000
				10	8 to 10	8	$440,000
				12*	5 to 11	9	$495,000
				14*	5 to 13	9	$495,000
				16*	6 to 13	9	$495,000
SW16	NB EOS, north of Main Street (1,120 feet)	New Wall	72	14*	7	2	$110,000
				16*	7	2	$110,000

*Barrier is calculated to break line-of-sight between truck stacks and receptors.

Chapter 8. Construction Noise

Components of the project are described in detail in Chapter 2. Noise generated by project-related construction activities would be a function of the noise levels generated by individual pieces of construction equipment, the type and amount of equipment operating at any given time, the timing and duration of construction activities, the proximity of nearby sensitive land uses, and the presence or lack of shielding at these sensitive land uses. Construction noise levels would vary on a day-to-day basis during each phase of construction depending on the specific task being completed. In general, construction noise levels at receptors nearest the project alignment would not be substantially higher than ambient traffic noise levels during the day or night. However, certain construction techniques such as pile driving and pavement cracking would generate high, impulsive noise levels that would be substantially higher than existing traffic noise levels and would exceed the absolute noise level limits established by Caltrans and local jurisdictions.

8.1. Construction Phasing and Noise Levels

Construction phases anticipated with the project would include demolition, earthwork, the installation of utilities, construction of noise barriers that are found to be feasible and reasonable, paving, and the installation of overhead signs and tolling devices. The majority of project construction activities would occur in the median of SR 85, a minimum of approximately 75 feet from the right-of-way. The majority of Category B Receptors located adjacent to US 101 are afforded shielding by existing noise barriers typically ranging from 10 to 16 feet in height. These existing noise barriers would provide a minimum 10 dBA reduction in construction noise levels for those activities occurring on the opposite side of the barrier.

In the section between the southern project limit and the SR 85 interchange in southern San Jose, where the median width varies between 46 and 86 feet, pavement widening would be constructed in the median to accommodate the dual express lane facility. A retaining wall in the median is required to accommodate the inside widening where a split profile exists between northbound and southbound US 101. No outside widening is proposed in this section.

A dual express lane facility is proposed for the majority of the corridor, with the exception of short segments near the SR 85 express lane connectors where a single express lane is proposed. A single express lane is proposed between the SR 85

Interchange and the Blossom Hill Road Interchange in San Jose, and between the Mathilda Avenue interchange and the SR 85 interchange in Mountain View. Outside widening is proposed to accommodate dual express lanes between the Blossom Hill Road interchange and the North Mathilda Avenue interchange.

Bridge widening and modifications to existing overcrossing abutments would be required at a number of grade separations and undercrossings.

The piles for the overhead signs would be up to 6 feet in diameter and extend to approximately 30 feet below ground surface. The piles for the tolling devices would be up to 2.5 feet in diameter and would extend to approximately 10 feet below ground surface. Some Traffic Operations Systems (TOS) equipment such as traffic monitoring stations, Closed Circuit Televisions, cabinets, and controllers would be installed along the outside edge of pavement within the existing right-of-way.

Trenching would be conducted along the outside edge of pavement for installation of conduits. The depth of trenching would be 3 to 5 feet below the roadway surface. Conduits would be jacked across the freeway to the median where needed to provide power and communication feeds to the new overhead signage and tolling equipment.

Biofiltration swales are proposed to provide storm water treatment for impervious areas that would be added or reworked as part of the project. These swales would be installed within the existing right-of-way.

Each construction phase would require a different combination of construction equipment necessary to complete the task and differing usage factors for such equipment.

Construction noise would primarily result from the operation of heavy construction equipment and arrival and departure of heavy-duty trucks. The highest maximum instantaneous noise levels would result from special impact tools such as impact pile drivers used to install the piles that would support the overhead signs, and impact hammers for pavement cracking. FHWA’s Roadway Construction Noise Model (RCNM) was used to calculate the maximum and average noise levels anticipated during each phase of construction. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The

usage factors represent the percentage of time that the equipment would be operating at full power. Vehicles and equipment anticipated during each phase of construction were input into RCNM to calculate noise levels at a distance of 100 feet. Table 8-1 presents the construction noise levels calculated for each major phase of the project. In some instances, maximum instantaneous noise levels are calculated to be slightly lower than hourly average noise levels. This occurs because maximum instantaneous noise levels generated by multiple pieces of construction equipment are not likely to occur at the same time. Hourly average noise levels resulting from multiple pieces of construction equipment would be additive resulting in slightly higher calculated noise levels. Noise generated by construction equipment drops off at a rate of 6 dB per doubling of distance.

Table 8-1. Construction Equipment Noise Levels at 100 feet

Construction Phase	Maximum Noise Level (L_{max}, dBA)	Hourly Average Noise Level ($L_{eq[h]}$, dBA)
Demolition	84	78
Earthwork	76	78
Paving	79	79
Pavement Cracking (Crack and Seat Operations)	87	83
Structures (with Pile Driving)	95	89
Structures (without Pile Driving)	77	78

8.2. Regulatory Criteria

Caltrans Standard Specifications, or any special requirements developed during the project design phase, would regulate noise from project construction activities. Section 14-8.02 (Noise Control) of the Caltrans Standard Specifications states:

- Do not exceed 86 dBA at 50 feet from the job site activities from 9 p.m. to 6 a.m. Use an alternative warning method instead of a sound signal unless required by safety laws.

- Equip an internal combustion engine with the manufacturer-recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

Typically, work taking place within the Caltrans right-of-way is not subject to local noise ordinances; however, Caltrans will work with the contractor to meet local

requirements where feasible. The following discussion details relevant local regulatory criteria.

Palo Alto

The City of Palo Alto allows construction operations between the hours of 8:00 a.m. and 6:00 p.m. Monday through Friday, and between the hours of 9:00 a.m. and 6:00 p.m. on Saturday. Construction is not allowed on Sundays. Construction, demolition or repair activities during allowable hours must meet the following standards:

- No individual piece of equipment shall produce a noise level exceeding one hundred ten dBA at a distance of twenty-five feet. If the device is housed within a structure on the property, the measurement shall be made out-side the structure at a distance as close to twenty-five feet from the equipment as possible.

- The noise level at any point outside of the property plane of the project shall not exceed one hundred ten dBA.

- The holder of a valid construction permit for a construction project in a non-residential zone shall post a sign at all entrances to the construction site upon commencement of construction, for the purpose of informing all contractors and subcontractors, their employees, agents, materialmen and all other persons at the construction site, of the basic requirements of this chapter.

Mountain View

According to Mountain View City Code, "No construction activity shall commence prior to 7:00 a.m. nor continue later than 6:00 p.m., Monday through Friday, nor shall any work be permitted on Saturday or Sunday or holidays unless prior written approval is granted by the building official."

Sunnyvale

Title 16, Chapter 16.08 of the Sunnyvale Municipal Code presents the following construction noise regulations:

- Construction activity shall be permitted between the hours of 7:00 a.m. and 6:00 p.m. daily Mondays through Fridays. Saturday hours of operation shall

be between 8:00 a.m. and 5:00 p.m. There shall be no construction activity on Sundays or national holidays when city offices are closed.

- No loud environmentally disruptive noises, such as air compressors without mufflers, continuously running motors or generators, loud playing musical instruments, radios, etc. will be allowed where such noises may be a nuisance to adjacent residential neighborhoods.

Santa Clara

The City of Santa Clara Municipal Code prohibits construction activities within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

San Jose

The City of San Jose requires construction operations to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. Allowable construction hours are 7:00 a.m. to 7:00 p.m., Monday through Friday.

Morgan Hill

Chapter 8.28, Section 8.28.040 of the Health and Safety section of the Morgan Hill Municipal Code prohibits construction activities between the hours of 8:00 p.m. and 7:00 a.m., Monday through Friday and between the hours of 6:00 p.m. and 9:00 a.m. on Saturday. Construction activities may not occur on Sundays or federal holidays.

8.3. Construction Noise Impacts

Roadway construction activities typically occur for relatively short periods of time as construction proceeds along the project's alignment. Construction noise would mostly be of concern in areas where impulse-related noise levels from construction activities would be concentrated for extended periods of time, where noise levels from individual pieces of equipment are substantially higher than ambient conditions, or when construction activities would occur during noise-sensitive early morning, evening, or nighttime hours.

Construction of the project is anticipated to occur during daytime and nighttime hours. As indicated above in Table 8-1, most construction phases would generate average noise levels that would exceed ambient daytime noise levels by 5 to 10 dBA $L_{eq[h]}$. Receptors shielded by noise barriers would be exposed to a similar increase in noise albeit at overall noise levels about 10 dBA lower because the shielding provided by the existing noise barriers would attenuate construction noise at a similar rate. Demolition involving impact tools or pile driving would generate average noise levels approximately 15 to 20 dBA $L_{eq[h]}$ higher than ambient noise conditions. Maximum instantaneous noise levels generated by typical construction activities would generally be at or below existing maximum noise levels generated by traffic. Shielding provided by existing noise barriers along the corridor would reduce maximum instantaneous noise levels from the majority of construction phases, with the exception of construction phases involving impact tools, such that noise levels would not be expected to exceed the quantitative noise limits established by the City of Palo Alto.

8.4. Construction Noise Mitigation Measures

To reduce the potential for noise impacts resulting from project construction, the following measures should be implemented during project construction.

- Noise-generating construction activities should be restricted to the allowable hours of construction as identified by local jurisdictions where feasible. Construction is generally allowed to start at 7:00 a.m., Monday through Friday, in most of the communities along the US 101 corridor. Construction is allowed to begin at 8:00 a.m. in Palo Alto. Construction activities should end by 6:00 p.m., Monday through Friday, in most of the communities along the US 101 corridor with the exception of San Jose and Morgan Hill, which allow construction to continue to 7:00 p.m. and 8:00 p.m., respectively. Sunnyvale allows construction between 8:00 a.m. and 5:00 p.m. on Saturdays. Palo Alto and Santa Clara allow construction between 9:00 a.m. and 6:00 p.m. on Saturdays. No construction activities should occur on Sundays or holidays. If work is necessary outside of these hours, Caltrans should require the contractor to implement a construction noise monitoring program and, if feasible, provide additional mitigation as necessary (in the form of noise control blankets or other temporary noise barriers, etc.) for affected receptors.

- Pile driving activities should be limited to daytime hours only.

- Equip all internal combustion engine driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- Unnecessary idling of internal combustion engines within 100 feet of residences should be strictly prohibited.
- Locate stationary noise generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a construction project area.
- Utilize "quiet" air compressors and other "quiet" equipment where such technology exists.
- Prohibit unnecessary idling of internal combustion engines within 100 feet of residences.
- Avoid staging of construction equipment within 200 feet of residences and locate all stationary noise-generating construction equipment, such as air compressors, portable power generators, or self-powered lighting systems as far practical from noise sensitive receptors.
- Require all construction equipment to conform to Section 14-8.02, Noise Control, of the latest Standard Specifications.
- The contractor should prepare a detailed construction plan identifying the schedule for major noise-generating construction activities and distribute this plan to adjacent noise-sensitive receptors. The construction plan should also list the construction noise reduction measures identified in this study.

Chapter 9. References

California Department of Transportation, Division of Environmental Analysis, Technical Noise Supplement, November 2009.

California Department of Transportation, Division of Environmental Analysis, Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects, May 2011.

California Department of Transportation, Traffic and Vehicle Data Systems, Annual Average Daily Truck Traffic on the California State Highway System, 2011.

CDM Smith, Technical Memorandum US 101 Express Lanes Forecasted Travel Demand, July 26, 2012.

City of Santa Clara, Planning Division, Approved Major Projects January 2008-June 2012, accessed via http://santaclaraca.gov/index.aspx?page=1011

City of Morgan Hill, Planning Division Project Status Report, March 2012, accessed via http://ca-morganhill.civicplus.com/index.aspx?nid=671

City of Mountain View, Planning Division Project List, July 16, 2012, accessed via http://www.ci.mtnview.ca.us/civica/filebank/blobdload.asp?BlobID=3222

City of San Jose, Department of Planning, Building, and Code Enforcement Planning Division, Development Activity Highlights and Five-Year Forecast (2013-2017), accessed via http://www.sanjoseca.gov/planning/data/dev_activity/Development%20Activity%20Forecast_2011.pdf

City of Palo Alto, Planning Department New Planning Applications through October 16, 2012, accessed via http://www.cityofpaloalto.org/gov/depts/pln/dev/default.asp#Development Reports

City of Sunnyvale, Development Update, August 2012, accessed via http://sunnyvale.ca.gov/Portals/0/Sunnyvale/CDD/CurrentProjects/Development%20Update/Planning/CDD-2012%20Dev%20Update%20-%20Aug.pdf

Federal Highway Administration, Highway Traffic Noise: Analysis and Abatement Guidance, December 2011.

Federal Highway Administration, 23 CFR Part 772: Procedures for Abatement of Highway Noise and Construction Noise. Federal Registrar, Vol. 75, No. 133, July 13, 2010.

Harris, Cyril M., Handbook of Acoustical Measurement and Noise Control, Reprint of Third Edition, 1998.

Illingworth & Rodkin, Inc., Great Oaks Place Residential Development / Airport West Stadium Development Environmental Noise Assessment, September 21, 2009.

Illingworth & Rodkin, Inc., Ramblewood Park Elementary School Initial Study Noise Section, October 20, 2003.

Illingworth & Rodkin, Inc., Ramblewood School Acoustical Review, December 19, 2003.

Illingworth & Rodkin, Inc., U.S. 101 Auxiliary Lanes (State Route 85 to Embarcadero Road) Noise Study Report, November 20, 2008.

National Cooperative Highway Research Program, Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, 1999.

Chapter 10. List of Preparers

Illingworth & Rodkin, Inc. completed this NSR under contract to URS. The following individuals had substantial roles in the preparation of this report:

- Michael Thill (Illingworth & Rodkin, Inc. — Senior Consultant, Principal) - Project Manager, noise measurements, data analysis, traffic noise modeling and report preparation.
- Dana Lodico (Lodico Acoustics LLC) - Data analysis, traffic noise modeling and report preparation.
- Jared McDaniel (Illingworth & Rodkin, Inc. — Staff Consultant) - Noise measurements, data analysis, traffic noise modeling and report preparation.
- Jordan Roberts (Illingworth & Rodkin, Inc. — Staff Consultant) - Noise measurements, data analysis, traffic noise modeling and report preparation.
- Carrie Janello (Illingworth & Rodkin, Inc. — Staff Consultant) - Noise measurements, data analysis, traffic noise modeling and report preparation.
- Joshua Carman (Illingworth & Rodkin, Inc. — Staff Consultant) - Noise measurements, data analysis, traffic noise modeling and report preparation.
- Chris Peters (Illingworth & Rodkin, Inc. — Technician) - Traffic noise measurements.
- Paul Donavan (Illingworth & Rodkin, Inc. — Senior Consultant) – Sound intensity measurements and analysis, project oversight and review.
- Richard Rodkin (Illingworth & Rodkin, Inc. — Senior Consultant) – Project oversight and review.

Appendix A
Definitions of Technical Terms

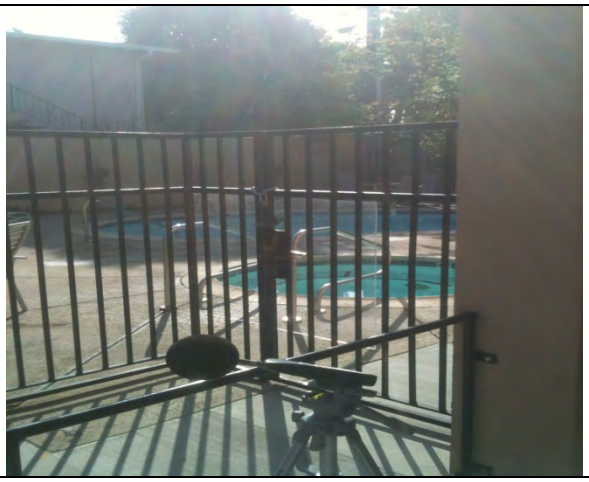
Definitions of Technical Terms

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m. to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

Appendix B
Site Photos

Appendix B Site Photographs 1-153

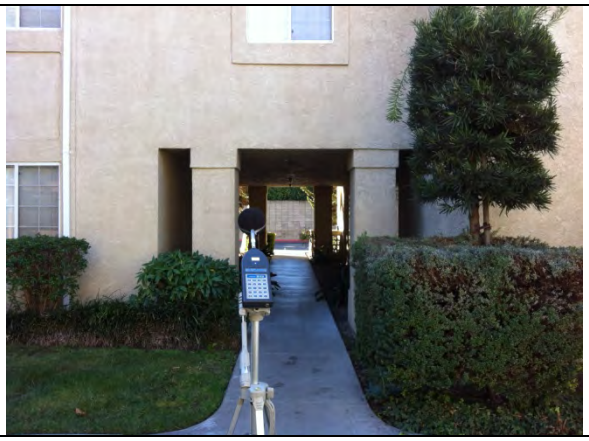


ST-1: Pool Area of Ramada Inn, Mountain View.

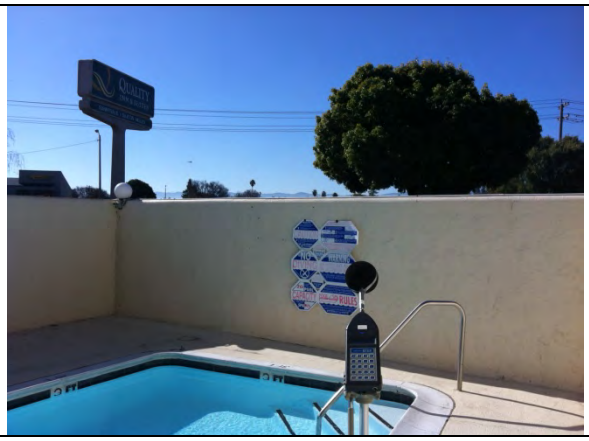
ST-2: In front of 235 Fairchild Drive, Mountain View.

ST-3: Offices at 323 Fairchild Drive, Mountain View.

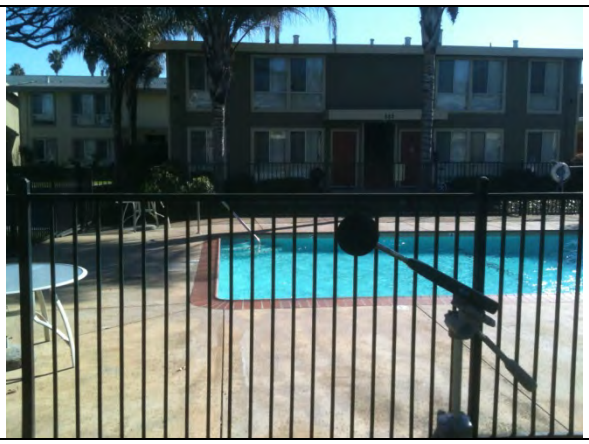
ST-4: Corner of Clyde Avenue and Fairchild Drive, Mountain View.



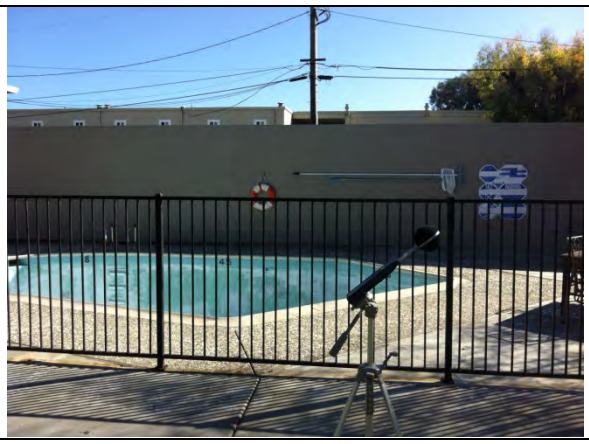
ST-5: Courtyard of Staybridge Suites, Sunnyvale.



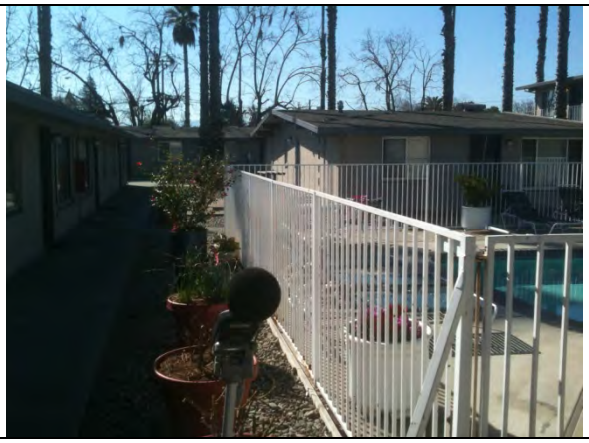
ST-6: Pool Area of Quality Inn & Suites, Sunnyvale.



ST-7: Pool area of Ahwanee Apartment Complex, Sunnyvale.



ST-8: Pool area of Weddell Apartments, Sunnyvale.



ST-9: Pool area of Florina Apartments, Sunnyvale.

ST-10: Common area of Eden Roc Apartments, Sunnyvale.

ST-11: 5800 Ahwanee Avenue, Sunnyvale.

ST-12: Fair Oaks Mobile Lodge, Sunnyvale.

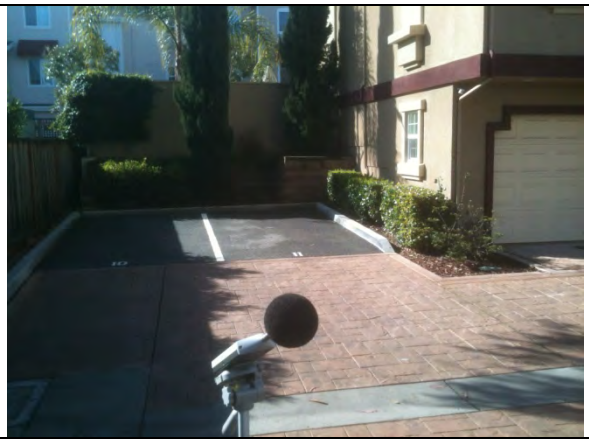
ST-13: Parking lot of Americas Best Value Inn, Sunnyvale.

ST-14: Pool area of Sunridge Apartments, Sunnyvale.

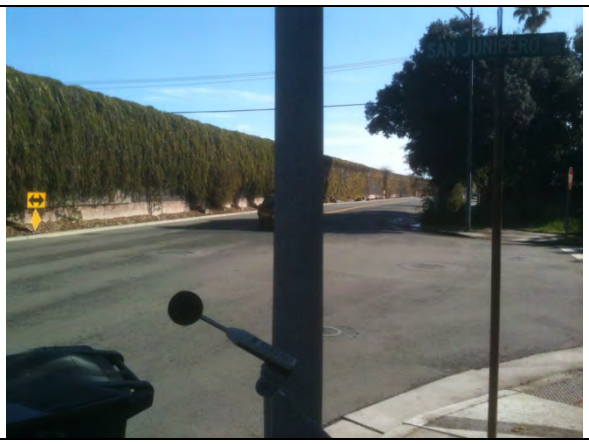
ST-15: Rear yard of 648 Lakewood Drive, Sunnyvale.

ST-16: In front of 662 North Ahwanee Terrrace, Sunnyvale.

ST-17: Common area of 662 North Ahwanee Terrace, Sunnyvale.



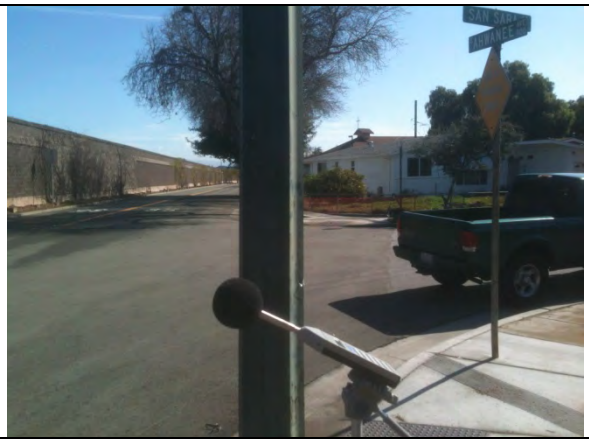
ST-18: In front of 624 South Ahwanee Terrace, Sunnyvale.



ST-19: In front of 798 East Ahwanee Avenue, Sunnyvale.

ST-20: Adjacent to 880 San Mateo Court, Sunnyvale.

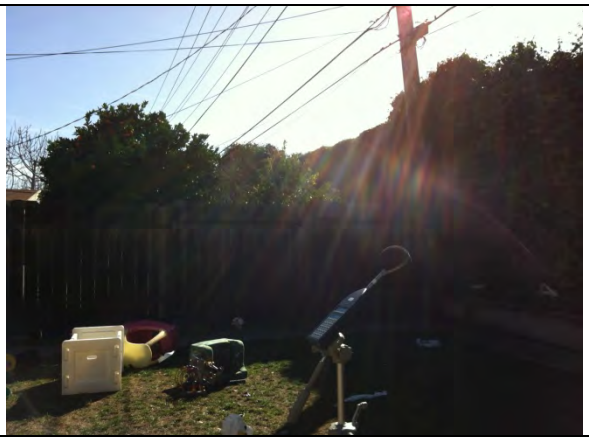
ST-21: Behind 835 San Pier Court, Sunnyvale.

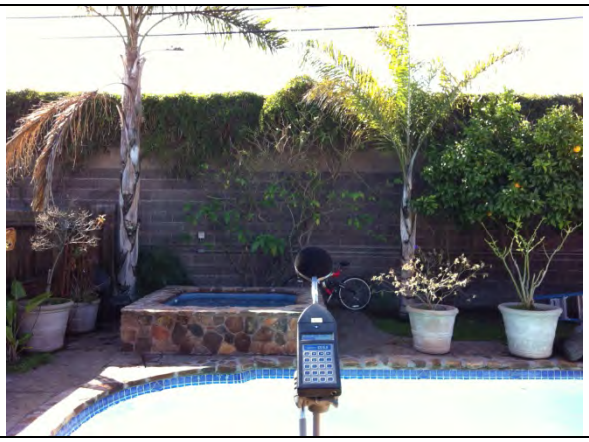
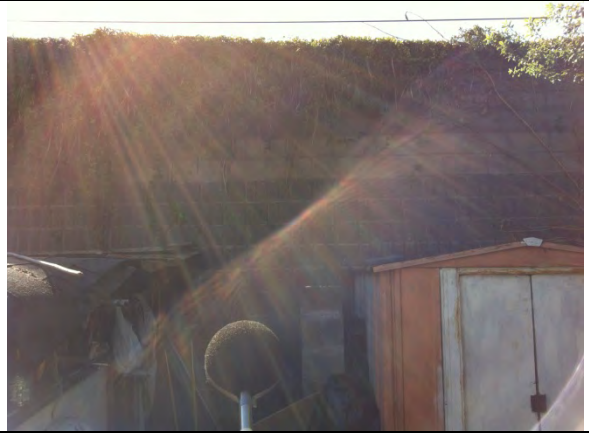
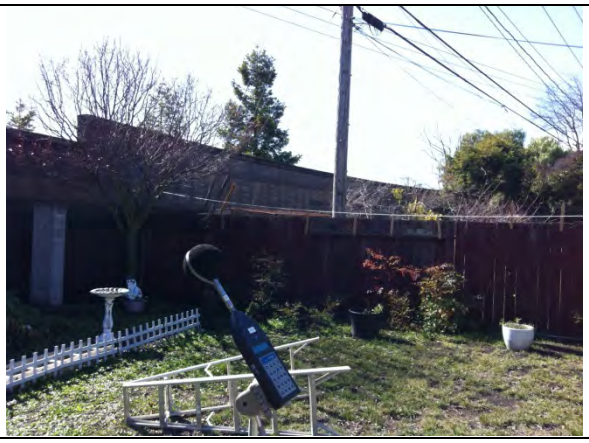


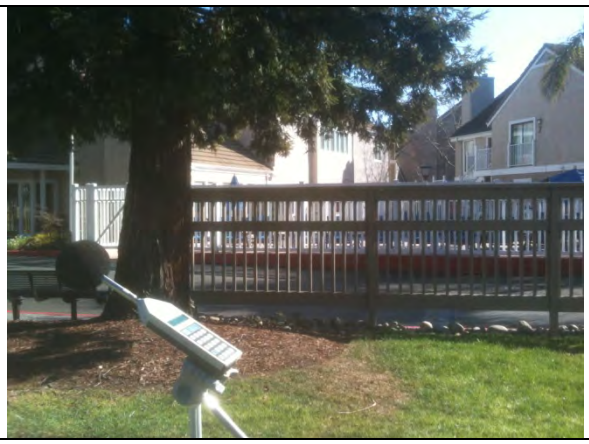
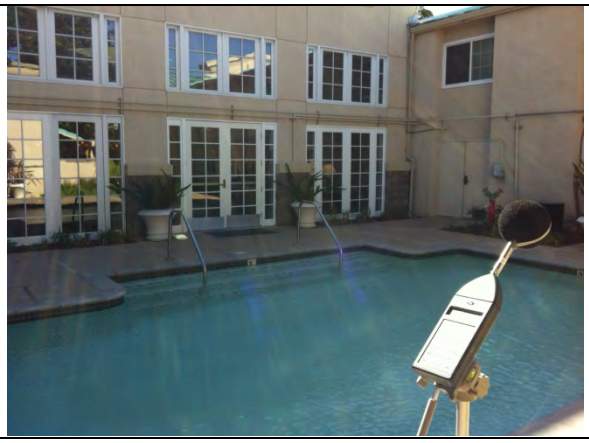
ST-22: In front of 831 San Saba Court, Sunnyvale.

ST-23: In front of 1033 Amador Avenue, Sunnyvale.

ST-24: Rear yard of 672 Lakewood Drive, Sunnyvale.

	
ST-25: Rear yard of 742 Lakewood Drive, Sunnyvale.	

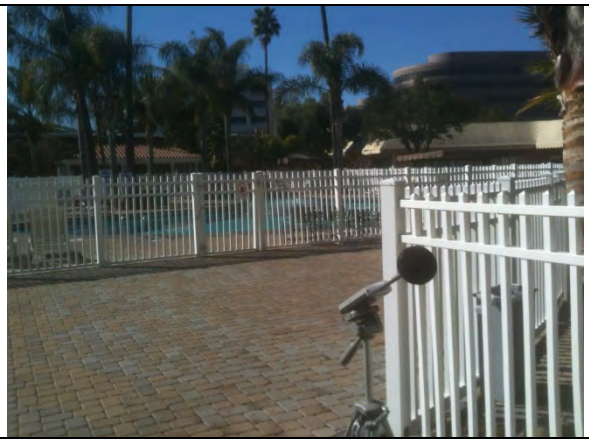
	
ST-26: Rear yard of 794 Lakewood Drive, Sunnyvale.	**ST-27**: Rear yard of 848 Lakewood Drive, Sunnyvale.
	
ST-28: Rear yard of 216 Velvetlake Drive, Sunnyvale.	**ST-29**: Common area of Avalon Silicon Valley Apartments, Sunnyvale.
	
ST-30: East Common area of Avalon Silicon Valley Apartments, Sunnyvale.	**ST-31**: Courtyard area of 1235 Wildwood Avenue, Sunnyvale.

	
ST-32: Rear yard equivalent of 397 Socorro Avenue, Sunnyvale.	**ST-33:** Pool area of Residence Inn Marriott, Sunnyvale.
	
ST-34: Courtyard of Plaza Suites, Santa Clara.	**ST-35**: Pool area of Ramada Inn, Sunnyvale.
	
ST-36: Adjacent to San Tomas Aquino Creek Trail, Santa Clara.	**ST-37**: Pool area of Biltmore Hotel, Santa Clara.

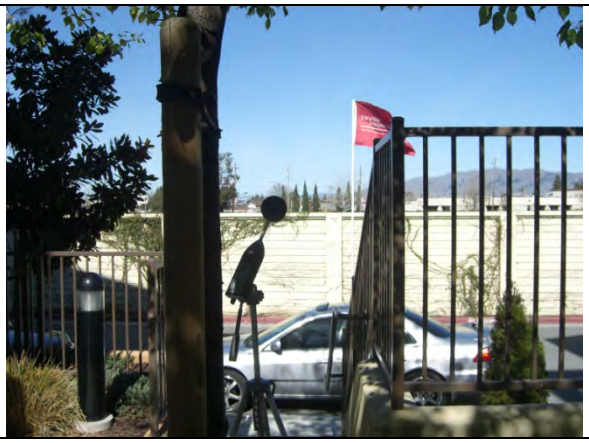
ST-38: Guadalupe River Trail, San Jose.

ST-39: Common area of office buildings on Gateway Place, San Jose.

ST-40: Pool area of Fairfield Inn and Suites, San Jose.

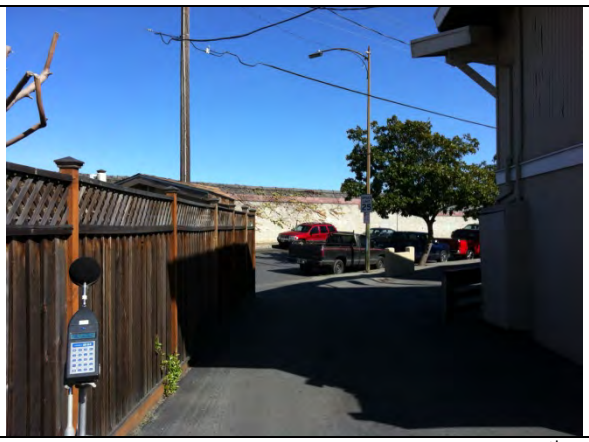


ST-41: Pool area of San Jose Airport Garden Hotel, San Jose.

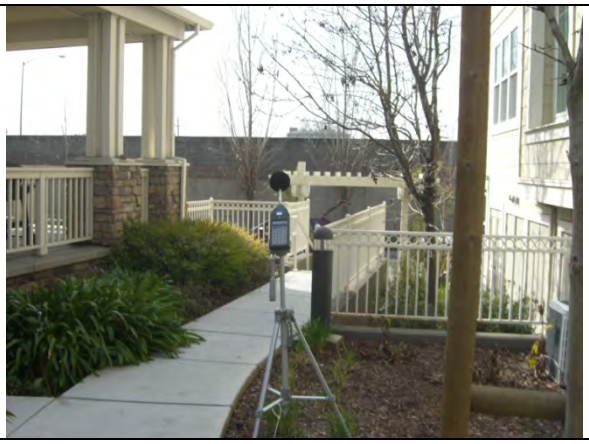


ST-42: Common area of 723 Pavilion Loop, San Jose.

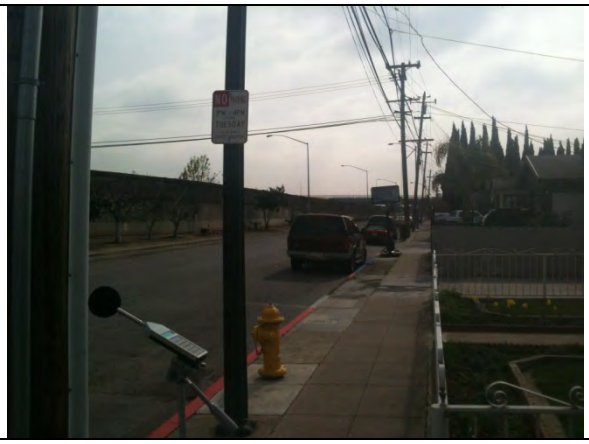
ST-43: Luna Park on Berryessa Road, San Jose.

	
ST-44: Common area of apartments on Luna Park Drive, San Jose.	**ST-45**: In front of 895 North Bayshore Road West, San Jose.
	
ST-46: Common area of 855 North Bayshore Road West, San Jose.	**ST-47**: Front yard of residences at North Bayshore Road West and East Mission, San Jose.
	
ST-48: Rear yard equivalent of 988 North 17th Street, San Jose.	**ST-49**: Pool area of Palm Court Apartments, San Jose.

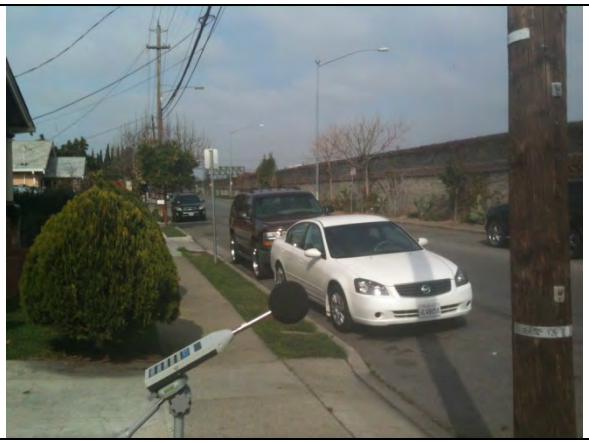
	
ST-50: Watson Park, San Jose.	



ST-51: Townhomes along Destino Circle, San Jose.

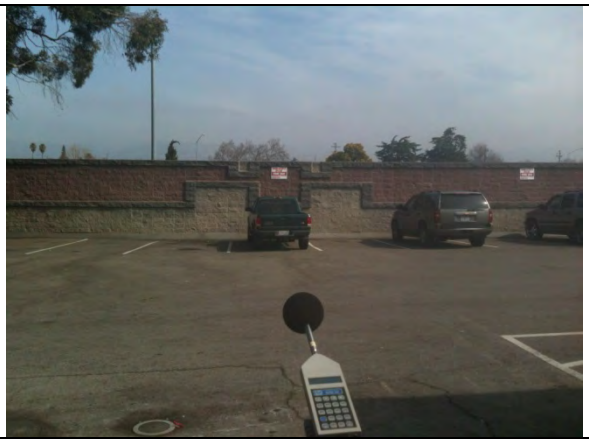


ST-52: Adjacent to Hacienda Creek Senior Apartments, San Jose.

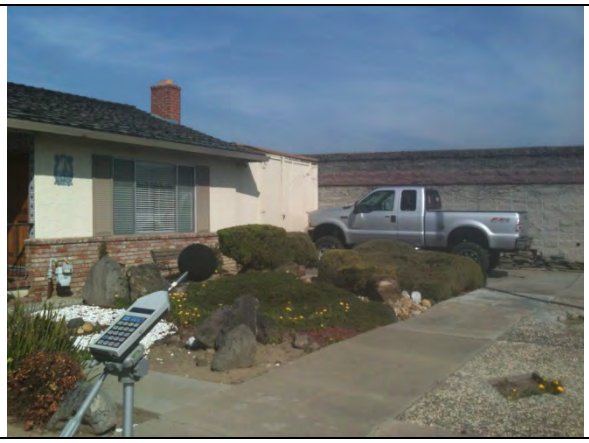


ST-53: In front of 321 East Court, San Jose.

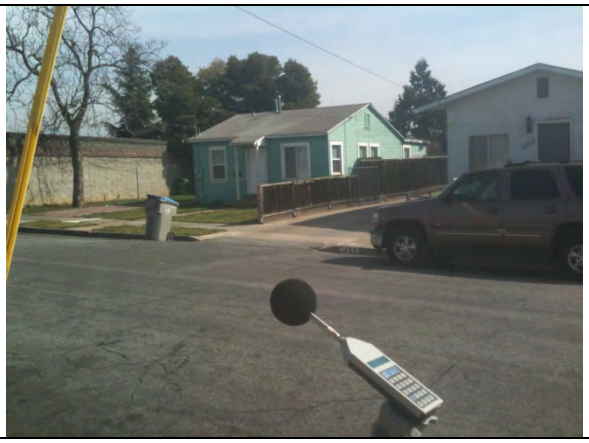
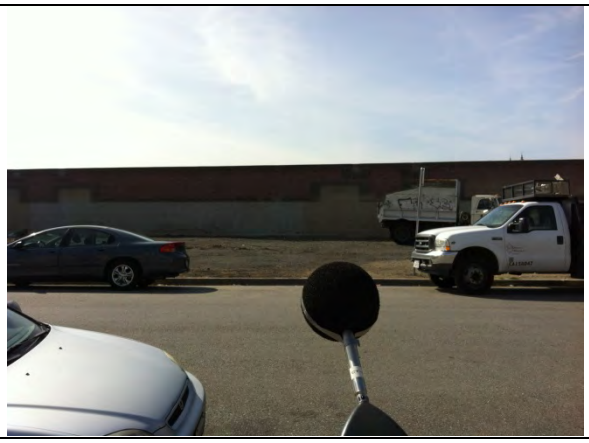
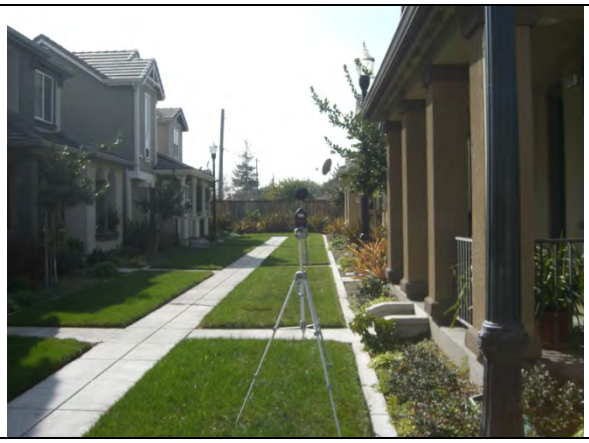
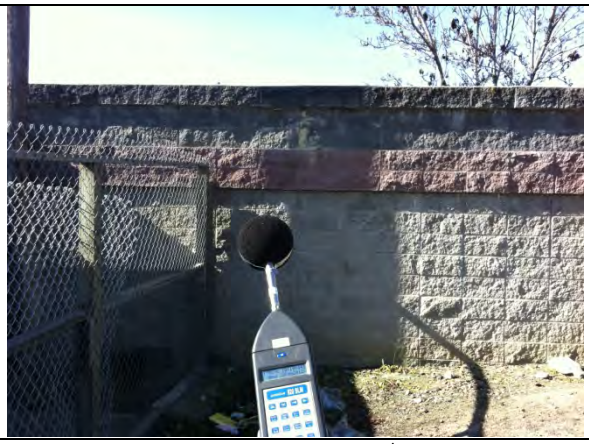
ST-54: Rear yard equivalent of 1494 View Drive, San Jose.

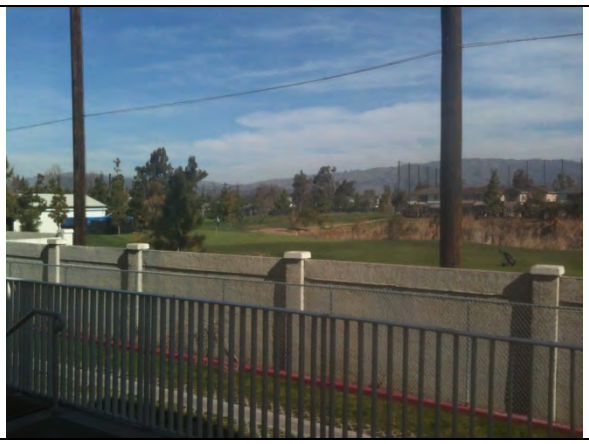
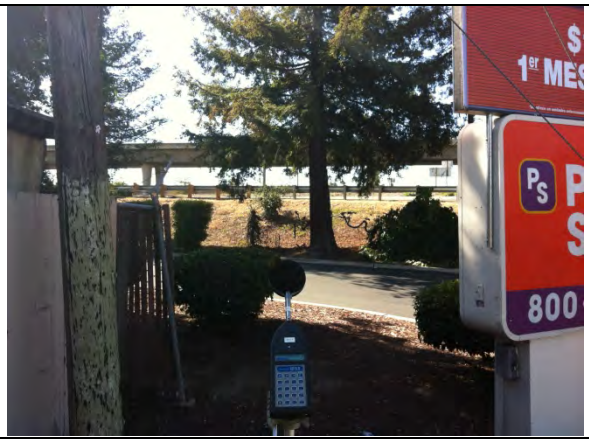


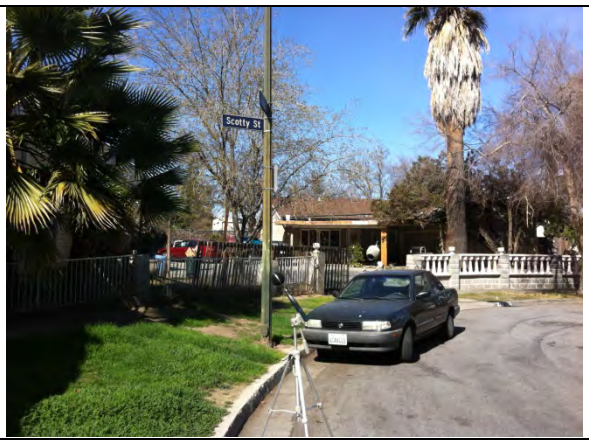
ST-55: Parking lot of Five Wounds School, San Jose.



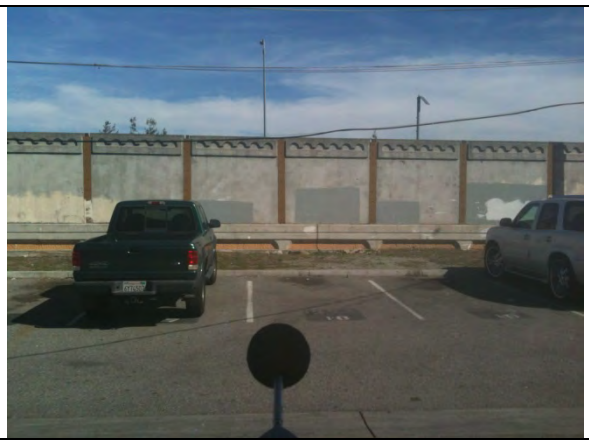
ST-56: Rear yard equivalent of 1459 East San Fernando Street, San Jose.

	
ST-57: Rear yard equivalent of 1457 Whitton Avenue, San Jose.	**ST-58**: Rear yard equivalent of 1503 Shortridge Avenue, San Jose.
	
ST-59: Rear yard equivalent of 1490 South 31st Street, San Jose.	**ST-60**: Common area between 229 and 225 Rayos Del Sol Drive, San Jose.
	
ST-61: In front of 1463 Sunny Court, San Jose.	**ST-62**: Rear yard of 237 South 31st Street, San Jose.

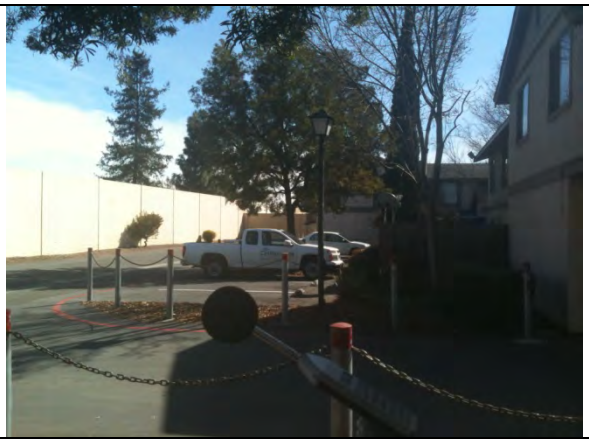
	
ST-63: Common area of Fairway Apartments, San Jose.	**ST-64**: In front of 155 Virginia Place, San Jose.
	
ST-65: Common area of Bonita Place Townhomes, San Jose.	**ST-66**: Between 1388 and 1389 Sunbeam Circle, San Jose.
	
ST-67: Side yard of 1369 Sunbeam Circle, San Jose.	**ST-68**: Rear yard equivalent of 1121 Terilyn Avenue, San Jose.



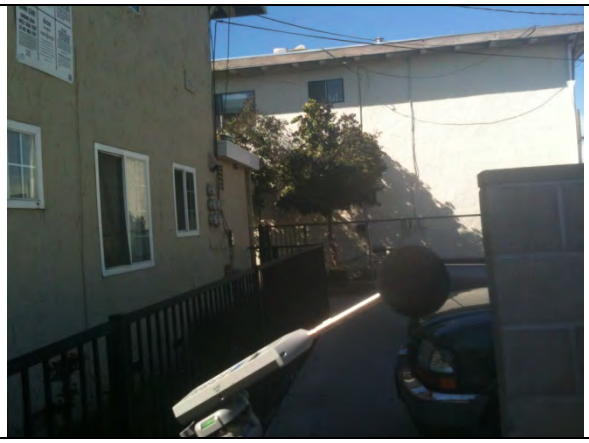
ST-69: Rear yard equivalent of 1505 Scotty Street, San Jose.



ST-70: In front of 1334 Crucero Drive, San Jose.



ST-71: Common area of apartments at 1390 Crucero Drive, San Jose.

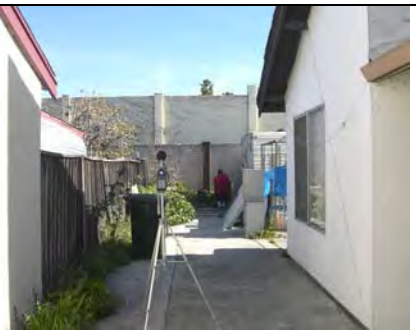


ST-72: Apartments at the end of Dubert Lane, San Jose.

ST-73: Front yard of 1634 Midfield Avenue, San Jose.

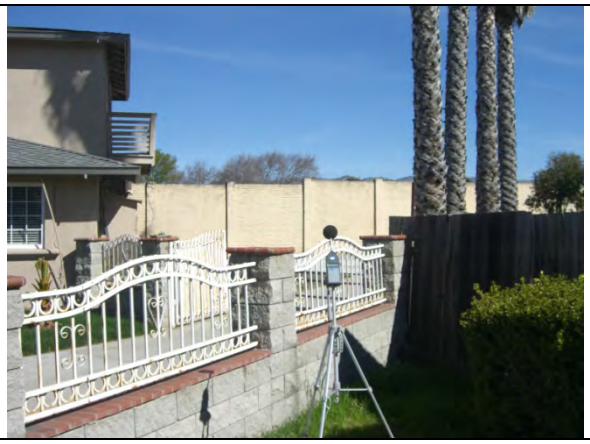
ST-74: In front of 1820 Midfield Avenue, San Jose.l

	
ST-75: Rear yard of 1441 Taper Court, San Jose.	

	
ST-76: In front of 1442 Joe Dimaggio Court, San Jose.	**ST-77**: Common area of 1886 Midfield Avenue, San Jose.
	
ST-78: Rear yard of 1382 Sunnycrest Circle, San Jose.	**ST-79**: Common area of Valley Palms Apartments at 2155 Lanai Avenue, San Jose.
	
ST-80: Rear yard of 1526 Denali Way, San Jose.	**ST-81:** Nisich Park, San Jose.

ST-82: Common area of 1430 Zachary Way, San Jose.

ST-83: Pool area of Motel 6 at 2560 Fontaine Road, San Jose.



ST-84: Rear yard of 1320 Mayhew Court, San Jose.

ST-85: Common area equivalent of Casa Real Apartments, San Jose.

ST-86: Rear yard equivalent of 1473 Freni Court, San Jose.

ST-87: Rear yard of 1318 Pellier Court, San Jose.

ST-88: Rear yard of 1326 Kane Court, San Jose.

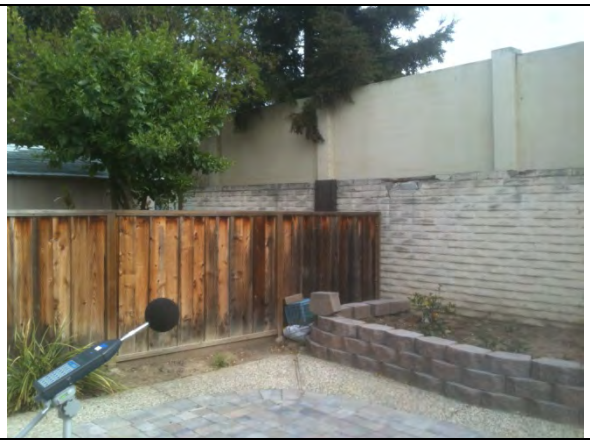
ST-89: Park on Plumas Drive, San Jose.

ST-90: Rear yard of 1390 Delano Court, San Jose.

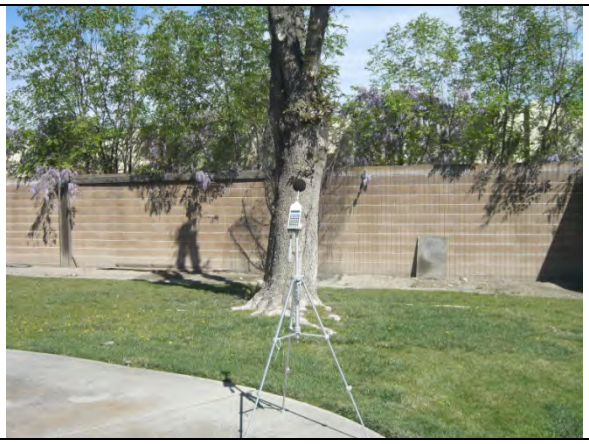
ST-91: Rear yard equivalent of 1540 Aldrich Way, San Jose.

ST-92: Rear yard equivalent of 1546 Barberry Court, San Jose.

ST-93: Rear yard equivalent of 1503 Aborn Road, San Jose.

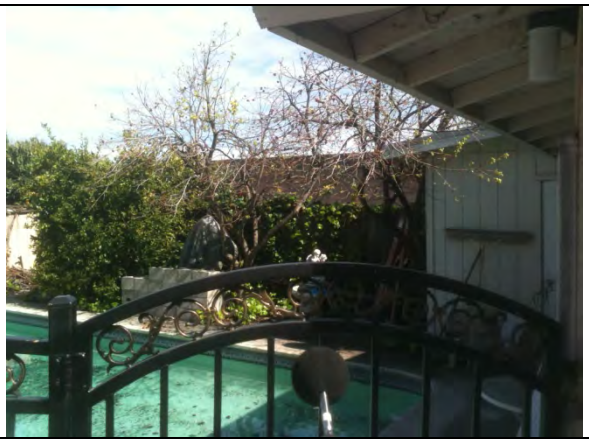


ST-94: Rear yard of 3070 Brandywine Drive, San Jose.



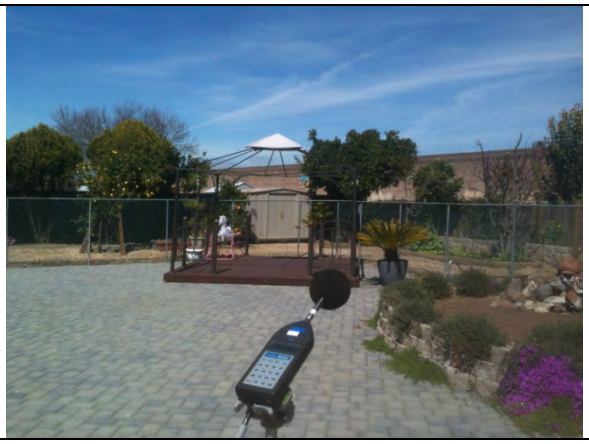
ST-95: Rear yard of 1331 Erinwood Court, San Jose.

ST-96: Rear yard equivalent of mobile homes along Rio De Plata, San Jose.



ST-97: Rear yard of 1365 Cotterell Drive, San Jose.

ST-98: Rear yard of 3787 Polton Place Way, San Jose.

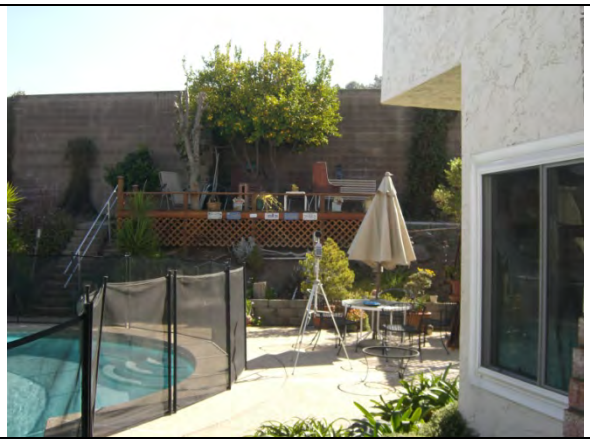


ST-99: Rear yard of 1393 Crailford Court, San Jose.

	
ST-100: Ramblewood Elementary School, San Jose.	

ST-101: Rear yard of 3615 Bridal Place Court, San Jose.

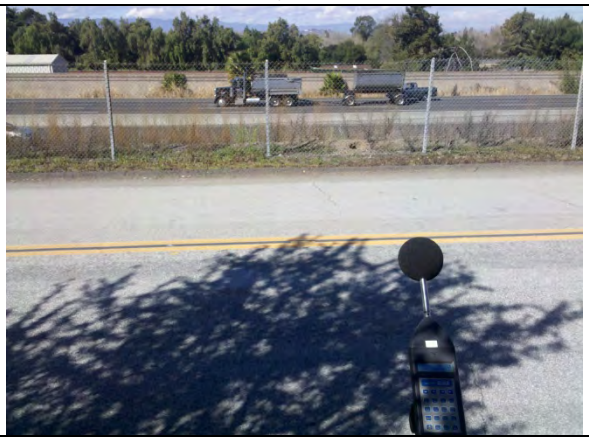
ST-102: Rear yard equivalent of 3689 Ivy Canyon Court, San Jose.



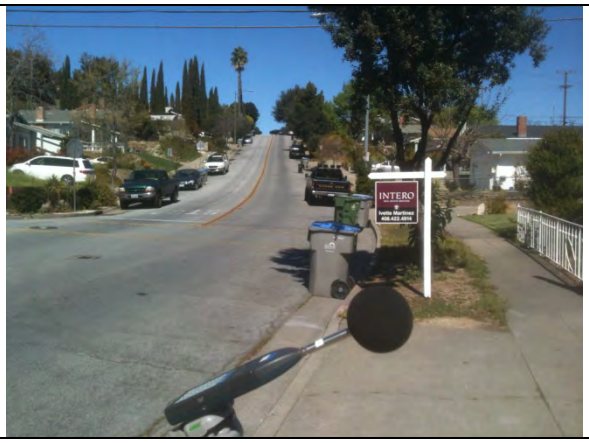
ST-103: Rear yard of 1260 Wentworth Way, San Jose.

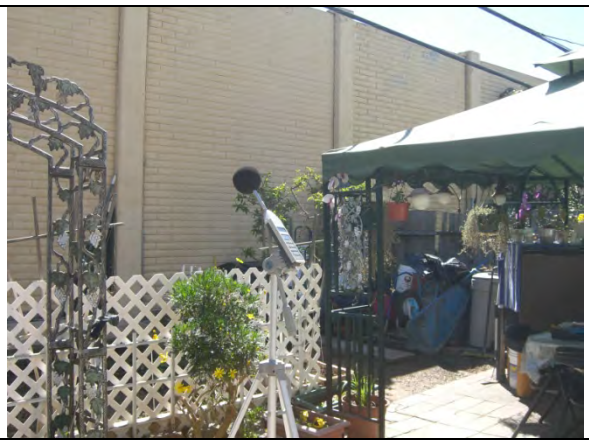
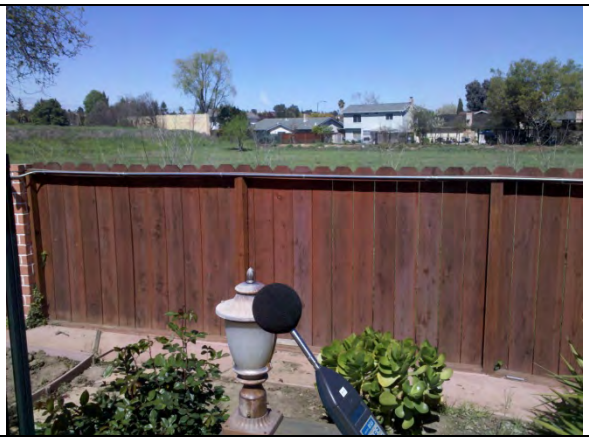
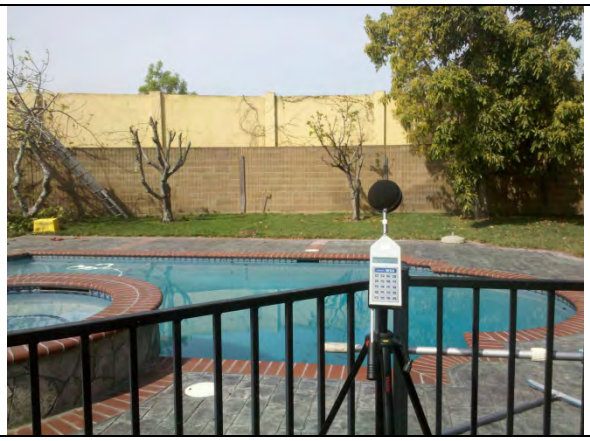
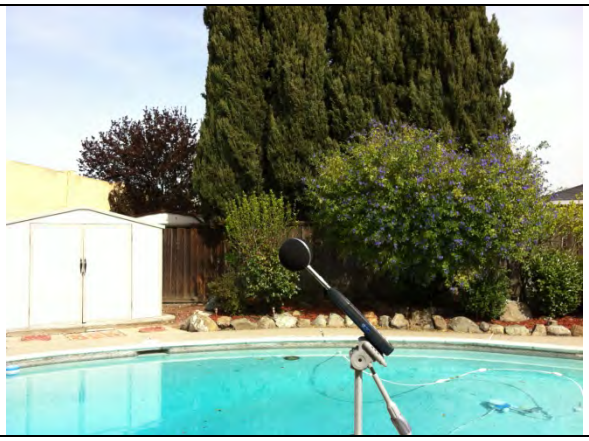
ST-104: Rear yard equivalent to 4062 McLaughlin Avenue, San Jose.

ST-105: Adjacent to 3812 Dove Hill Road, San Jose.



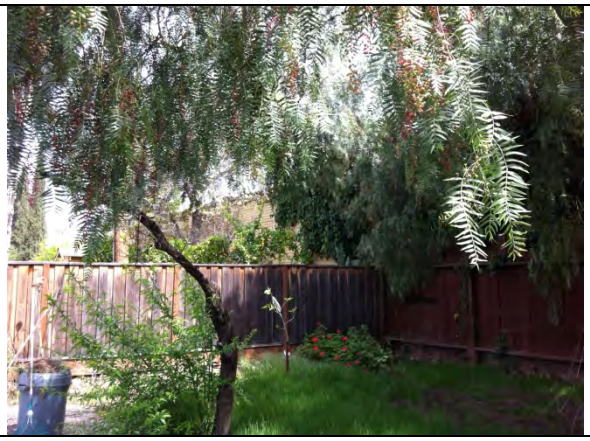
ST-106: Adjacent to 3700 Dove Road, San Jose.

	
ST-107: Picnic area of Hellyer County Park, San Jose.	**ST-108**: Side yard equivalent of 4823 Nicole Court, San Jose.
	
ST-109: Rear yard of 4830 Snow Drive, San Jose.	**ST-110**: Front of 4898 Snow Drive, San Jose.
	
ST-111: Rear yard of 4947 Fontanelle Place, San Jose.	**ST-112**: Rear yard of 318 Fontanelle Place, San Jose.

	
ST-113: Rear yard of 5034 Snow Drive, San Jose.	**ST-114:** Rear yard of 5150 Snow Drive, San Jose.
No Photograph Available	
ST-115: Backyard of 406 Fontanelle Drive, San Jose.	**ST-116**: Rear yard of 5157 Pebbletree Court, San Jose.
	
ST-117: Rear yard of 429 Lionwood Place, San Jose.	**ST-118**: Rear yard of 5273 Pebbletree Way, San Jose.

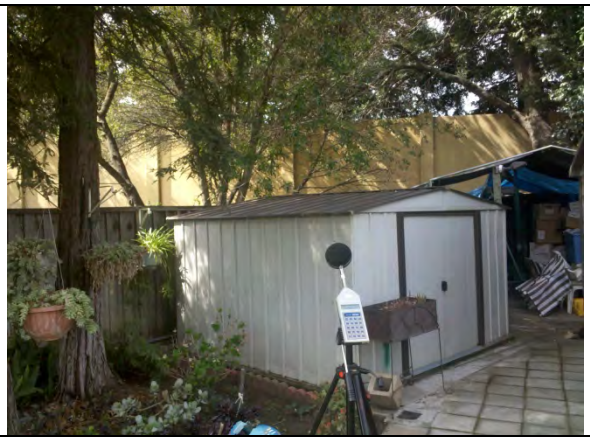
ST-119: Rear yard of residence on Great Oaks Drive, San Jose.

ST-120: Rear yard of 428 Century Oaks Drive, San Jose.



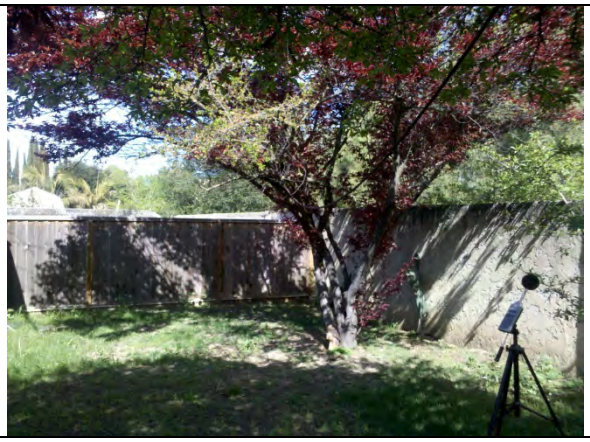
ST-121: Rear yard of 5360 Great Oaks Drive, San Jose.

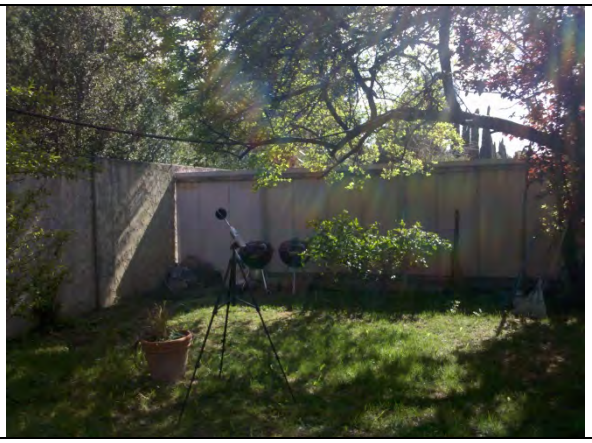
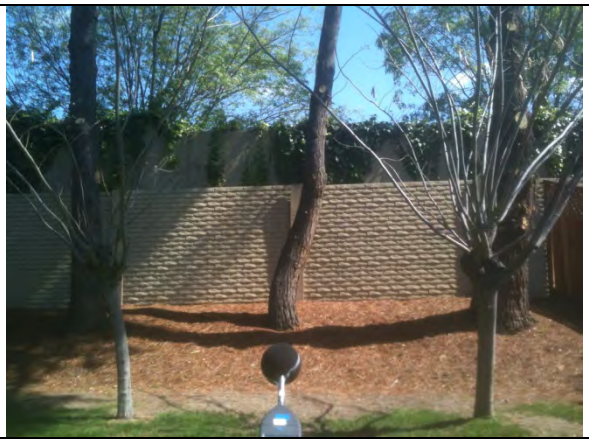
ST-122: Adjacent to 54a Calle Pintada, San Jose.



ST-123: Rear yard of 445 Century Cross Court, San Jose.

ST-124: Cul-de-sac of Calle Gaviota, San Jose.

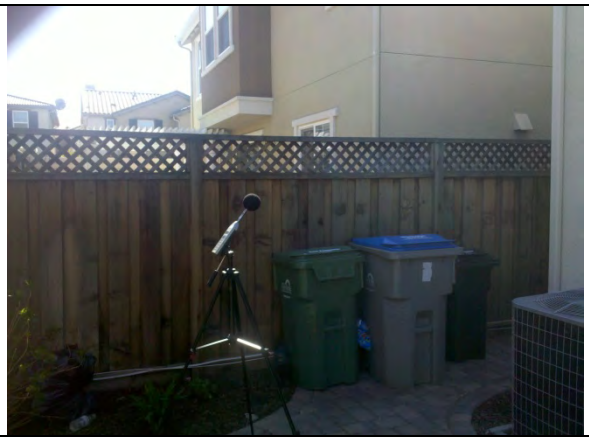
	
ST-125: Rear yard of 5428 Demerest Lane, San Jose.	

	
ST-126: Rear yard of 5476 Demerest Lane, San Jose.	**ST-127**: Rear yard of 133 Casswell Court, San Jose.
	
ST-128: Rear yard of 127 Dunwell Court, San Jose.	**ST-129**: Rear yard of 164 Southsun Court, San Jose.
	
ST-130: Rear yard of 121 Meadwell Court, San Jose.	**ST-131**: Rear yard equivalent of 109 Tennant Avenue, San Jose.

ST-132: Rear yard of 404 Birkhaven Place, San Jose.

ST-133: Pool area of 449 Danna Court, San Jose.

ST-134: Coyote Creek Trail near Parkway Lakes, San Jose.



ST-135: Rear yard of 7032 Basking Ridge Avenue, San Jose.

ST-136: Rear yard of 7406 Basking Ridge Avenue, San Jose.

ST-137: Parkway Fishing Lakes, San Jose.

ST-138: Parkway Fishing Lakes, San Jose.

ST-139: Setback of residence along Malech Road, San Jose.

ST-140: Coyote Creek Trail, south of Bailey Avenue on-ramp, San Jose.

ST-141: Coyote Creek Trail, San Jose.

ST-142: Patio area of Coyote Creek Golf Course, San Jose.

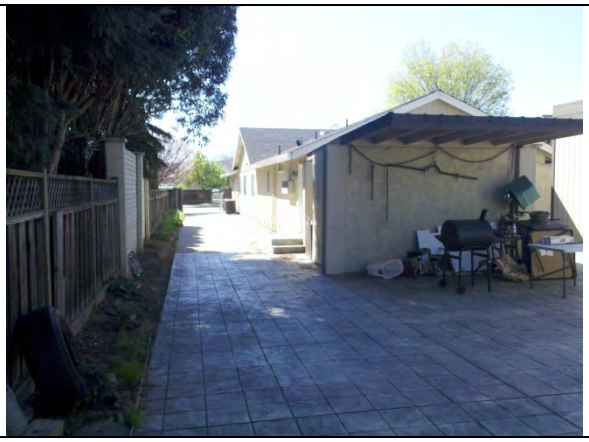
ST-143: Rear yard equivalent of 19490 Vista De Lomas, Morgan Hill.

ST-144: Rear yard equivalent of 825 Burnett Avenue, Morgan Hill.

ST-145: Front of 740 Peebles Avenue, Morgan Hill.

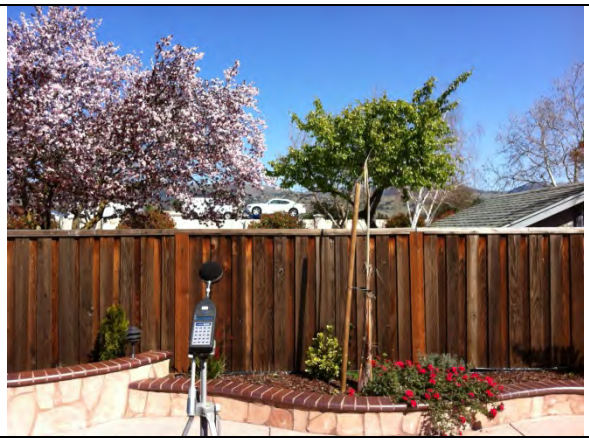
ST-146: Rear yard of 17900 Laurel Road, Morgan Hill.

ST-147: Rear yard equivalent of 1790 Condit Road, Morgan Hill.

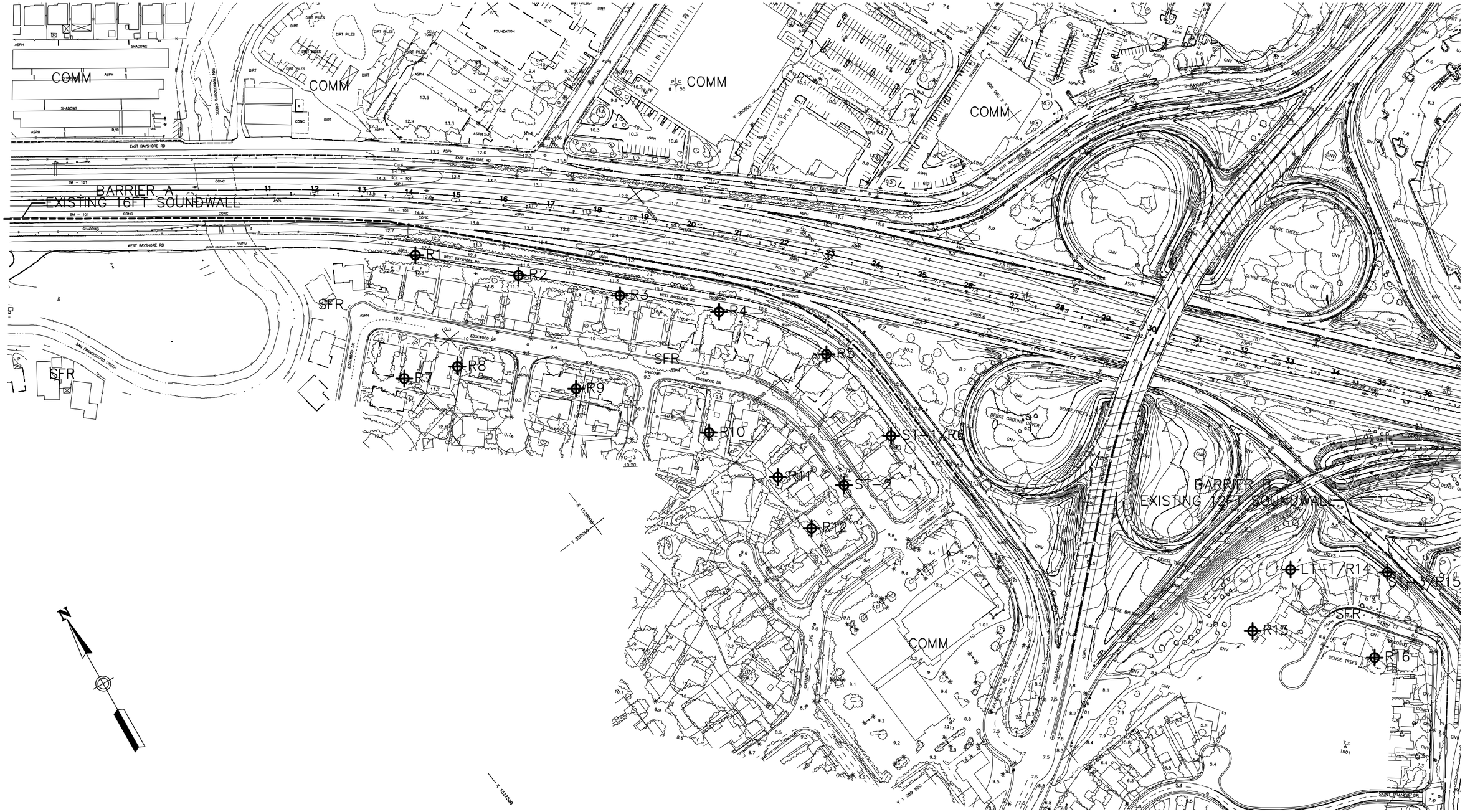


ST-148: Rear yard of 17406 Walnut Grove Drive, Morgan Hill.

ST-149: Adjacent to 1115 Diana Avenue, Morgan Hill.

	
ST-150: Rear yard of 17355 Walnut Grove Drive, Morgan Hill.	**ST-151**: Front of 17355 Walnut Grove Drive, Morgan Hill.
	
ST-152: Pool area of Executive Inn Suites, Morgan Hill.	**ST-153**: Rear yard of 16370 Saint John Court, Morgan Hill.

Appendix C
Segment 1 Receptor Locations and Noise Barriers



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

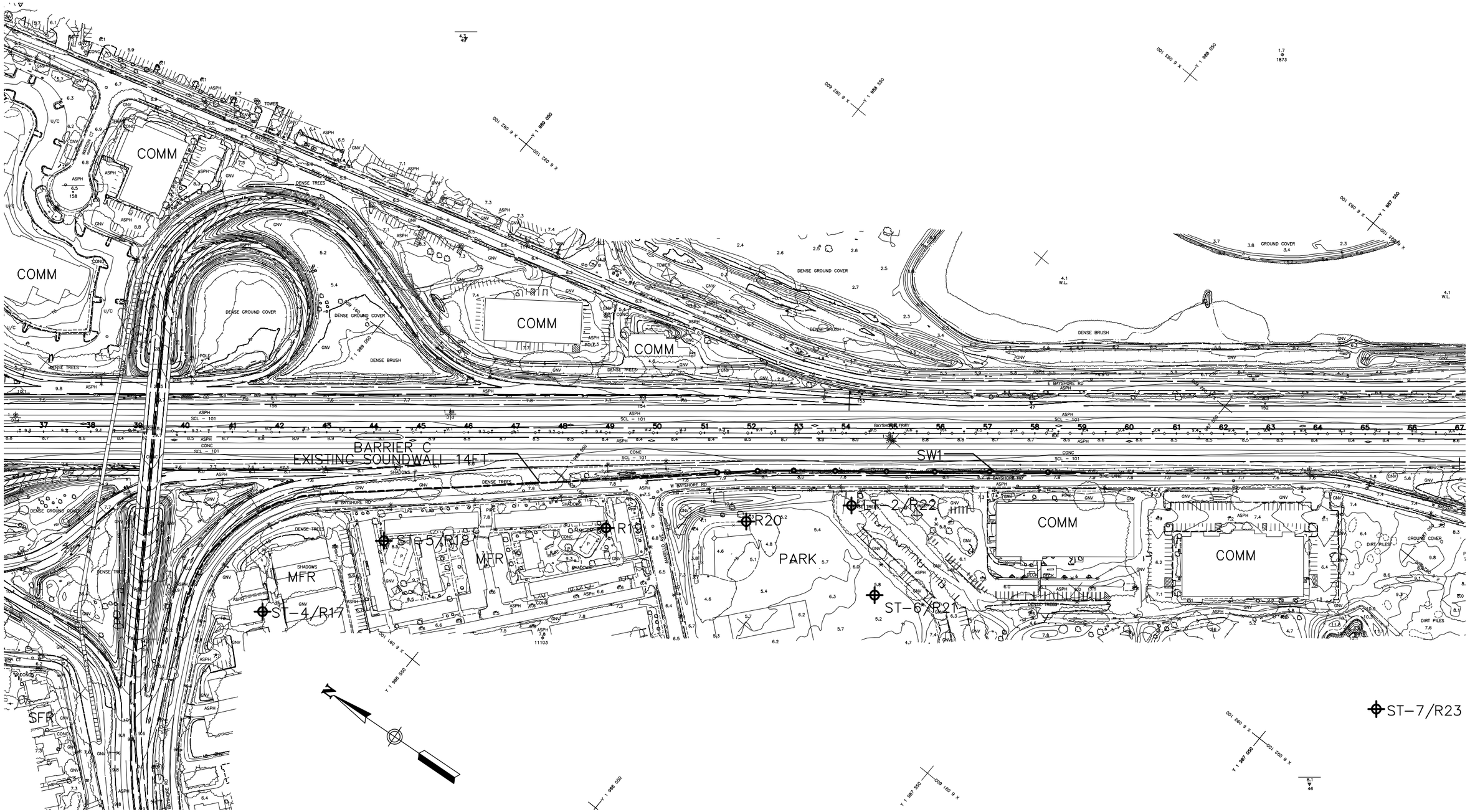
SFR —SINGLE FAMILY RESIDENCE
MFR —MULTI—FAMILY RESIDENCE
COMM —COMMERCIAL

1:200
FEET

0 FT 200FT 400FT 800FT

U.S. 101 AUXILIARY LANES
SENSITIVE RECEIVER & NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

SFR —SINGLE FAMILY RESIDENCE

MFR —MULTI-FAMILY RESIDENCE

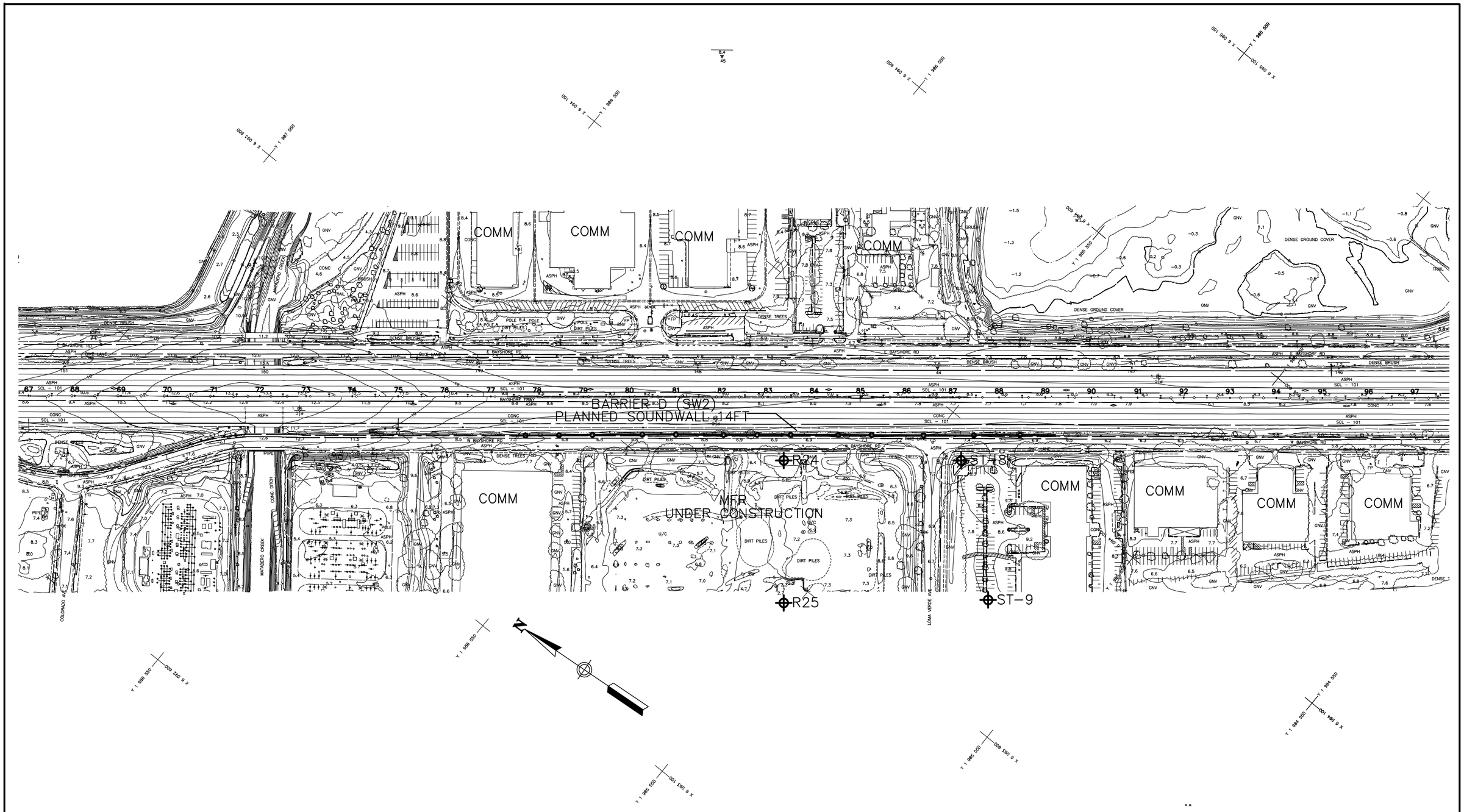
COMM —COMMERCIAL

1:200
FEET

0 FT 200FT 400FT 800FT

U.S. 101 AUXILIARY LANES SENSITIVE RECEIVER & NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

SFR —SINGLE FAMILY RESIDENCE

MFR —MULTI—FAMILY RESIDENCE

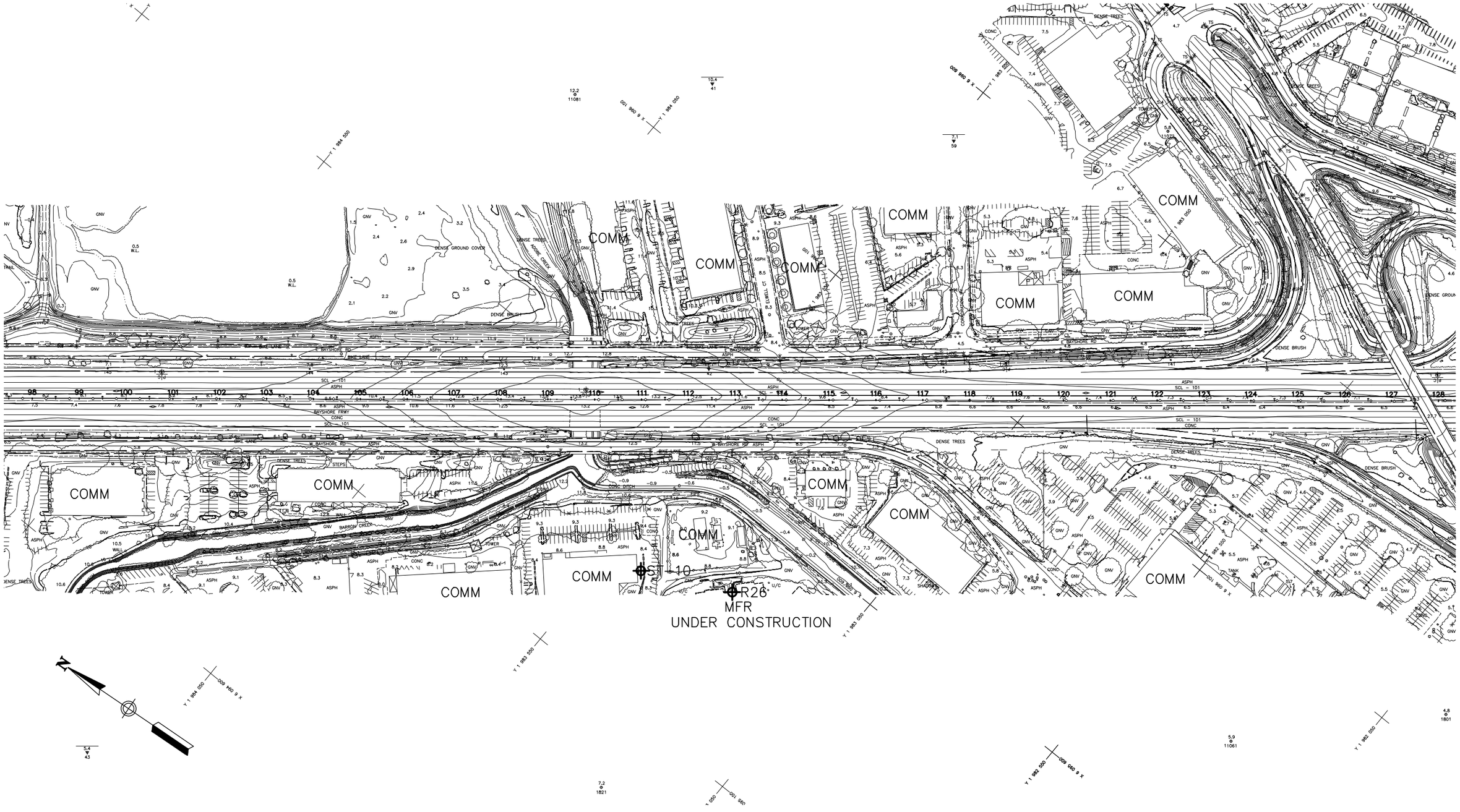
COMM —COMMERCIAL

1: 200
FEET

0 FT 200FT 400FT 800FT

U.S. 101 AUXILIARY LANES
SENSITIVE RECEIVER &
NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

SFR —SINGLE FAMILY RESIDENCE

MFR —MULTI—FAMILY RESIDENCE

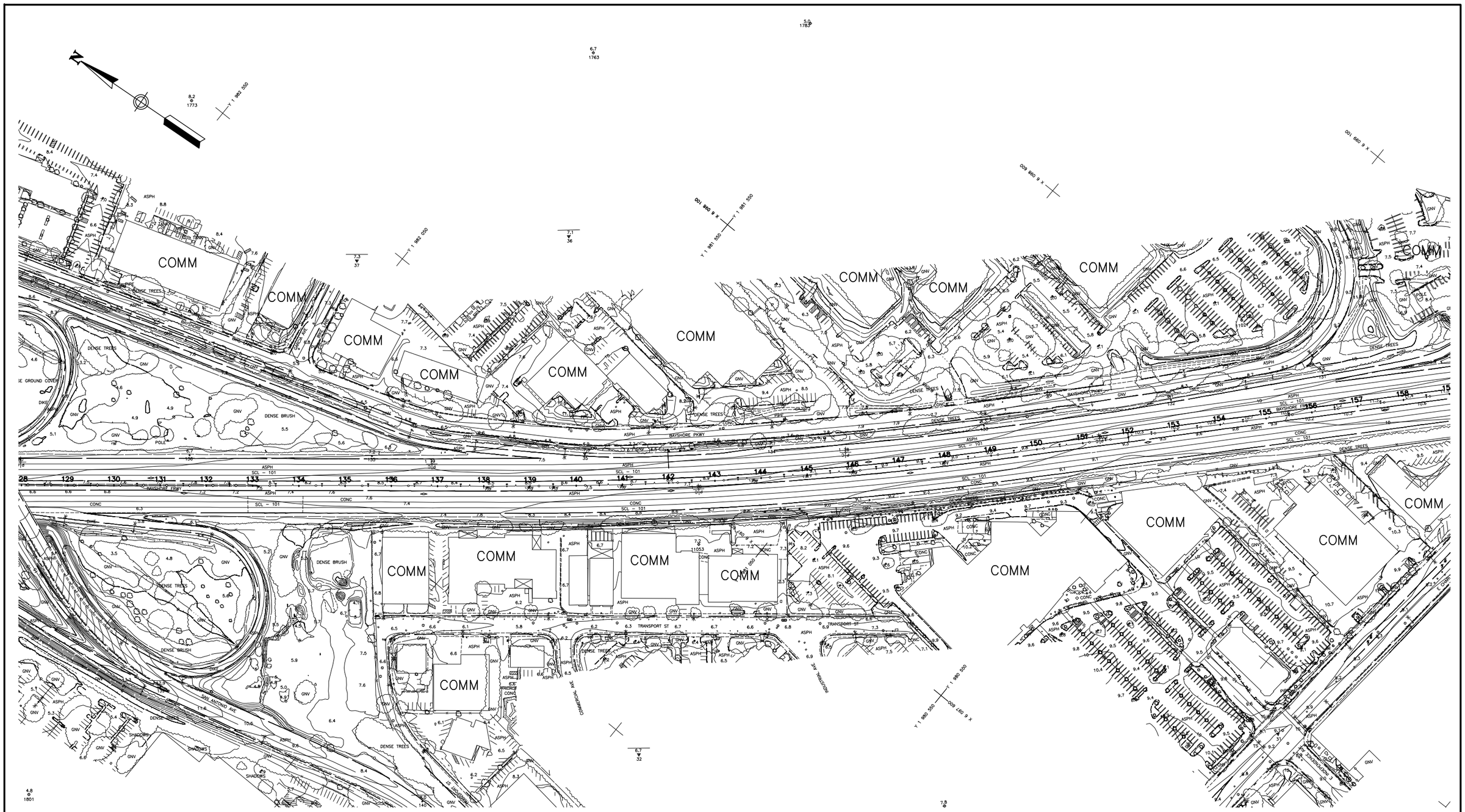
COMM —COMMERCIAL

1:200
FEET

0 FT 200FT 400FT 800FT

U.S. 101 AUXILIARY LANES SENSITIVE RECEIVER & NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

SFR —SINGLE FAMILY RESIDENCE

MFR —MULTI–FAMILY RESIDENCE

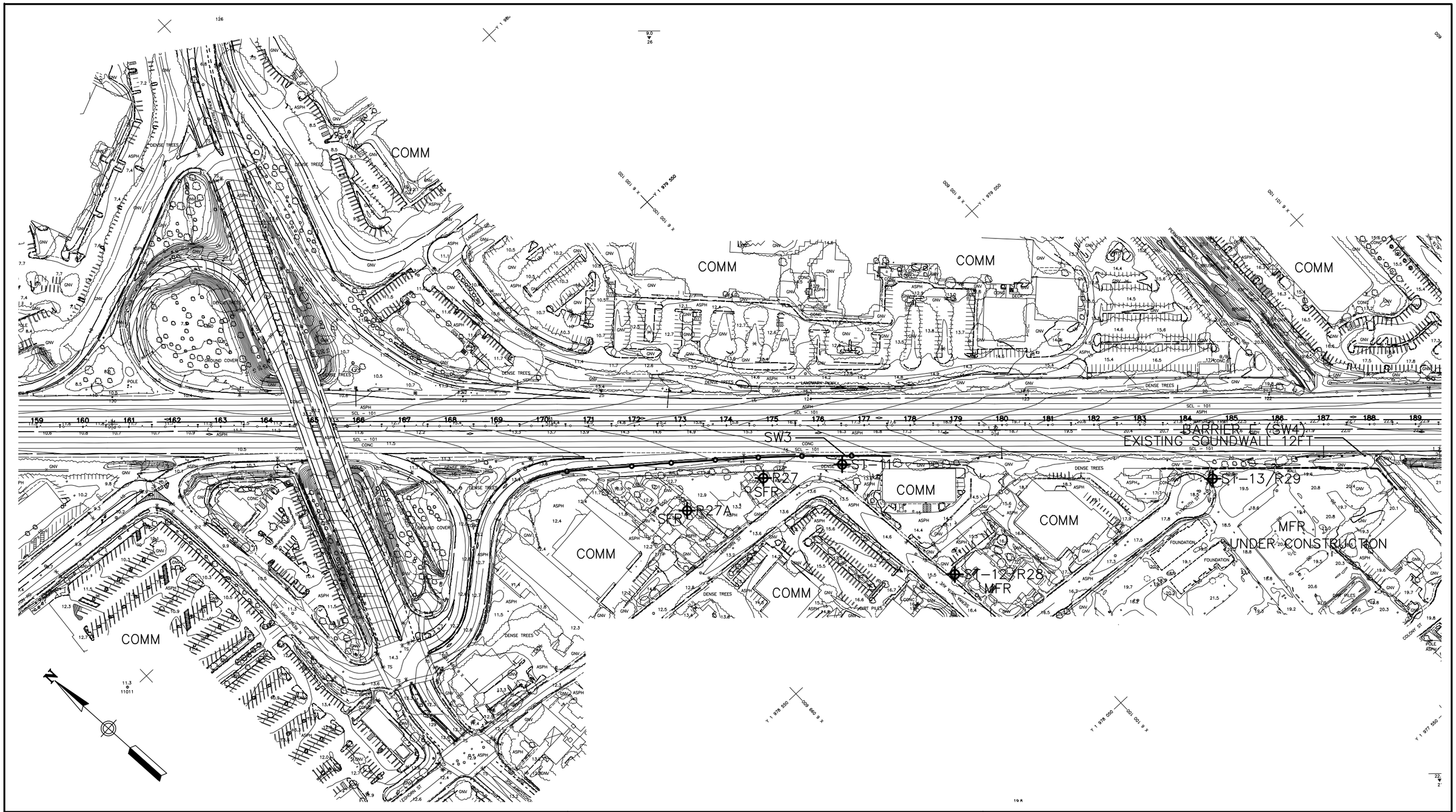
COMM —COMMERCIAL

1:200
FEET

0 FT 200FT 400FT 800FT

U.S. 101 AUXILARY LANES SENSITIVE RECEIVER & NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

SFR —SINGLE FAMILY RESIDENCE

MFR —MULTI—FAMILY RESIDENCE

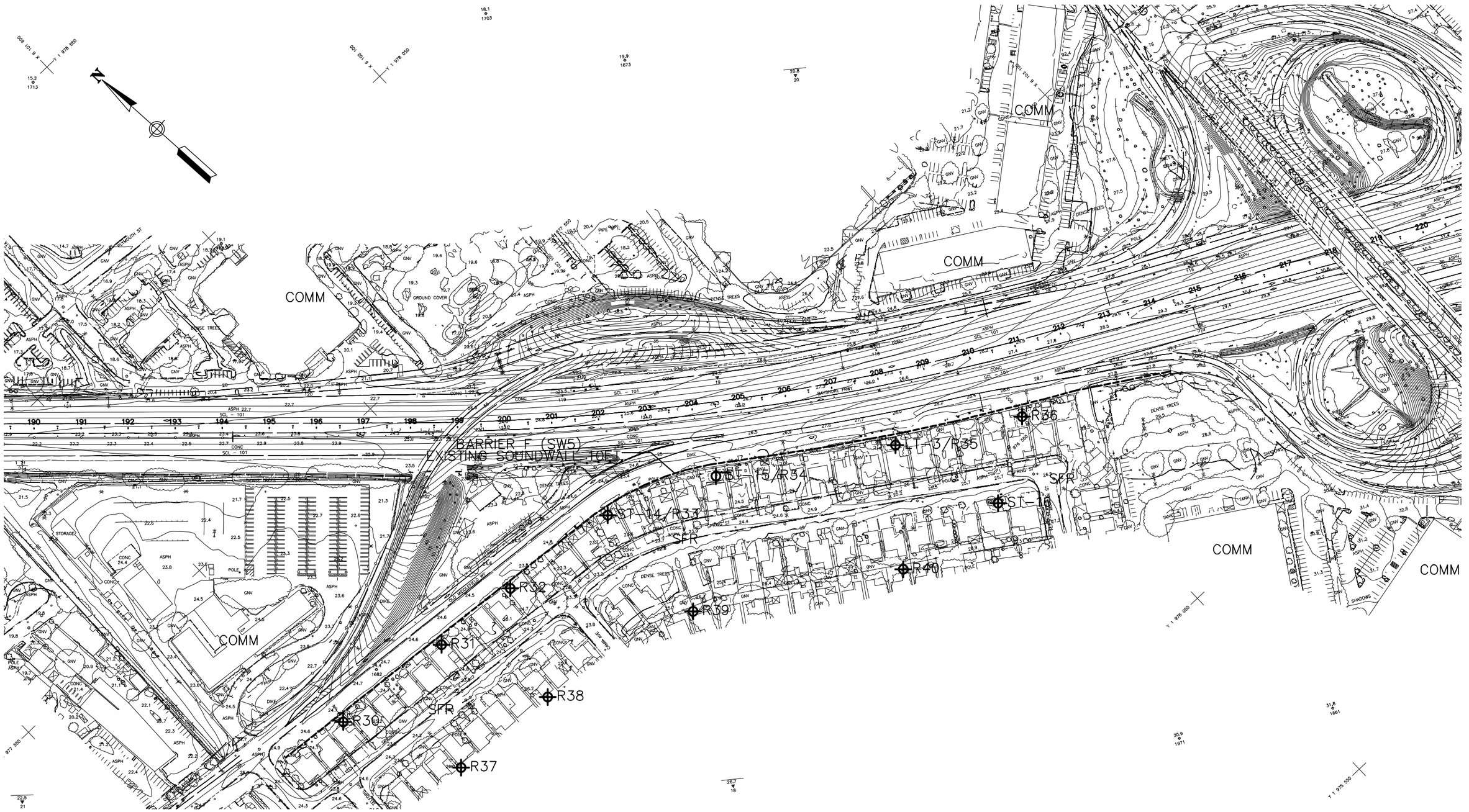
COMM —COMMERCIAL

1:200
FEET

0 FT 200FT 400FT 800FT

U.S. 101 AUXILARY LANES SENSITIVE RECEIVER & NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



LEGEND

- RECIEVER LOCATION
- FEASIBLE SOUNDWALL
- EXISTING SOUNDWALL

SFR —SINGLE FAMILY RESIDENCE
MFR —MULTI—FAMILY RESIDENCE
COMM —COMMERCIAL

1:200
FEET

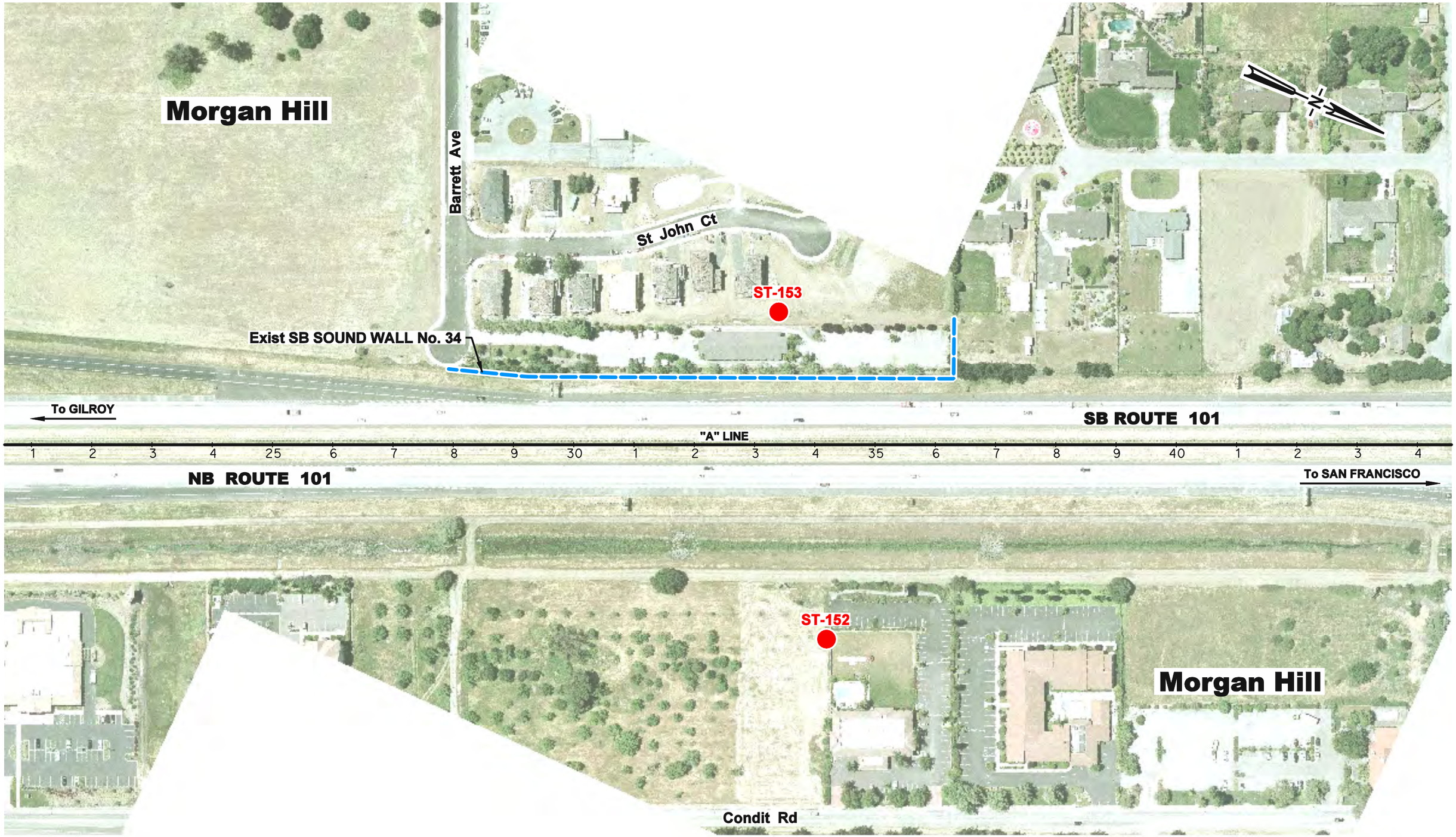
0 FT 200FT 400FT 800FT

U.S. 101 AUXILARY LANES
SENSITIVE RECEIVER & NOISE BARRIER LOCATIONS

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET NO. 7 OF 7

Appendix D
US 101 Receptor Locations and Noise Barriers (Segments 2 – 16)



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 1 OF 55

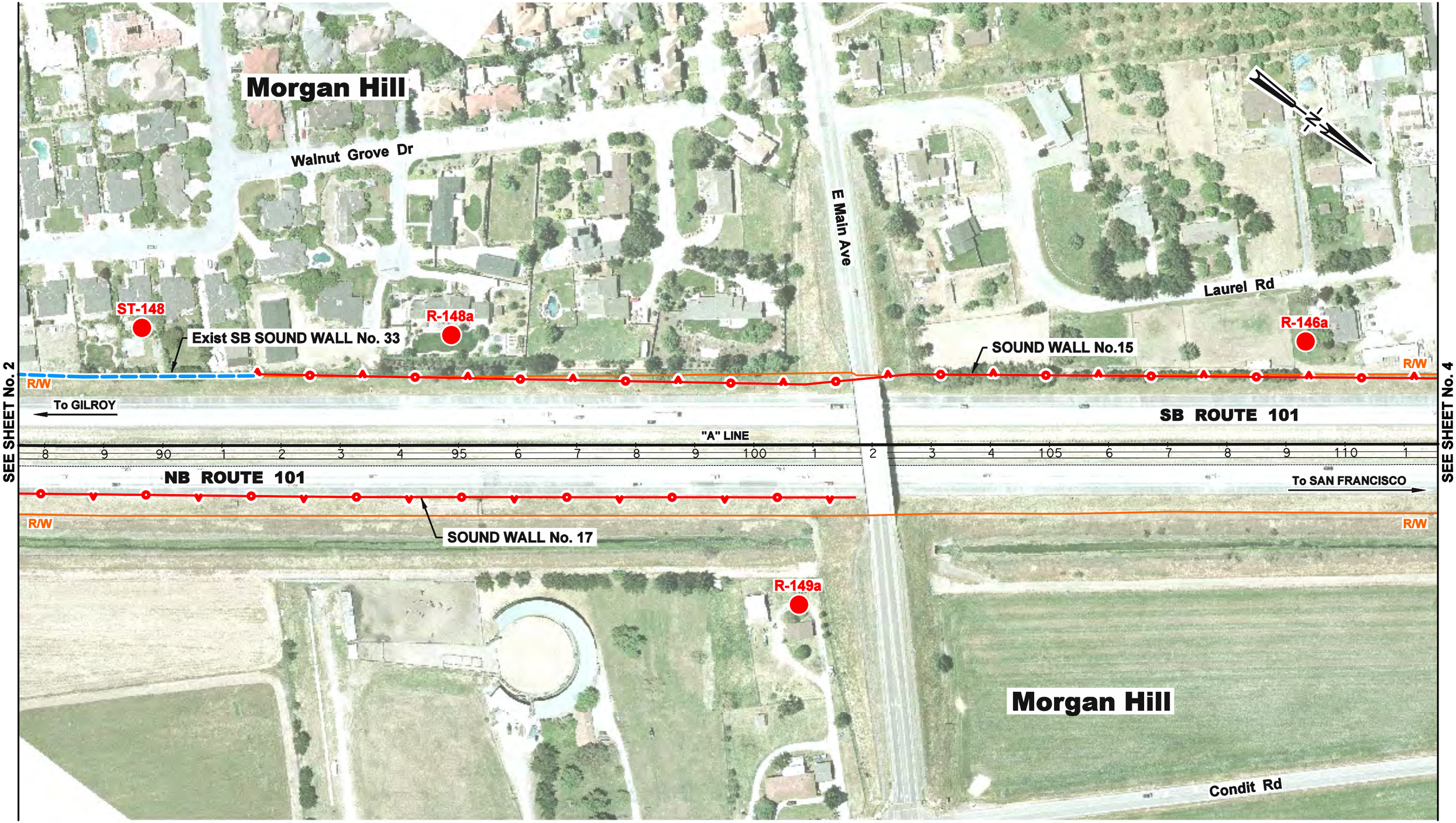
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

SHEET 2 OF 55



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

SHEET 3 OF 55

SEE SHEET No. 3

Morgan Hill

Laurel Rd

ST-146

SOUND WALL No. 15

R/W

R/W

To GILROY

SB ROUTE 101

"A" LINE

2 3 4 115 6 7 8 9 120 1 2 3 4 125 6 7 8 9 130 1 2 3 4 135

NB ROUTE 101

To SAN FRANCISCO

R/W

R/W

SOUND WALL No. 16

ST-147

Condit Rd

Morgan Hill

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

Morgan Hill

Peebles Ave

R-145a

ST-145

Freeway Vista

R/W

R/W

SOUND WALL No. 13

To GILROY

SB ROUTE 101

"A" LINE

NB ROUTE 101

To SAN FRANCISCO

R/W

R/W

SOUND WALL No. 14

R-143b

Peebles Ave

Morgan Hill

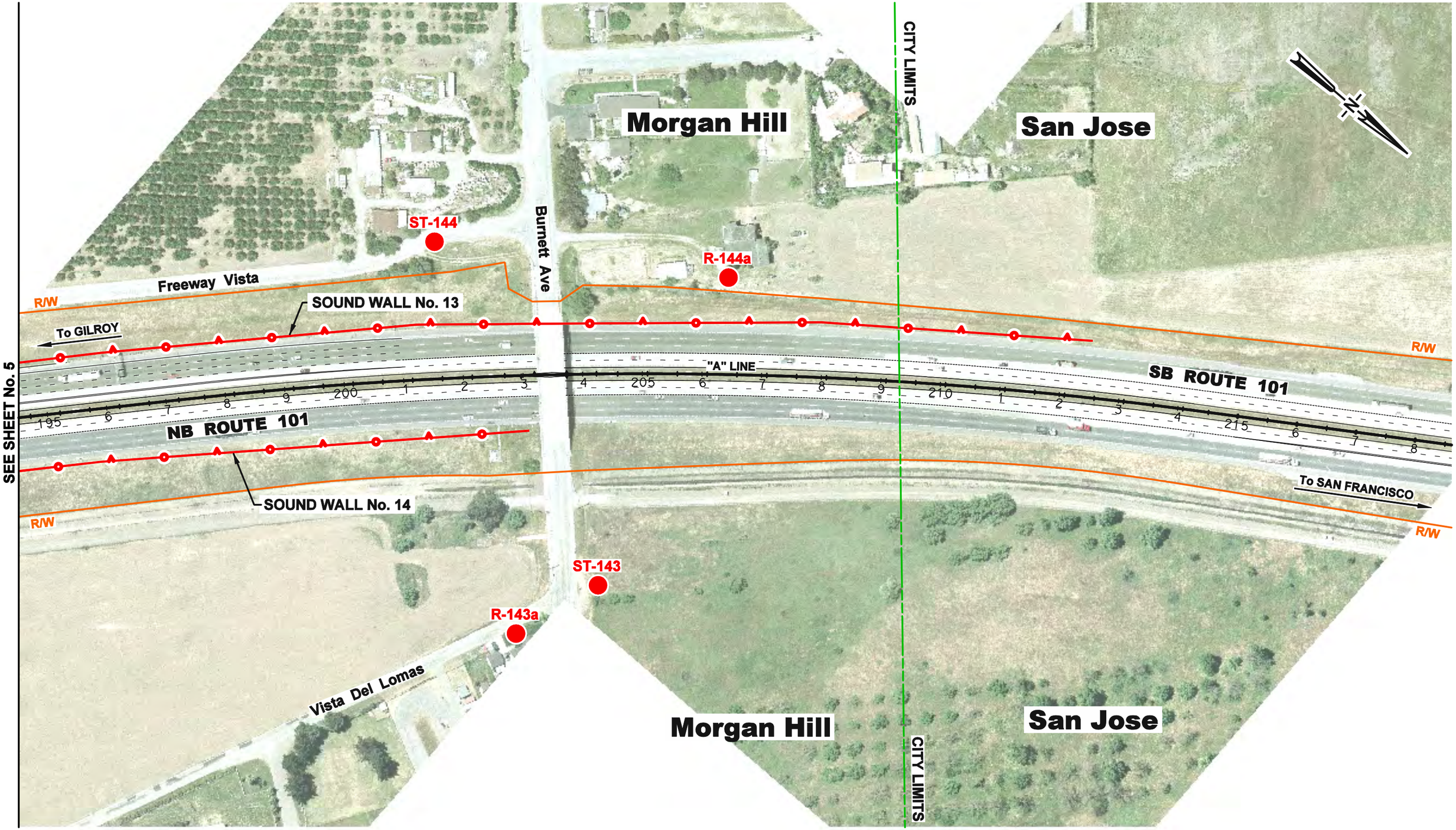
SEE SHEET No. 6

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

San Jose

ST-142

R/W

Coyote Creek Golf Dr

COYOTE CREEK GOLF COURSE

R-142c

R/W

SOUND WALL No. 11

To GILROY

SB ROUTE 101

"A" LINE

9 340 1 2 3 4 345 6 7 8 9 350 1 2 3 4 355 6 7 8 9 360 1 2

NB ROUTE 101

To SAN FRANCISCO

SEE SHEET No. 8

SOUND WALL No. 12

R/W

San Jose

COYOTE CREEK GOLF COURSE

R-142d

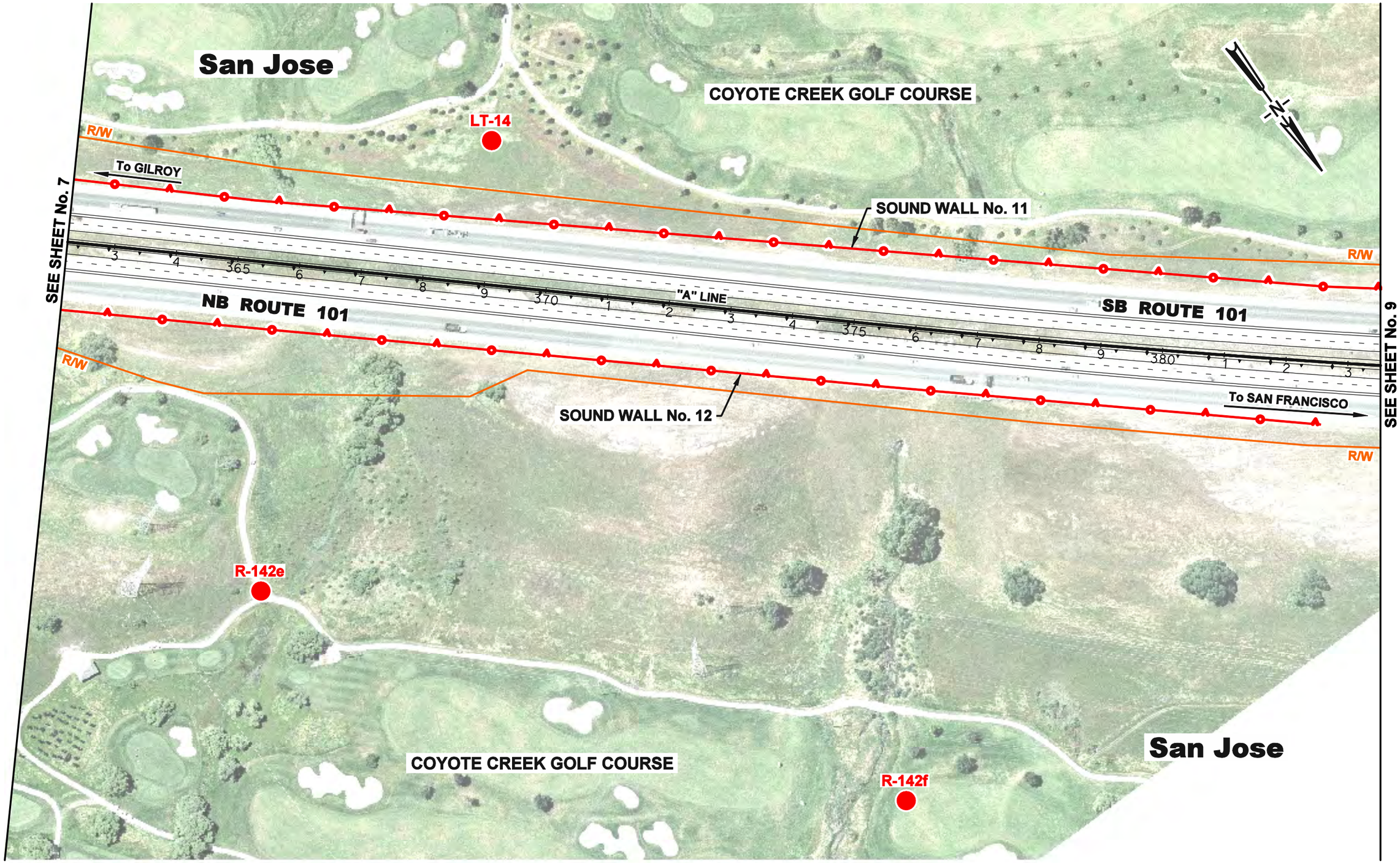
R/W

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

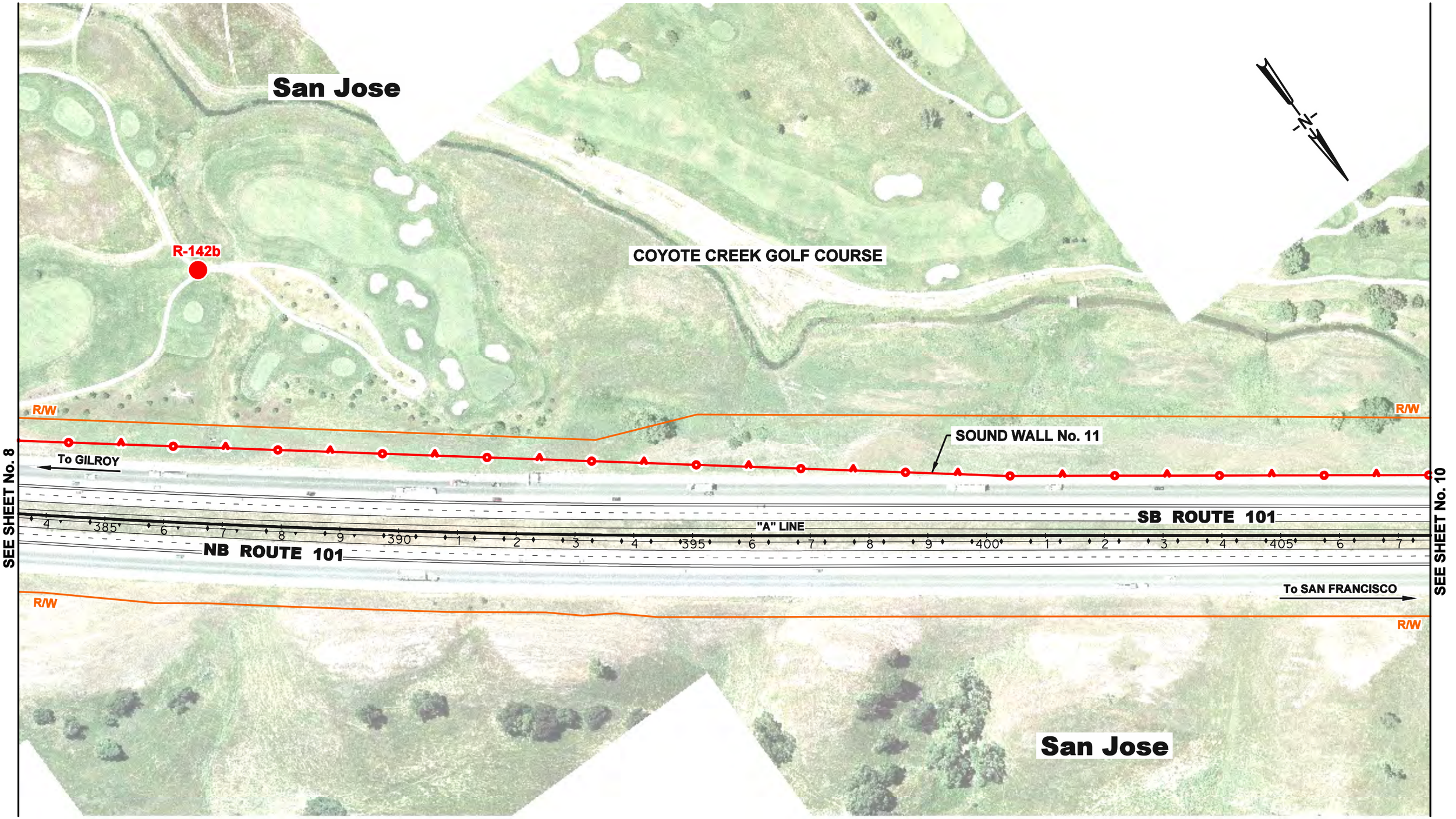


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

San Jose

COYOTE CREEK GOLF COURSE

R-142a

Coyote Creek Trail

R/W

R/W

SOUND WALL No. 11

SEE SHEET No. 9

To GILROY

SB ROUTE 101

"A" LINE

8 9 410 1 2 3 4 415 6 7 8 9 420 1 2 3 4 425 6 7 8 9 430 1

NB ROUTE 101

To SAN FRANCISCO

R/W

R/W

San Jose

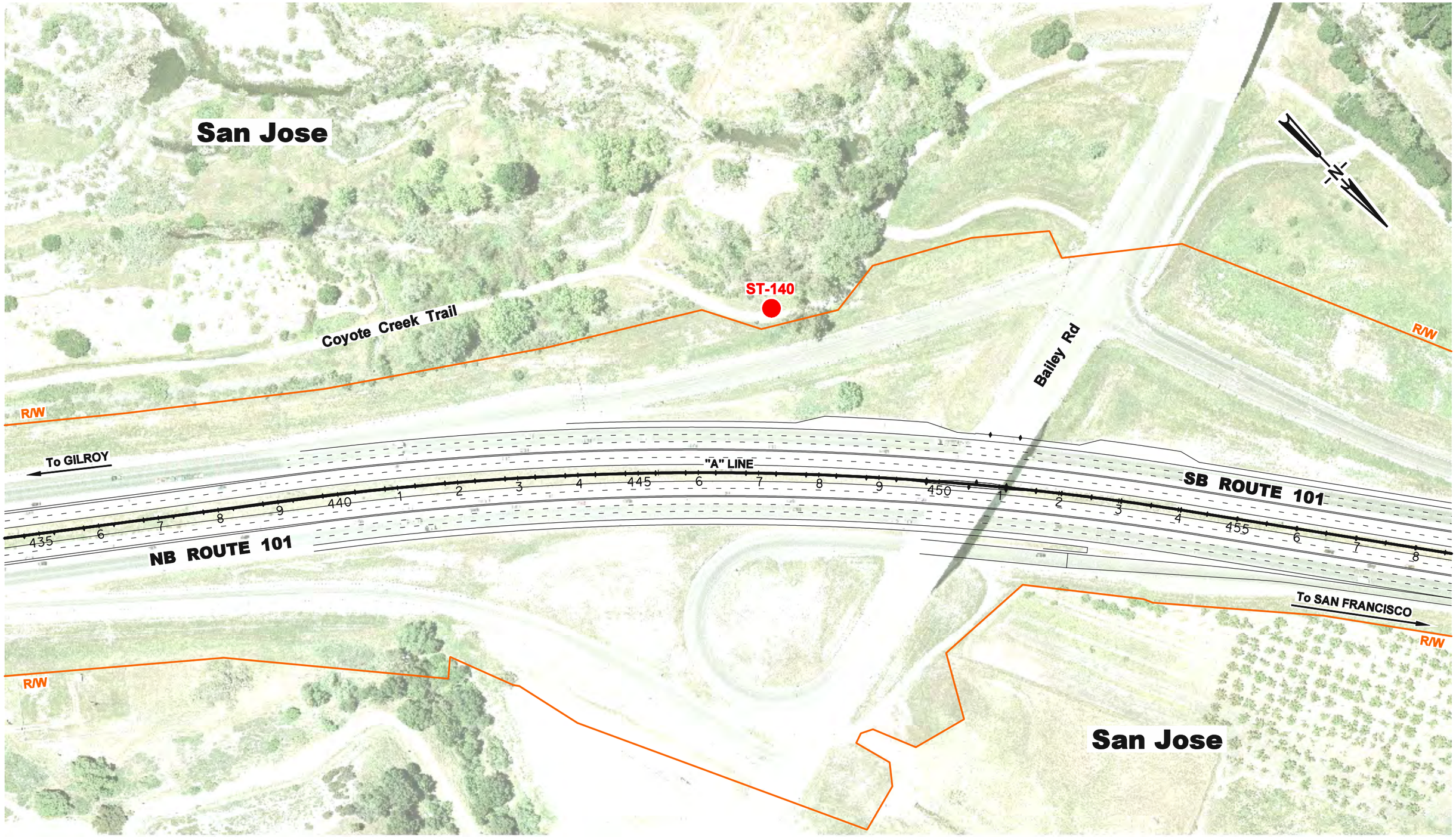
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 10 OF 55

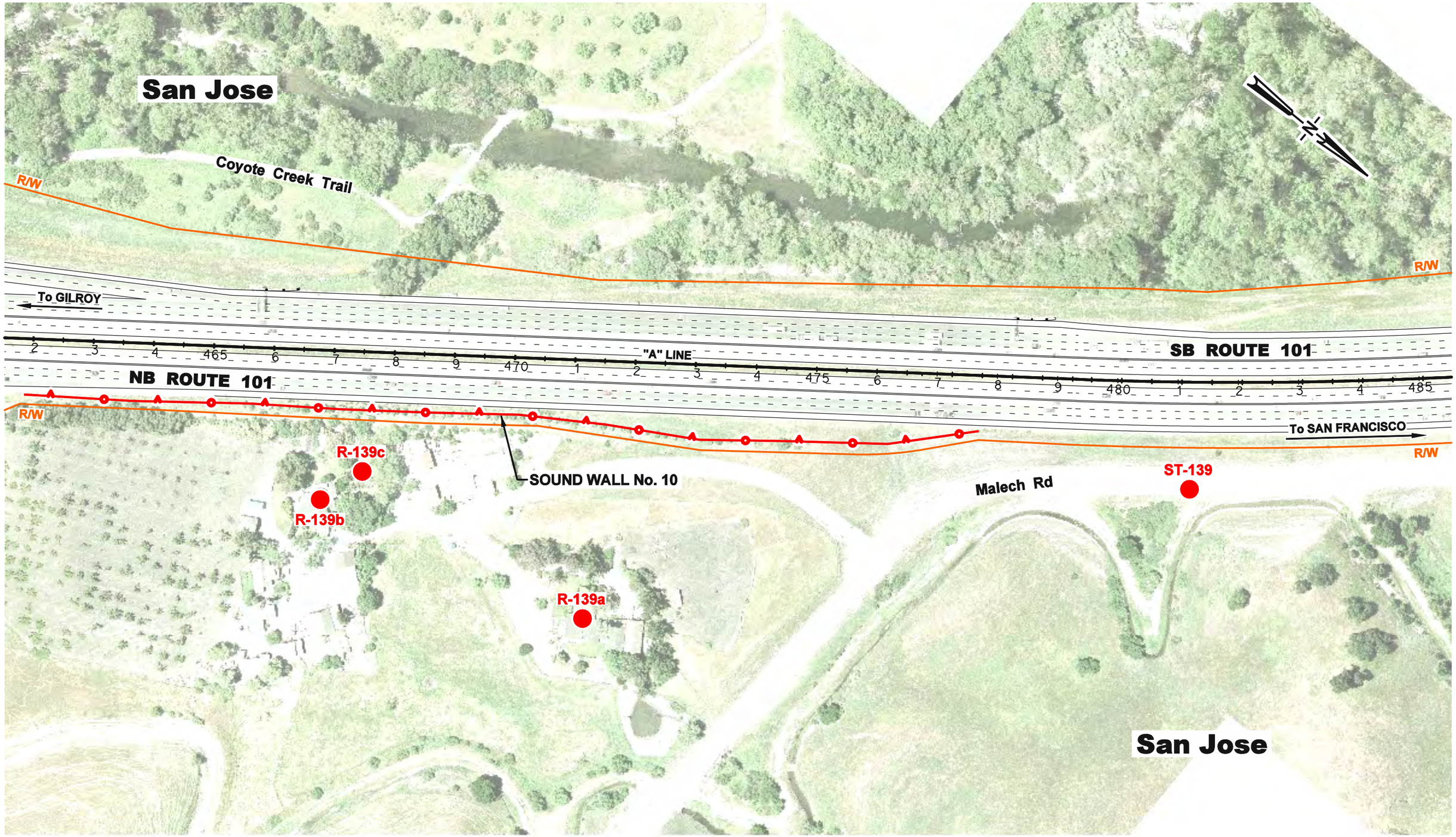


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

San Jose

R-137a

R/W

To GILROY

R/W

SB ROUTE 101

"A" LINE

7 8 9 500 1 2 3 4 505 6 7 8 9 510 1 2 3 4 515 6 7 8 9 520

NB ROUTE 101

To SAN FRANCISCO

R/W

R/W

Malech Rd

San Jose

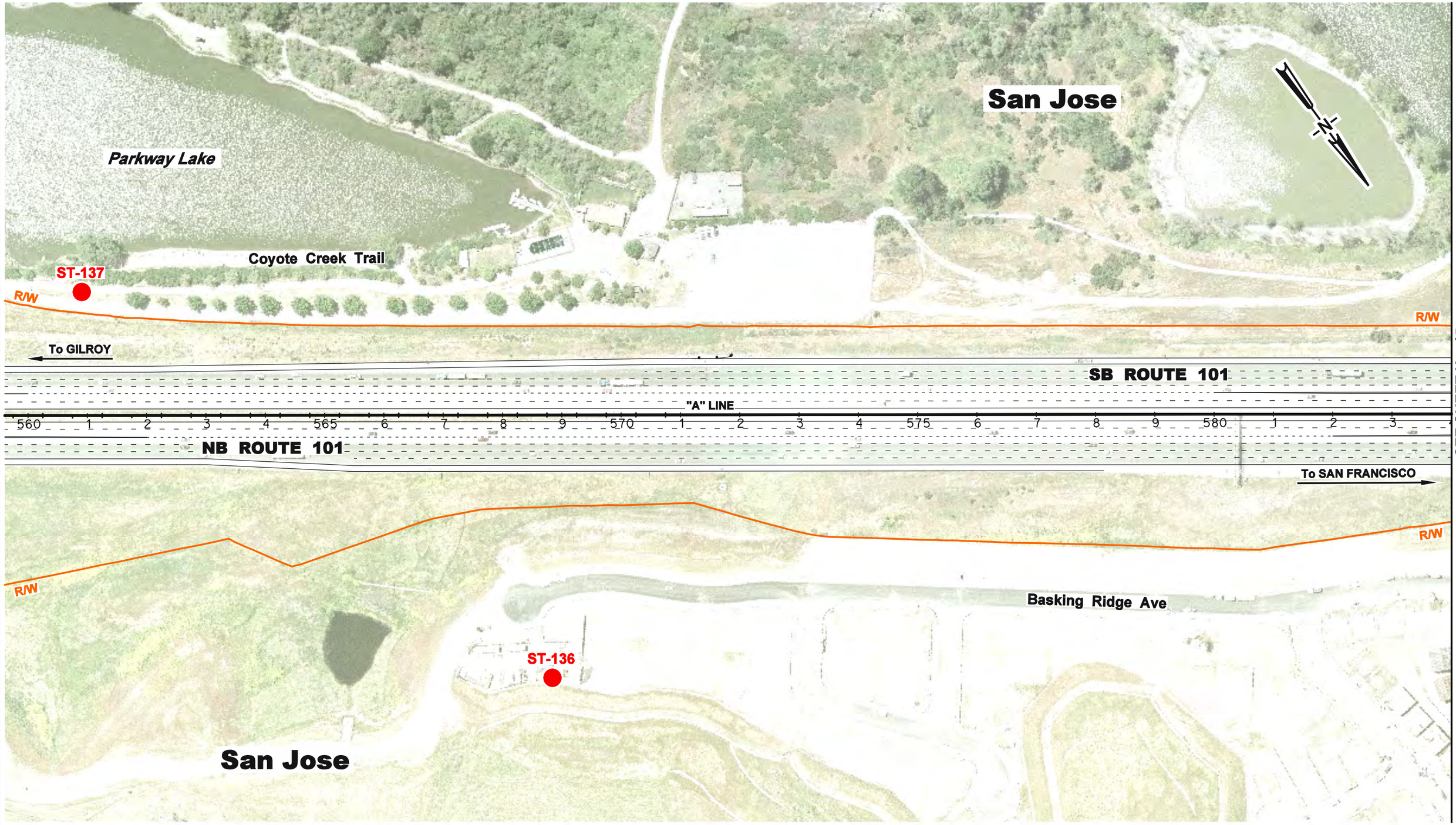
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 13 OF 55



SEE SHEET No. 15

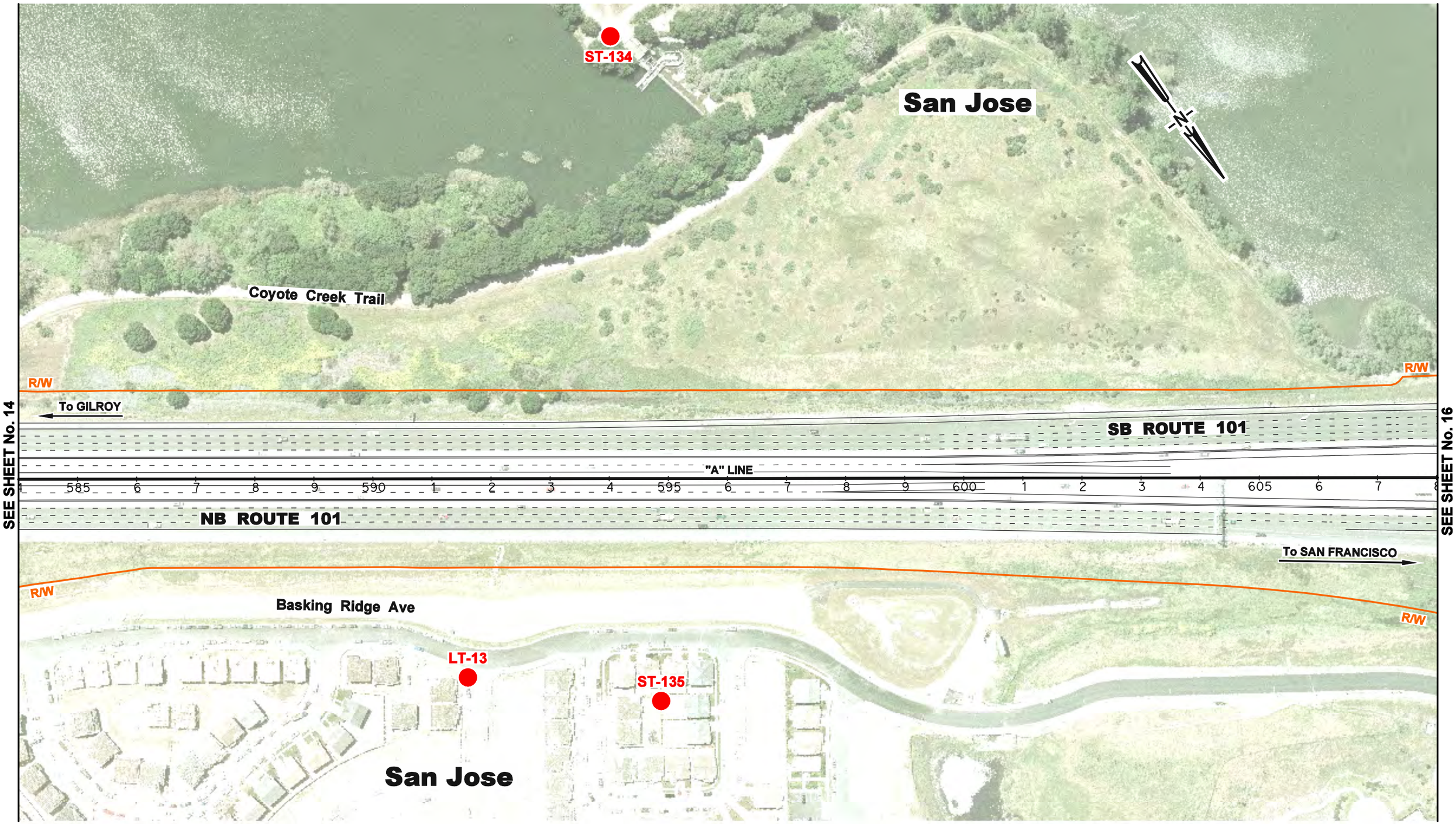
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 14 OF 55

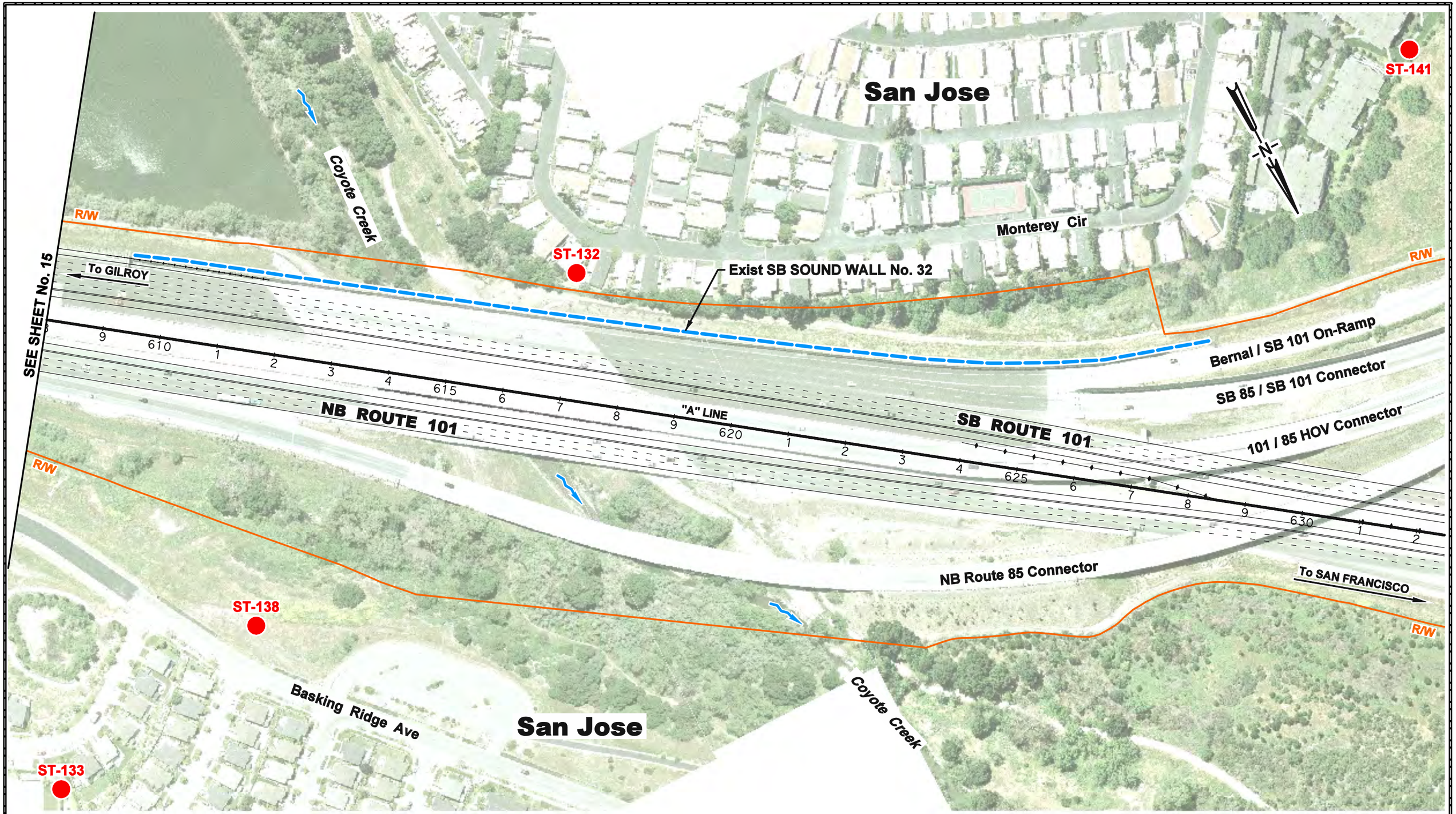


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



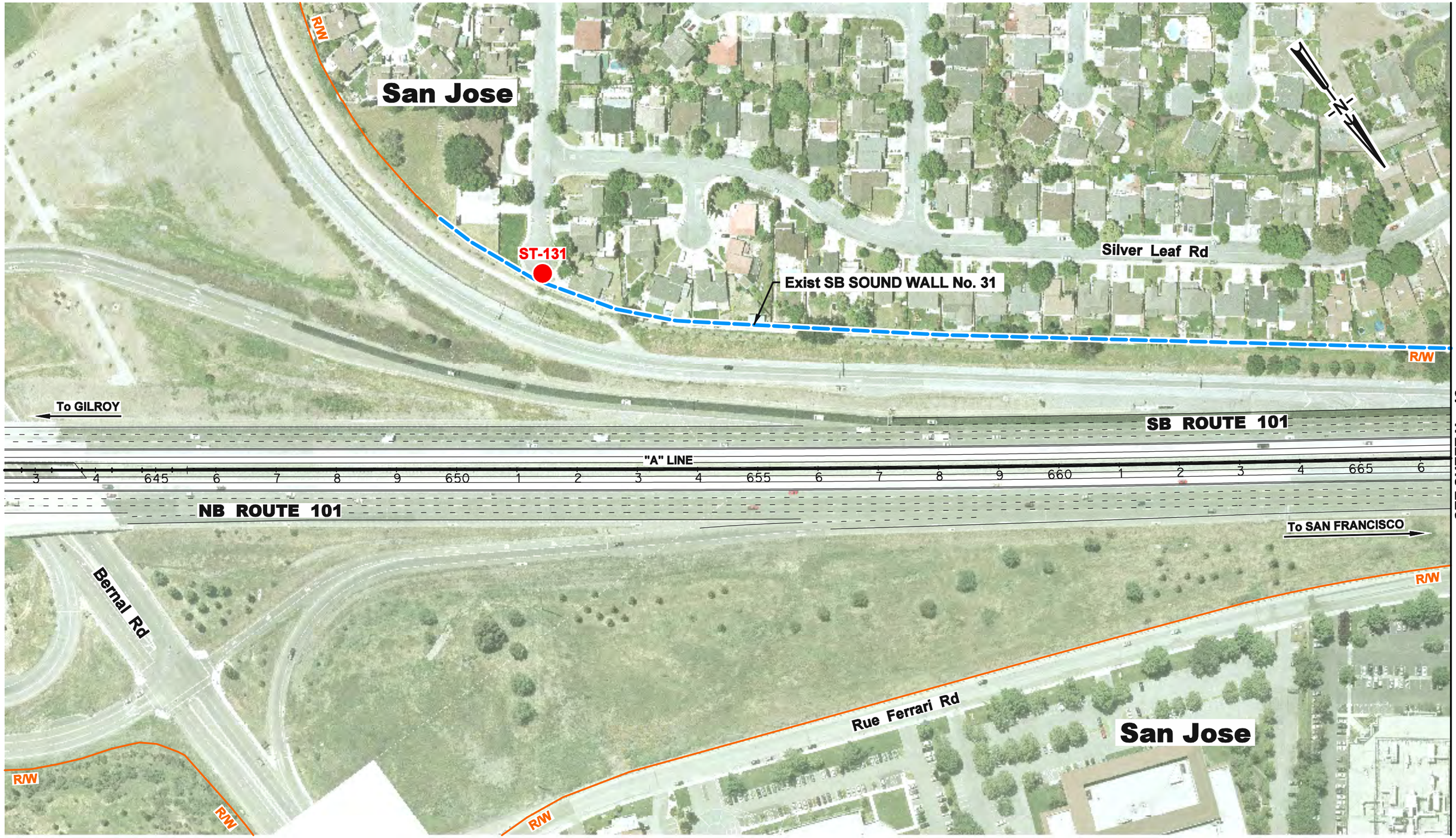
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics - Air Quality

SHEET 16 OF 55

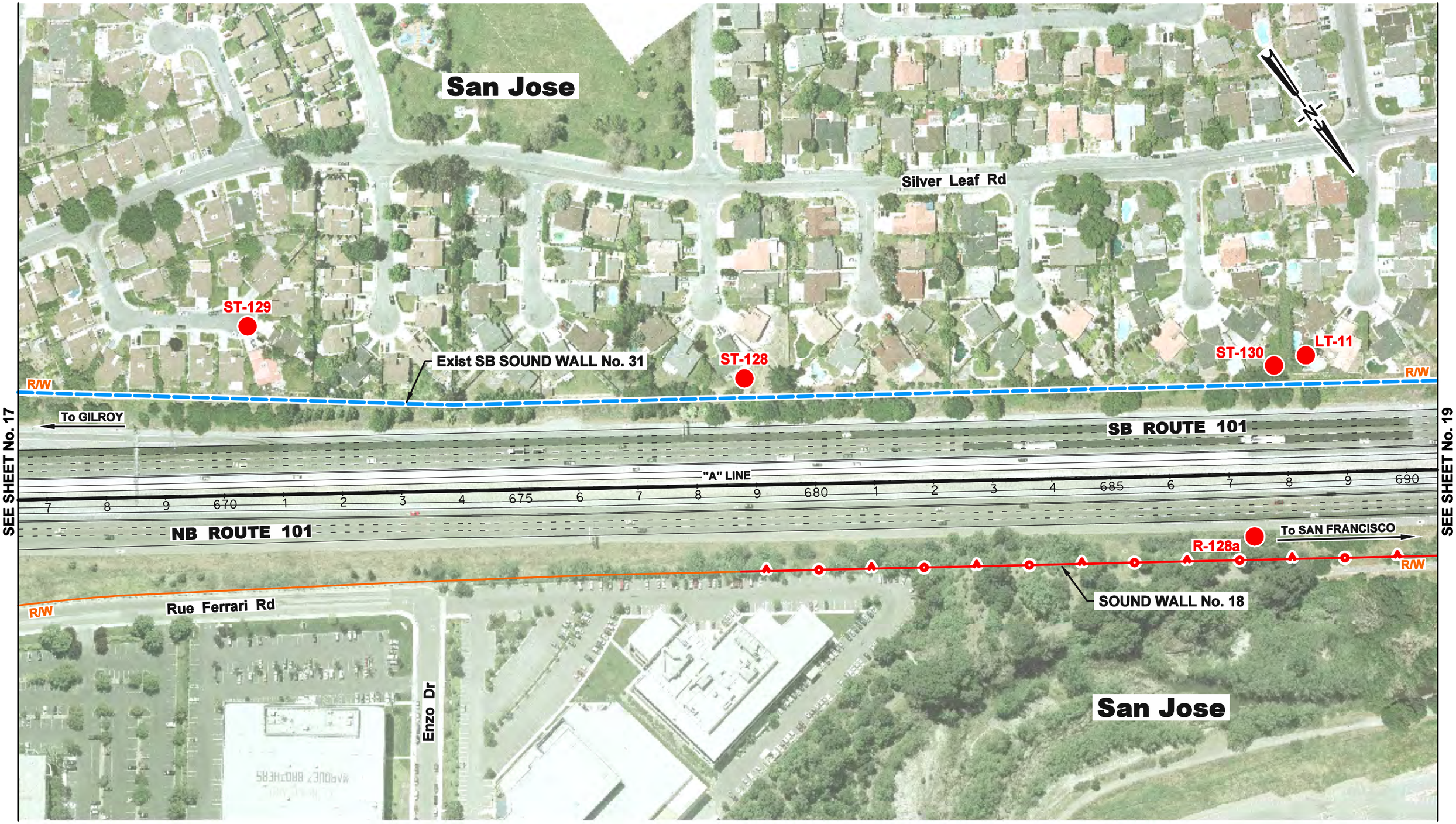


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

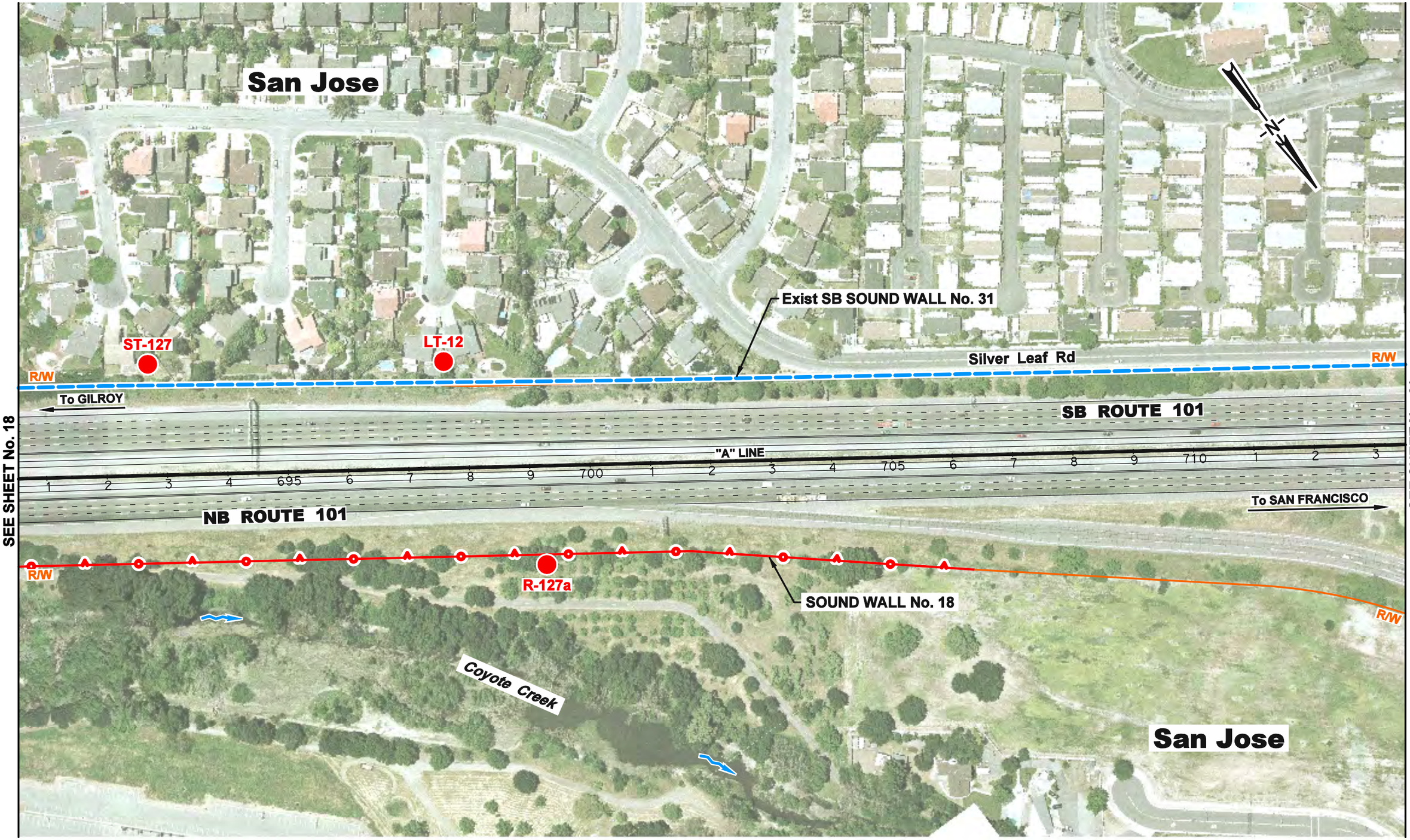


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

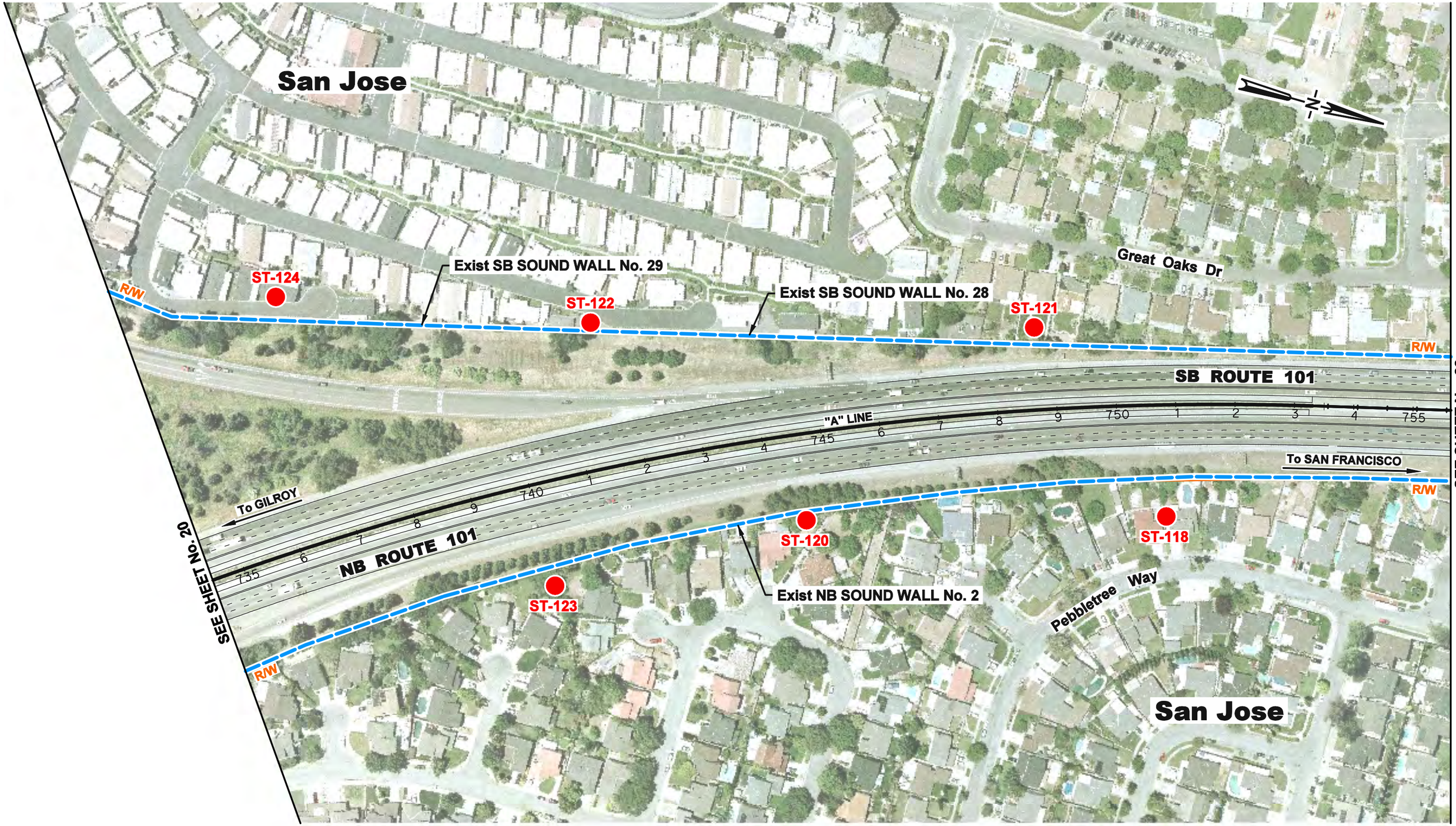
ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



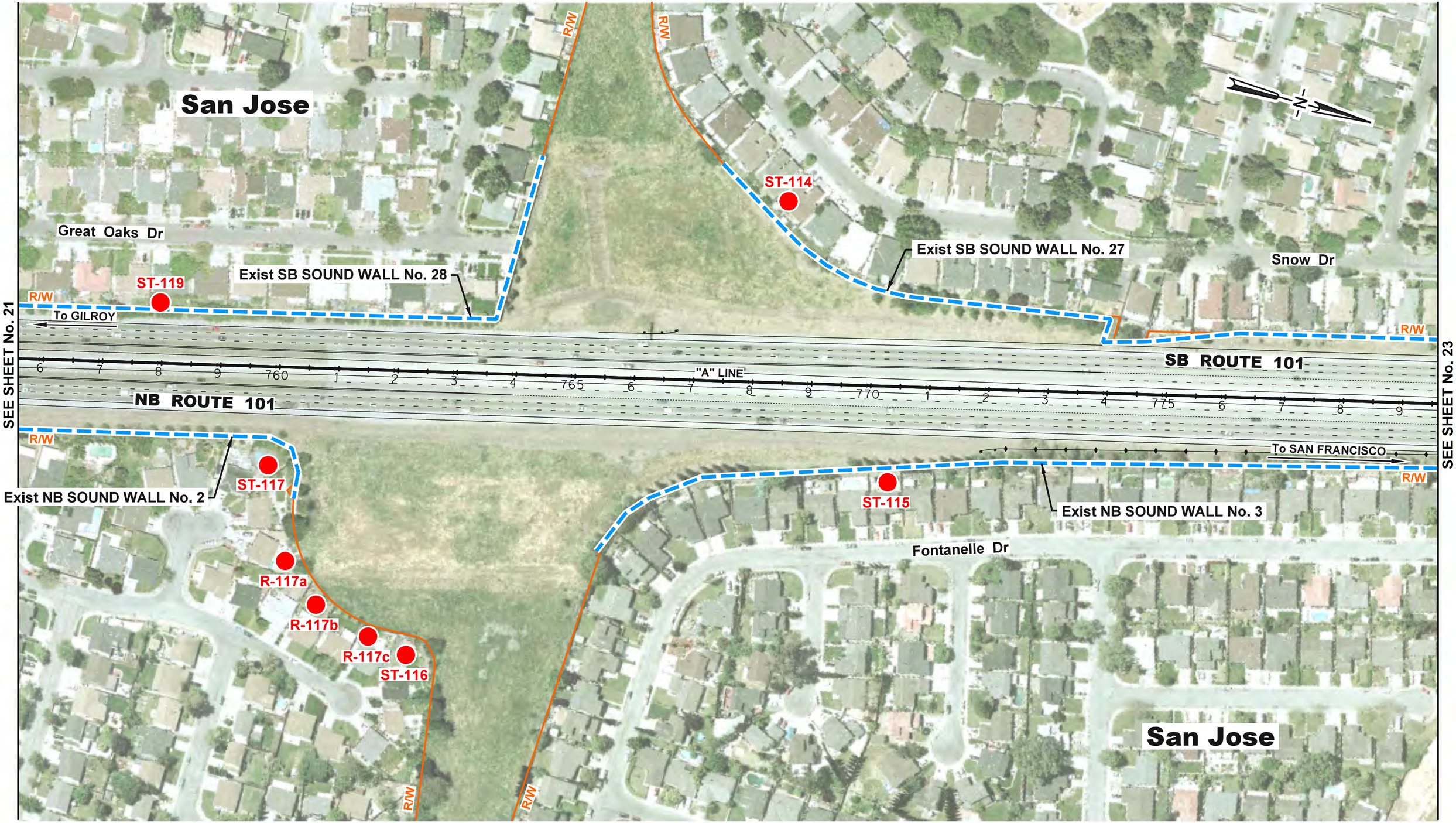
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 21 OF 55



3/27/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

SHEET 22 OF 55

Noise 22.dgn 3/27/2013 10:13:27 AM

San Jose

Snow Dr

Exist SB SOUND WALL No. 27

ST-113

ST-110

LT-10

ST-109

R/W

To GILROY

SEE SHEET No. 22

780 1 2 3 4 785 6 7 8 9 790 1 2 3 4 795 6 7 8 9 800 1 2 3

"A" LINE

NB ROUTE 101

SB ROUTE 101

To SAN FRANCISCO

SEE SHEET No. 24

ST-112

Exist NB SOUND WALL No. 4

Fontanelle Dr

ST-111

Exist NB SOUND WALL No. 5

ST-108

Coyote Rd

San Jose

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 23 OF 55

San Jose

HELLYER COUNTY PARK

N

R/W

R-107a

ST-107

Coyote Rd

Exist SB SOUND WALL No. 27

Exist SB SOUND WALL No. 26

Exist SB SOUND WALL No. 25

R/W

To GILROY

Hellyer Ave

SEE SHEET No. 23

SB ROUTE 101

"A" LINE

4 805 6 7 8 9 810 1 2 3 4 815 6 7 8 9 820 1 2 3 4 825 6

NB ROUTE 101

R/W

To SAN FRANCISCO

R/W

Coyote Creek

San Jose

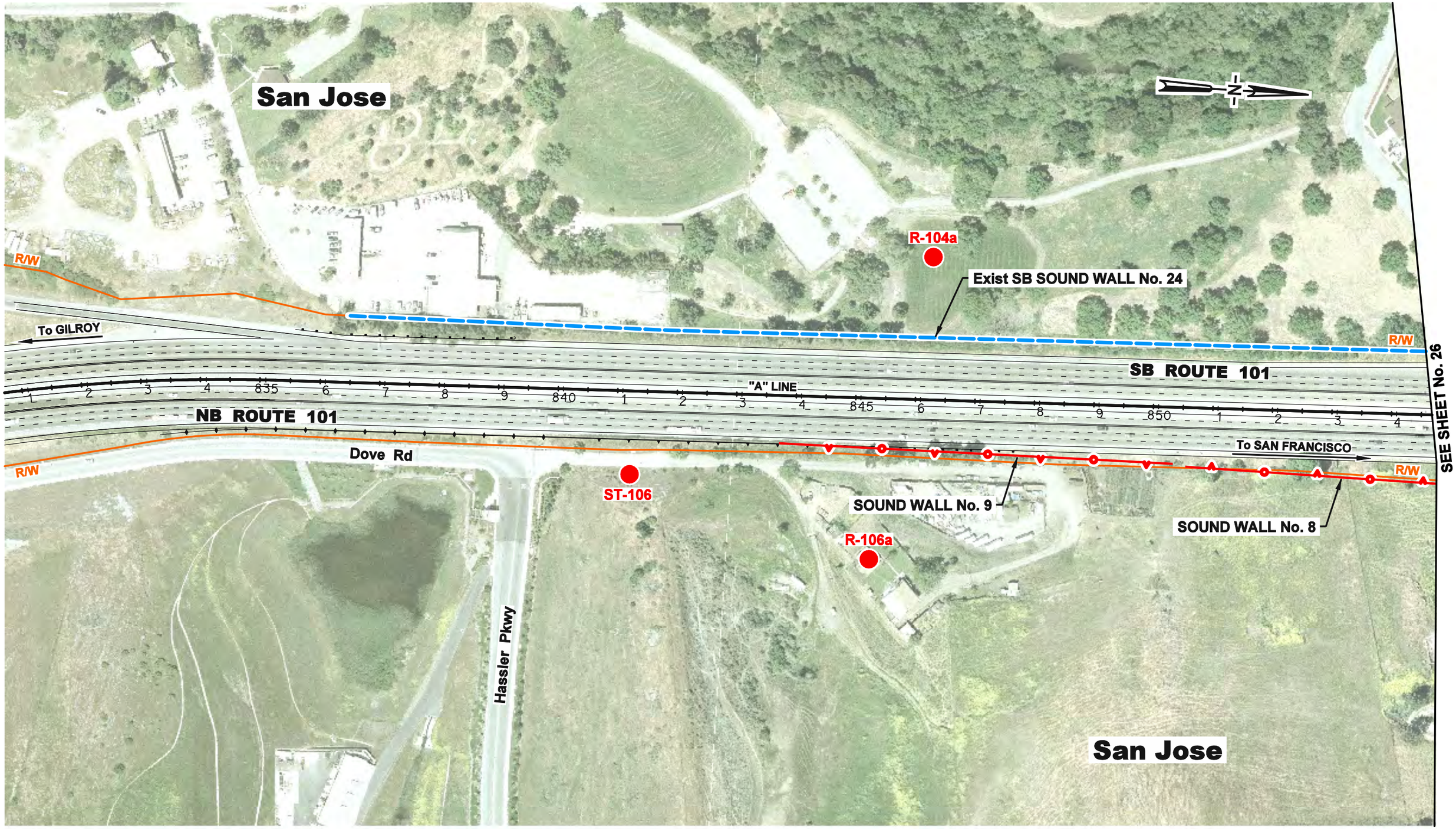
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 24 OF 55



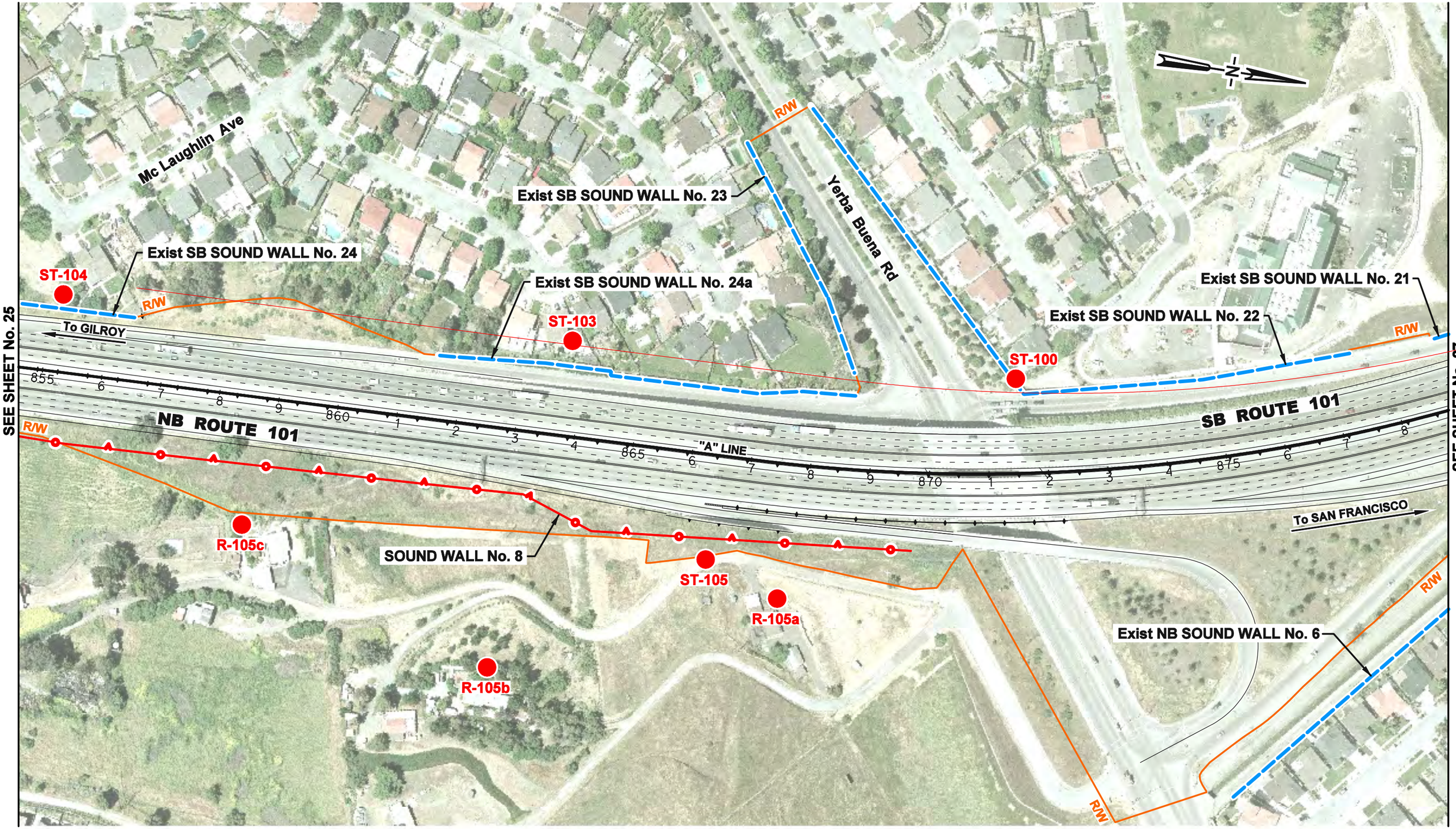
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

SHEET 25 OF 55

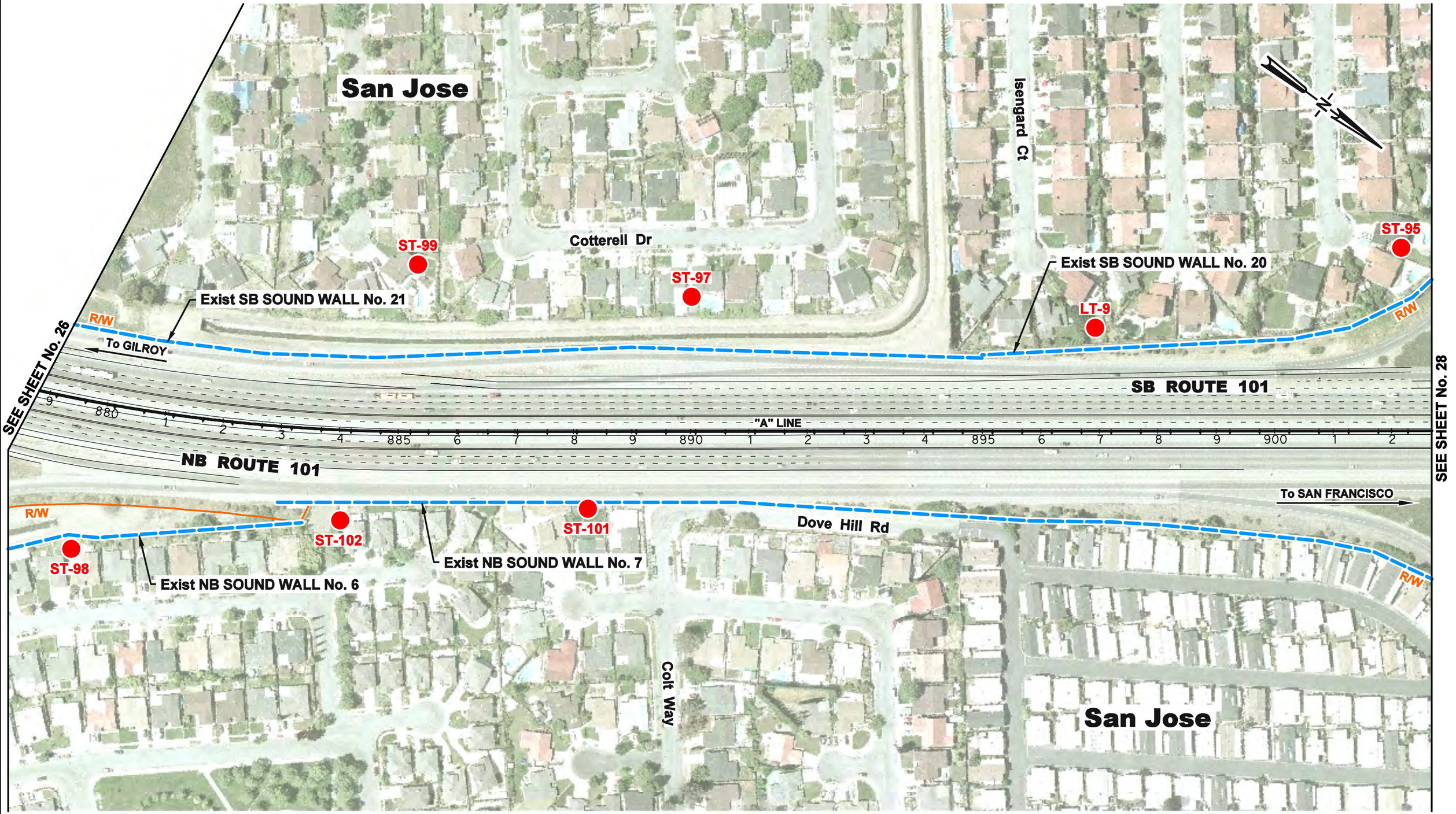


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 27 OF 55

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

San Jose

ST-89

Plumas Dr

Bellingham Dr

Exist SB SOUND WALL No. 18

ST-88

R/W

R/W

To GILROY

SB ROUTE 101

"A" LINE

7 8 9 930 1 2 3 4 935 6 7 8 9 940 1 2 3 4 945 6 7 8 9 950

SEE SHEET No. 28

SEE SHEET No. 30

NB ROUTE 101

To SAN FRANCISCO

R/W

R/W

Exist NB SOUND WALL No. 10

ST-92

ST-91

Fontaine Rd

Aldrich Way

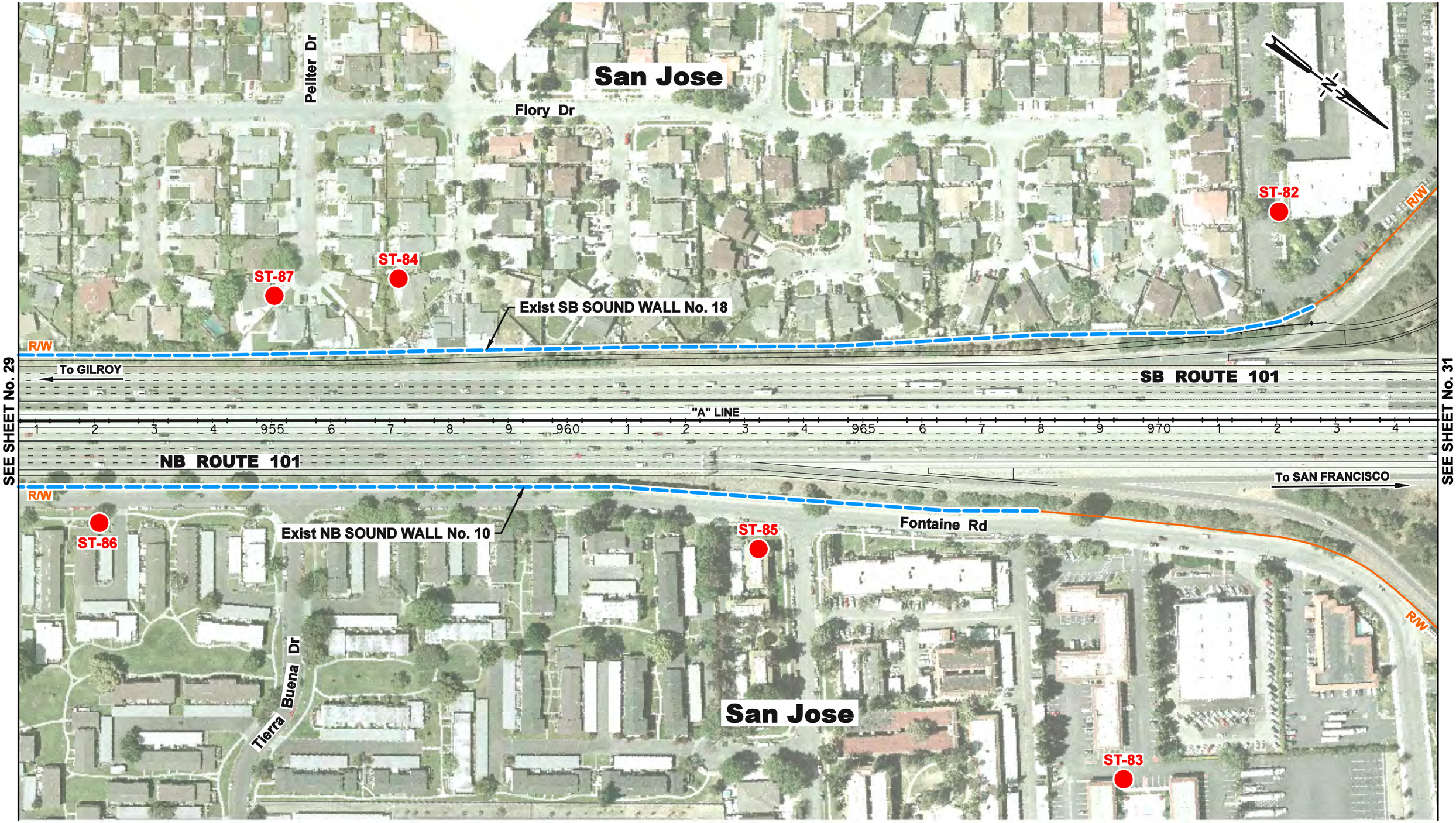
San Jose

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

San Jose

Kilchoan Way

Taper Ln

Holly Hill Dr

ST-74

LT-8

Exist SB SOUND WALL No. 17

R/W

R/W

To GILROY

SB ROUTE 101

"A" LINE

9 1000 1 2 3 4 1005 6 7 8 9 1010 1 2 3 4 1015 6 7 8 9 1020 1 2

NB ROUTE 101

SEE SHEET No. 31

SEE SHEET No. 33

R/W

Midfield Ave

Exist NB SOUND WALL No. 11

To SAN FRANCISCO

ST-76

ST-77

R/W

San Jose

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

San Jose

Camelian Dr

Crucero Dr

Exist SB SOUND WALL No. 16

Exist SB SOUND WALL No. 17

ST-75

ST-72

ST-71

ST-70

R/W

R/W

To GILROY

SB ROUTE 101

"A" LINE

3 4 1025 6 7 8 9 1030 1 2 3 4 1035 6 7 8 9 1040 1 2 3 4 1045

NB ROUTE 101

To SAN FRANCISCO

SEE SHEET No. 32

SEE SHEET No. 34

R/W

Midfield Ave

ST-73

Exist NB SOUND WALL No. 11

Exist NB SOUND WALL No. 12

R/W

Miami Dr

San Jose

3/01/13

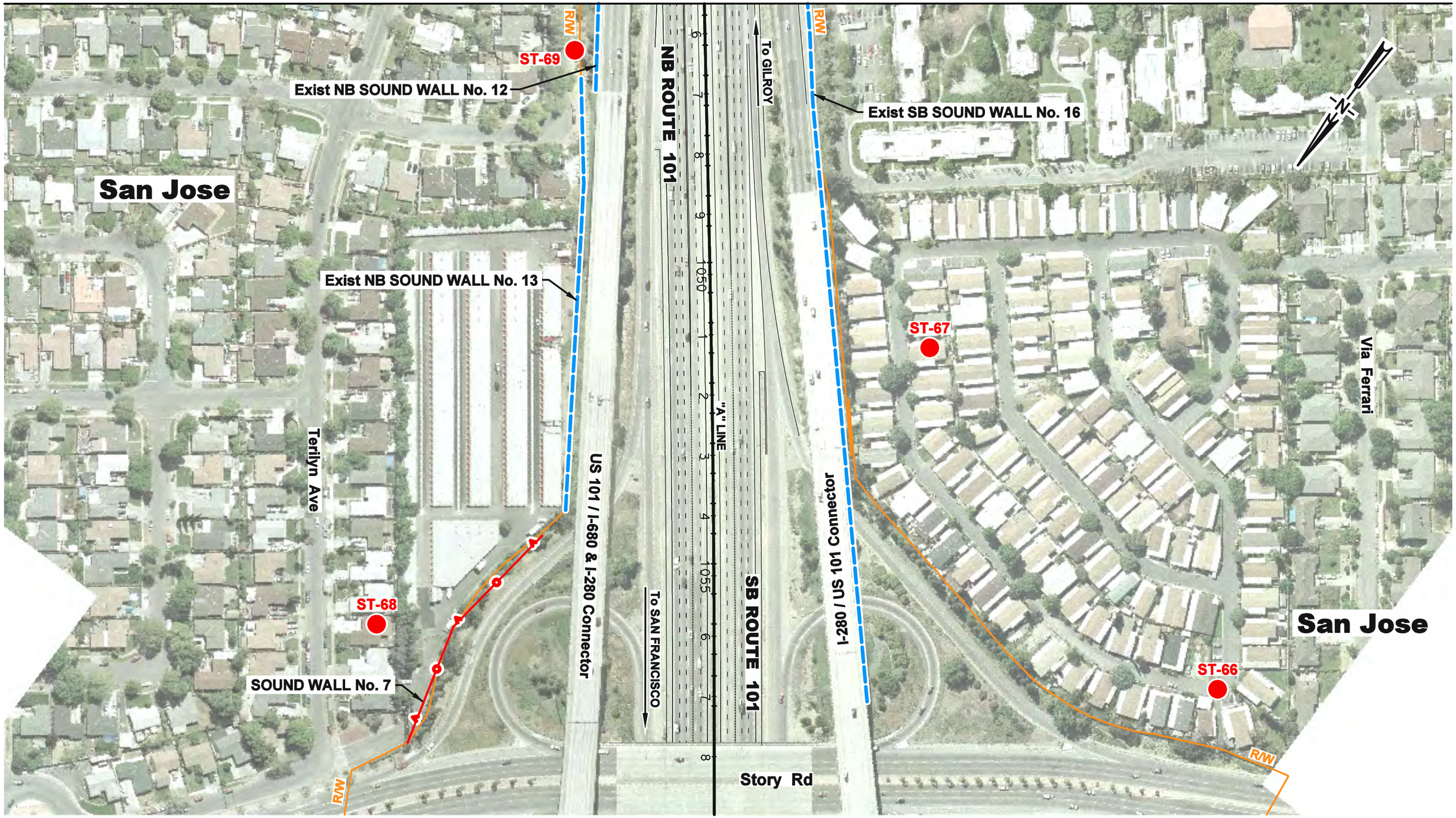
0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 33 OF 55

SEE SHEET No. 33



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

Bonita Ave

San Jose

Exist SB SOUND WALL No. 15

R/W

ST-65

Exist SB SOUND WALL No. 14

US 101 / I-280 Connector

US 101 / I-680 Connector

ST-61

LT-7

Exist SB SOUND WALL No. 13

ST-60

R/W

To GILROY

Exist SB SOUND WALL No. 12

SB ROUTE 101

"A" LINE

2 3 4 1085 6 7 8 9 1090 1 2 3 4 1095 6 7 8 9 1100 1 2 3 4 1105

NB ROUTE 101

To SAN FRANCISCO

SEE SHEET No. 36

I-680 / US 101 Connector

R-64a

ST-64

ST-63

Exist NB SOUND WALL No. 15

R-62a

ST-62

R/W

S 31st St

Exist NB SOUND WALL No. 14

R/W

RANCHO DEL PUEBLO GOLF COURSE

San Jose

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 35 OF 55

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 37 OF 55

San Jose

WATSON PARK

R-50d

R-50c

ST-50

R-50b

R-50a

SOUND WALL No. 6

Coyote Creek

Rail Road OC

R/W

To GILROY

To SAN FRANCISCO

SB ROUTE 101

NB ROUTE 101

"A" LINE

1165 1170 1175 1180

SEE SHEET No. 37

SEE SHEET No. 39

San Jose

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

San Jose

N

Taylor St

ST-49

SOUND WALL No. 5

Exist SB SOUND WALL No. 8

ST-47

Exist SB SOUND WALL No. 7

ST-46

N Bayshore Rd West

R/W

SEE SHEET No. 38

To GILROY

SB ROUTE 101

"A" LINE

NB ROUTE 101

1185 6 7 8 9 1190 1 2 3 4 1195 6 7 8 9 1200 1 2 3 4 1205

R/W

SEE SHEET No. 40

Mabury Rd

To SAN FRANCISCO

Exist NB SOUND WALL No. 19

San Jose

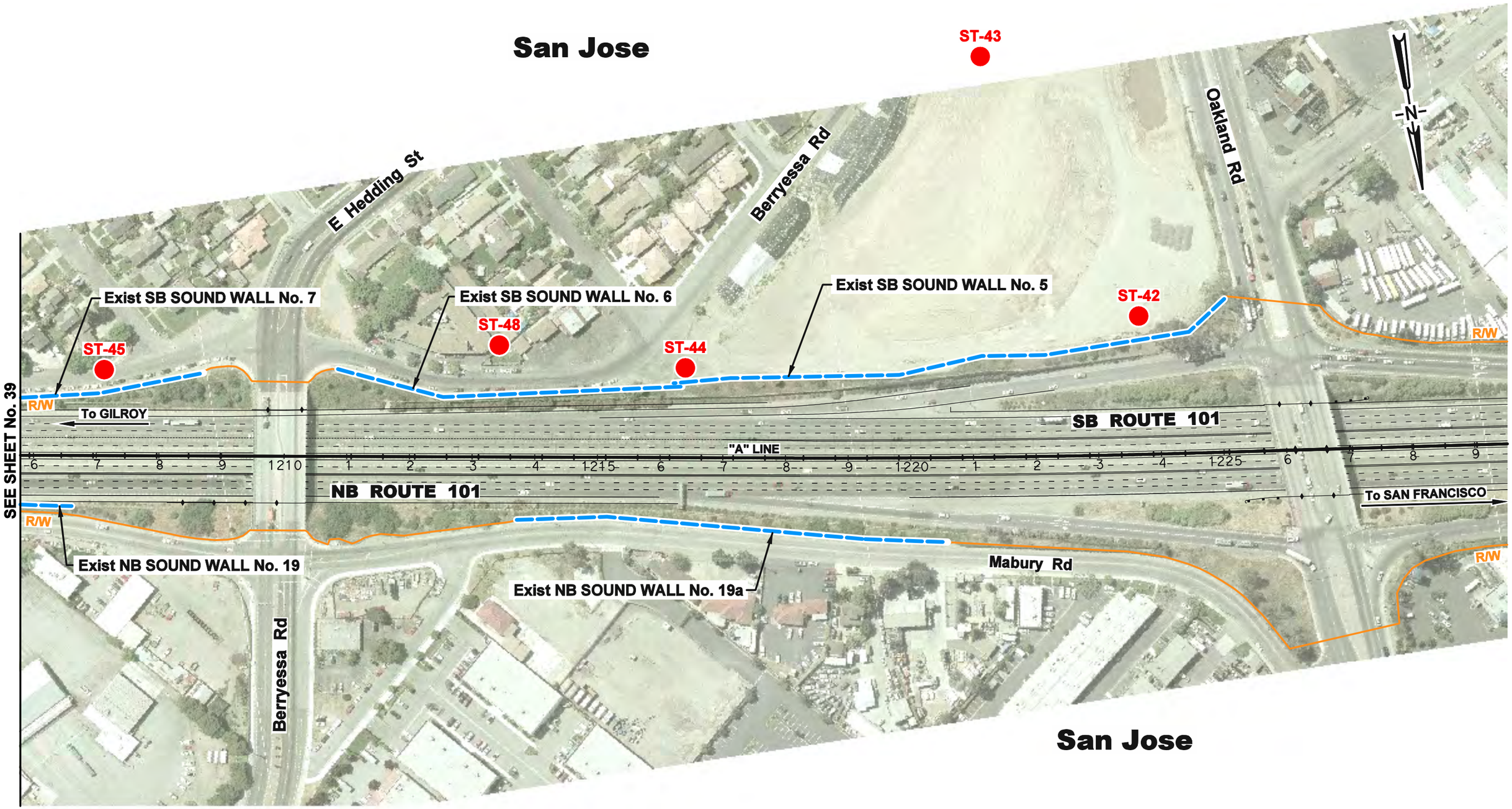
3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

SHEET 39 OF 55



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

SHEET 40 OF 55

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

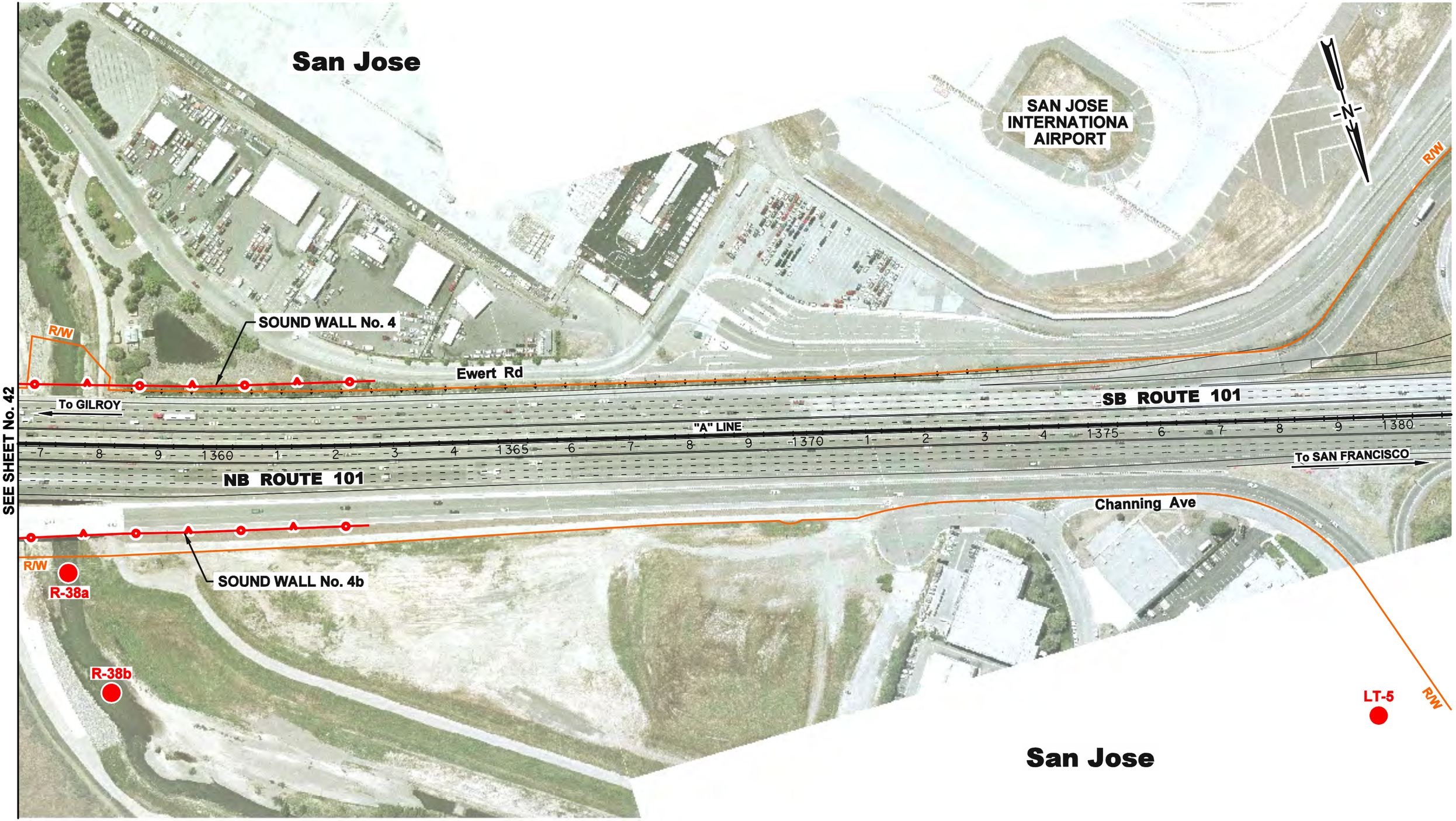
ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

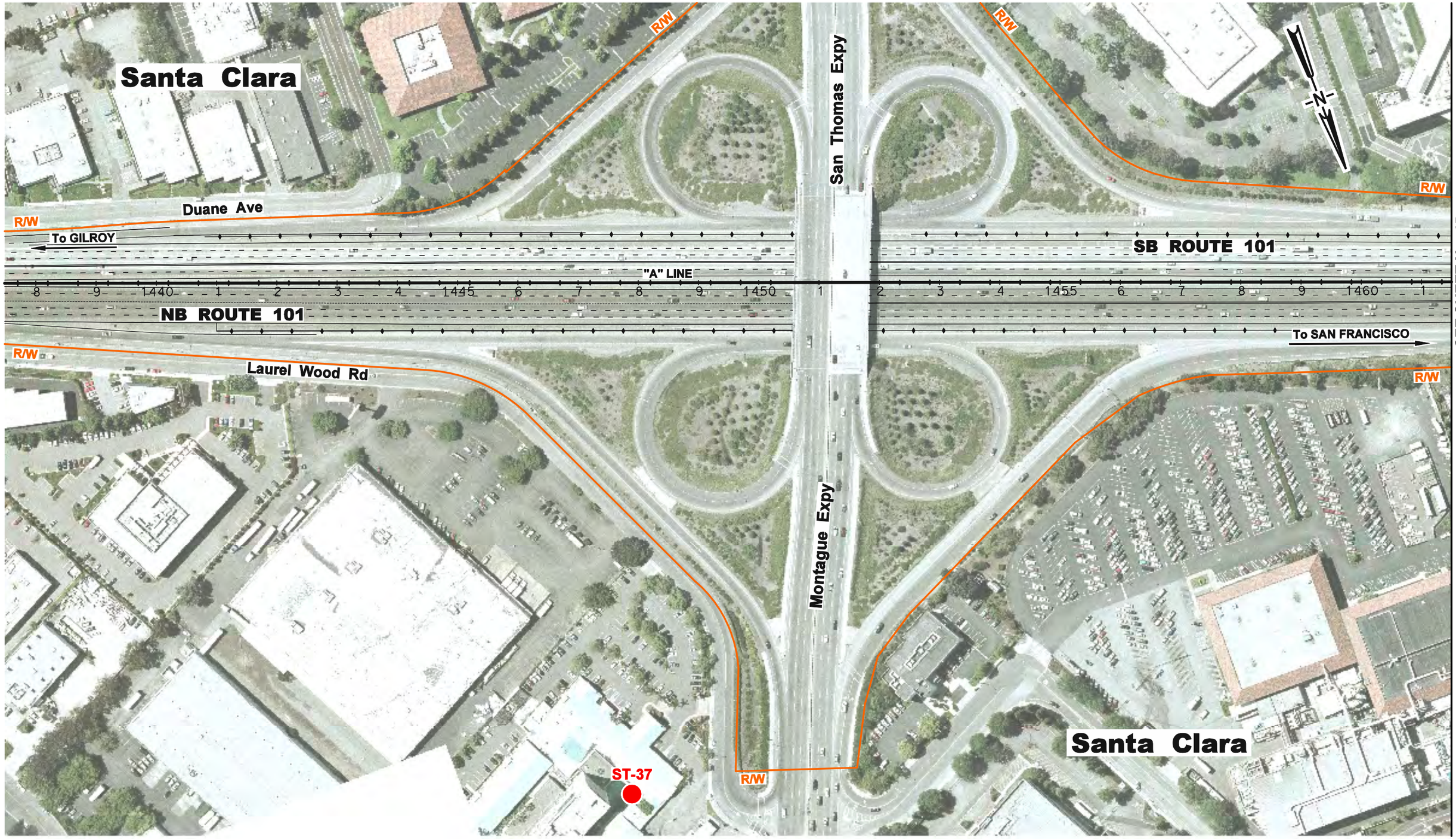


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

Santa Clara

LT-4

SOUND WALL No. 3

R/W

To GILROY

SB ROUTE 101

"A" LINE

2 3 4 1465 6 7 8 9 1470 1 2 3 4 1475 6 7 8 9 1480 1 2 3 4 1485

NB ROUTE 101

To SAN FRANCISCO

SEE SHEET No. 44

R-36a

SOUND WALL No. 3b

San Tomas Aquino Creek

ST-36

Santa Clara

Freedom Cir

N

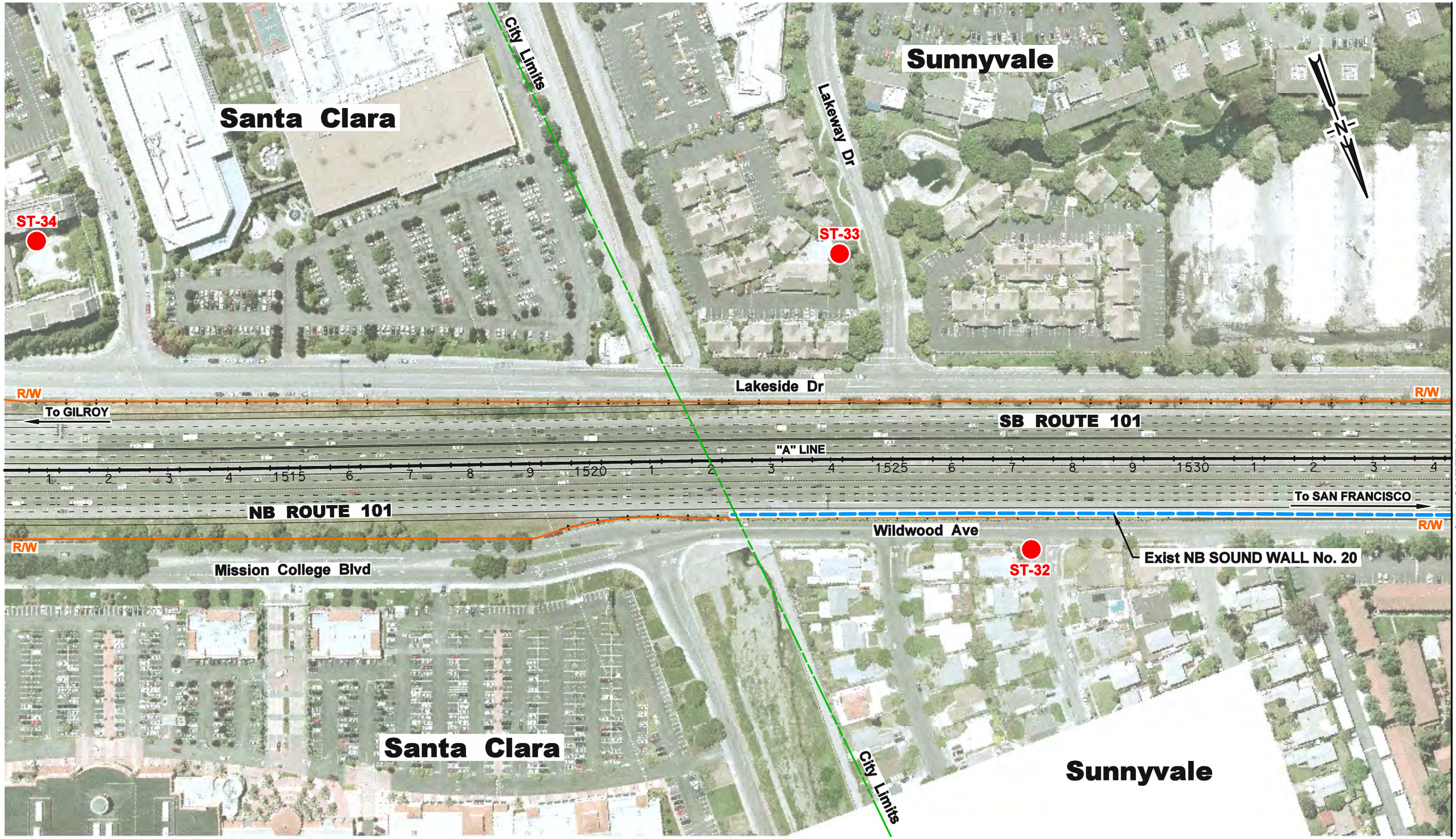
0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

3/01/13

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

SHEET 45 OF 55



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

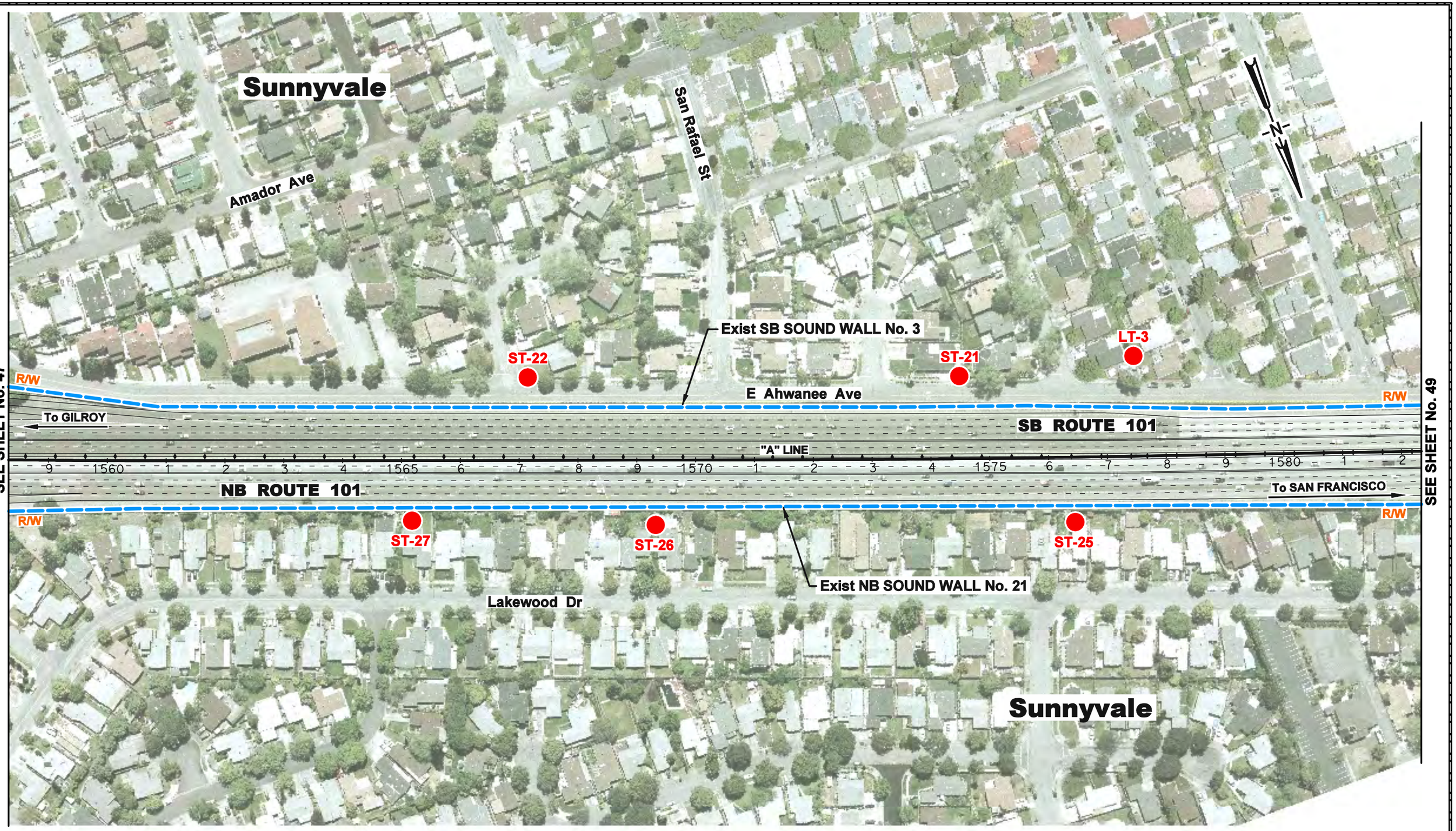
SHEET 46 OF 55

3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

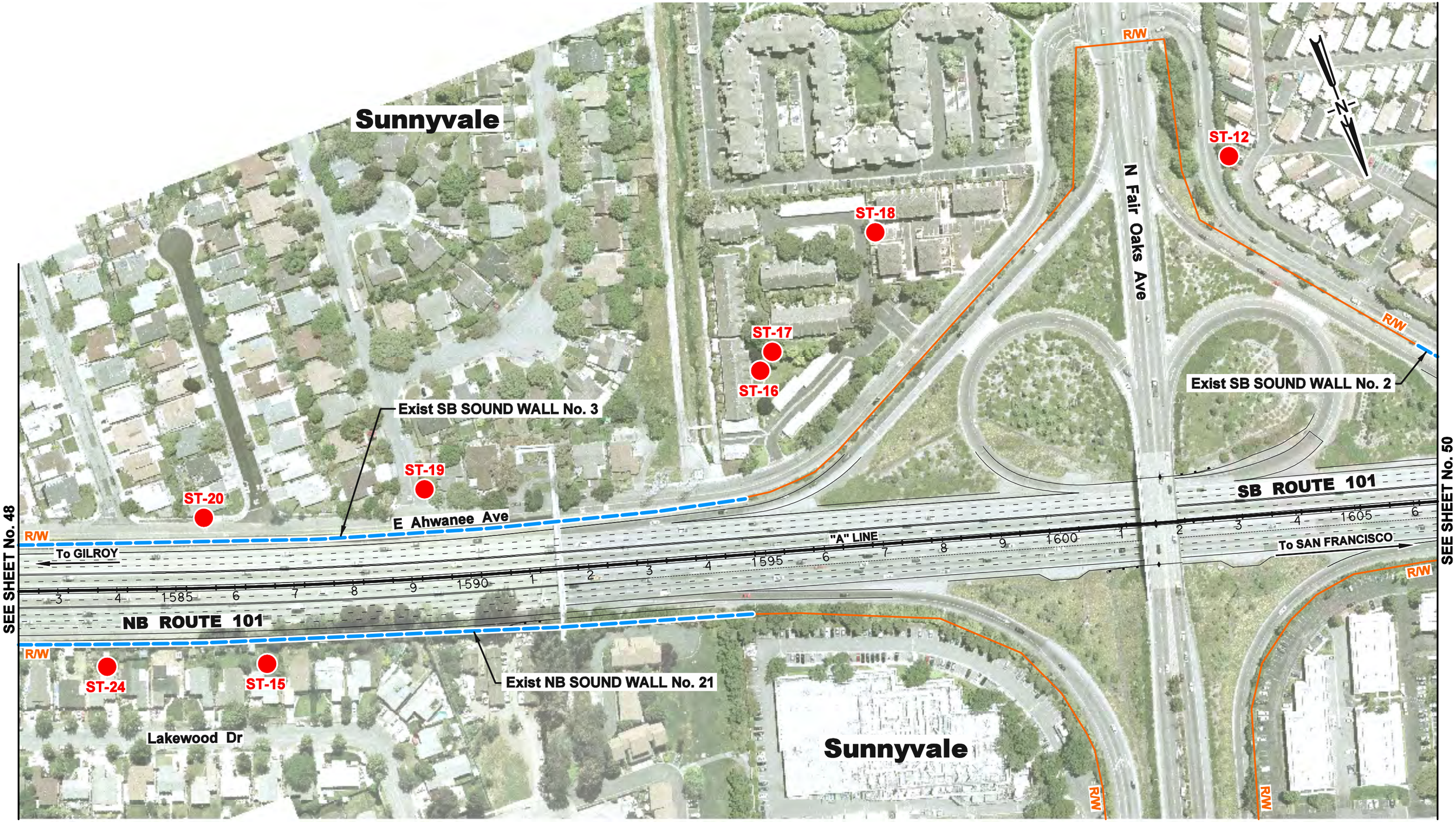


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

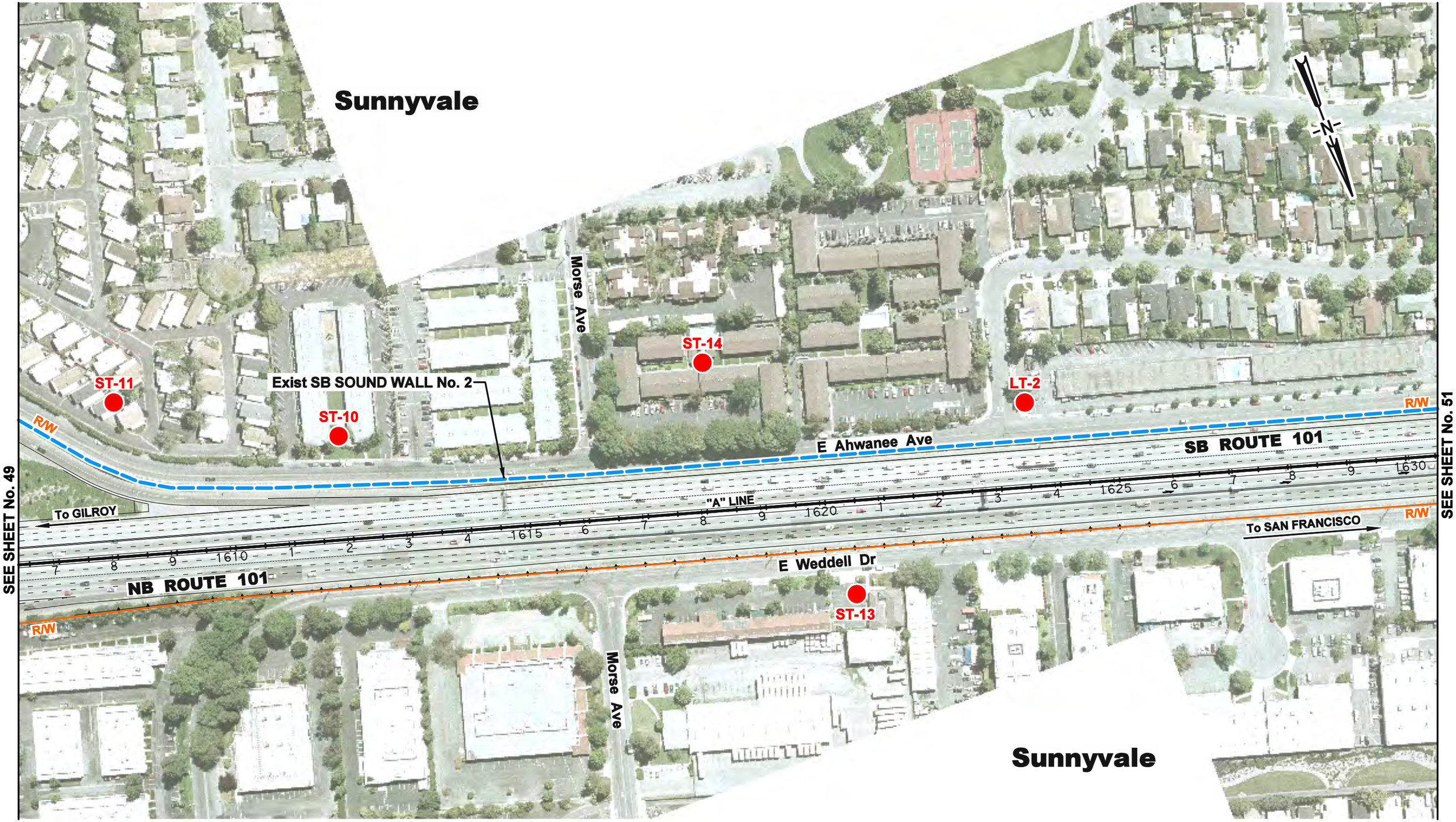


0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

3/01/13

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality

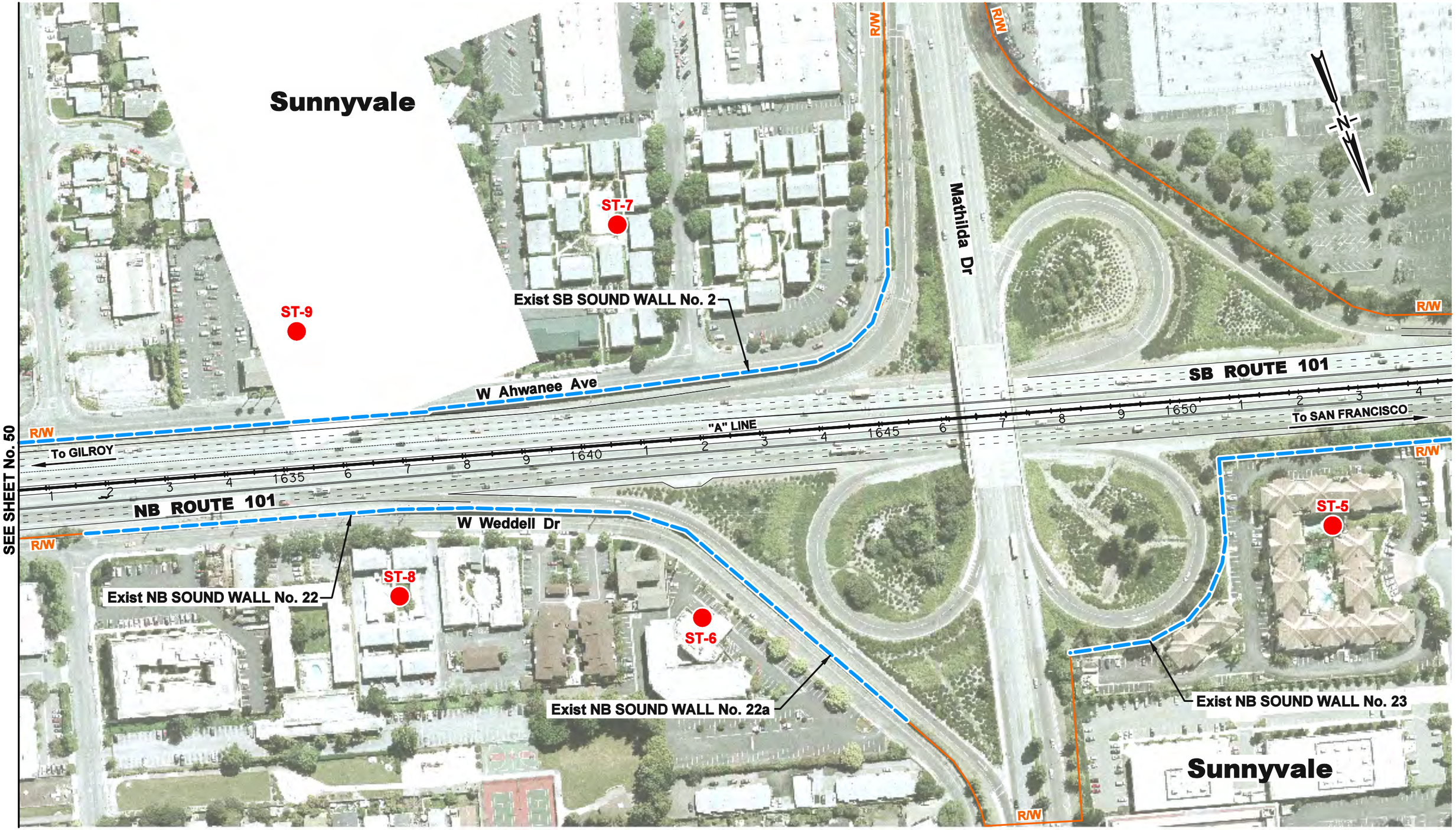


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

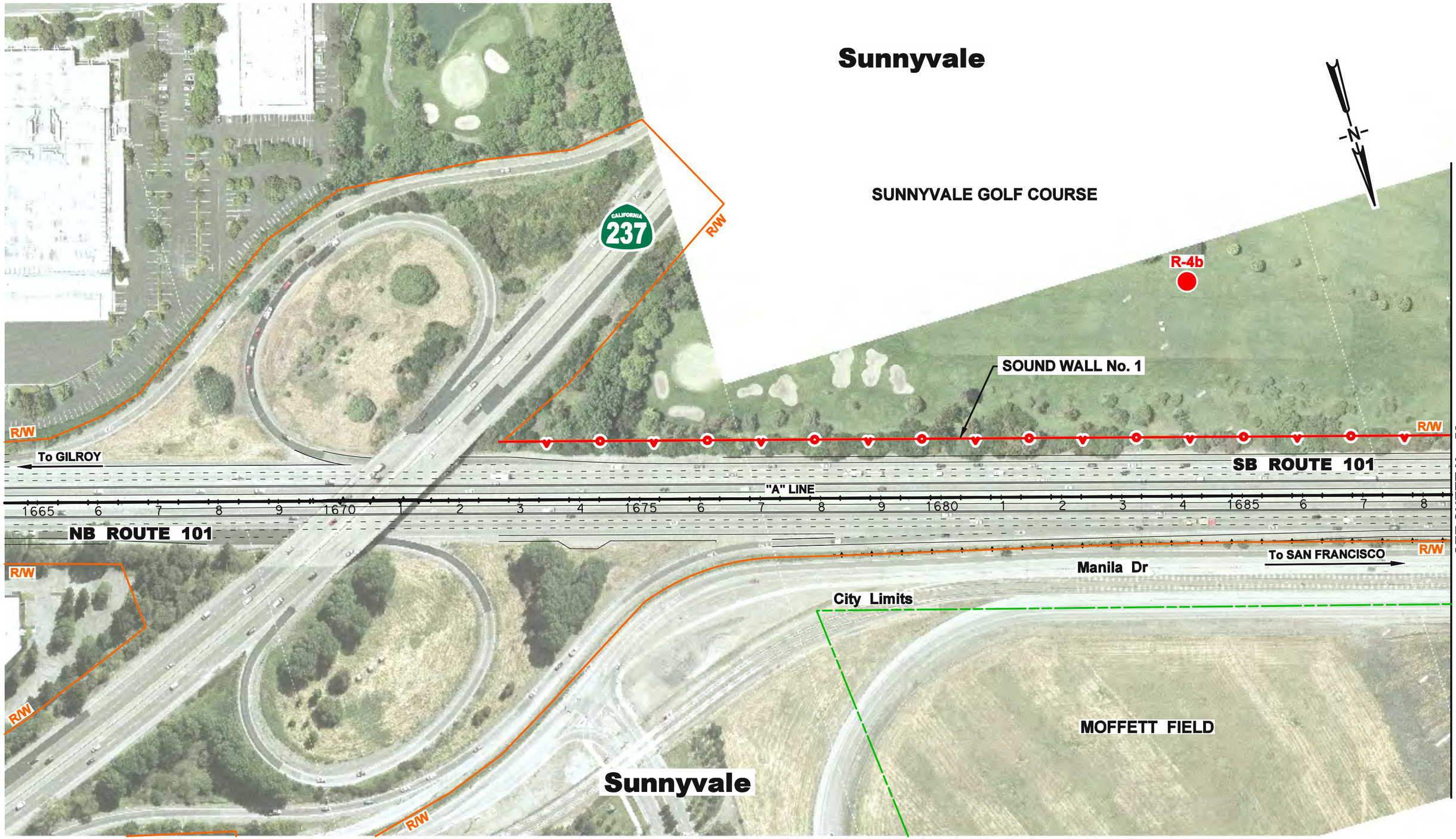


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

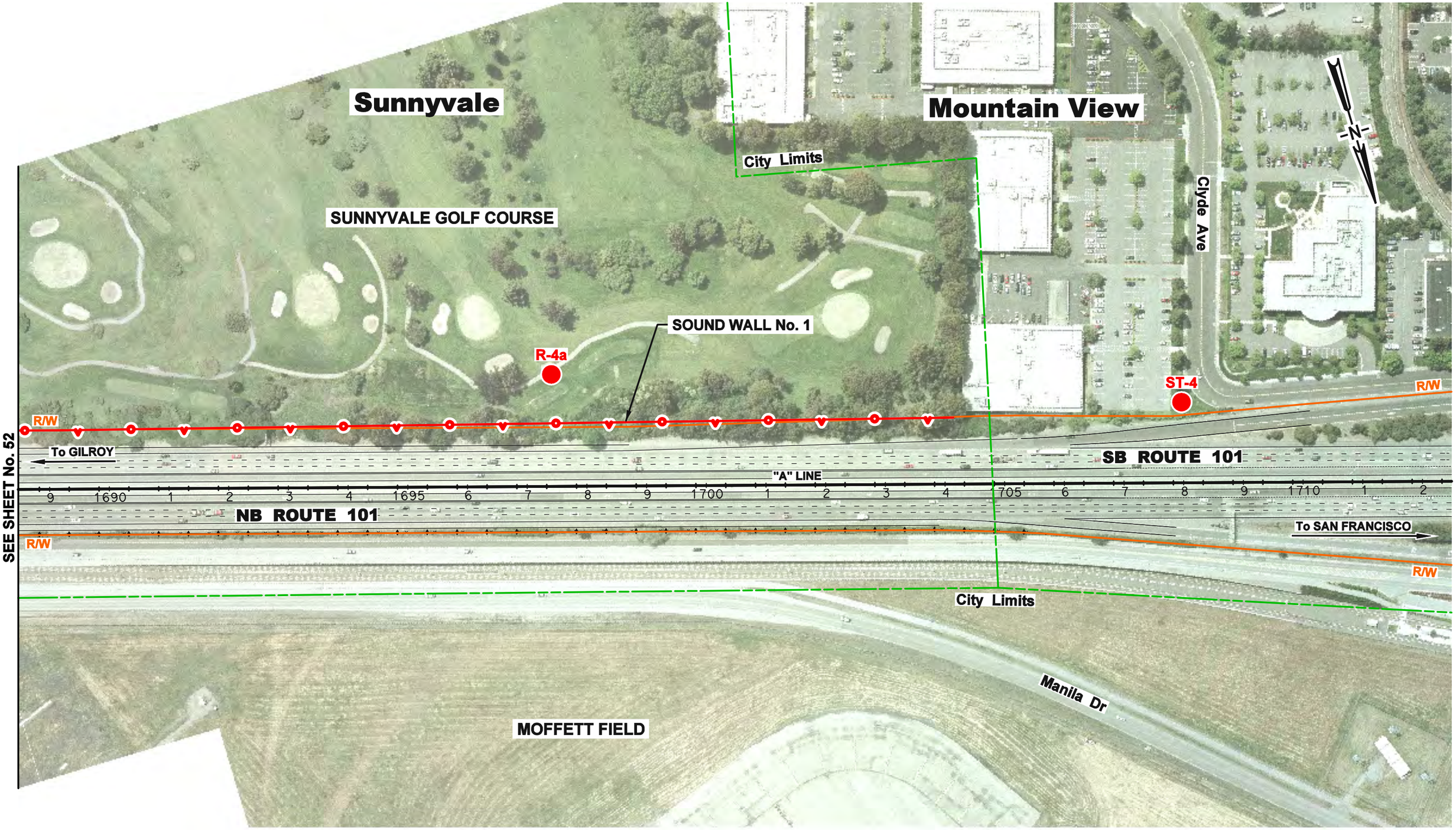


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

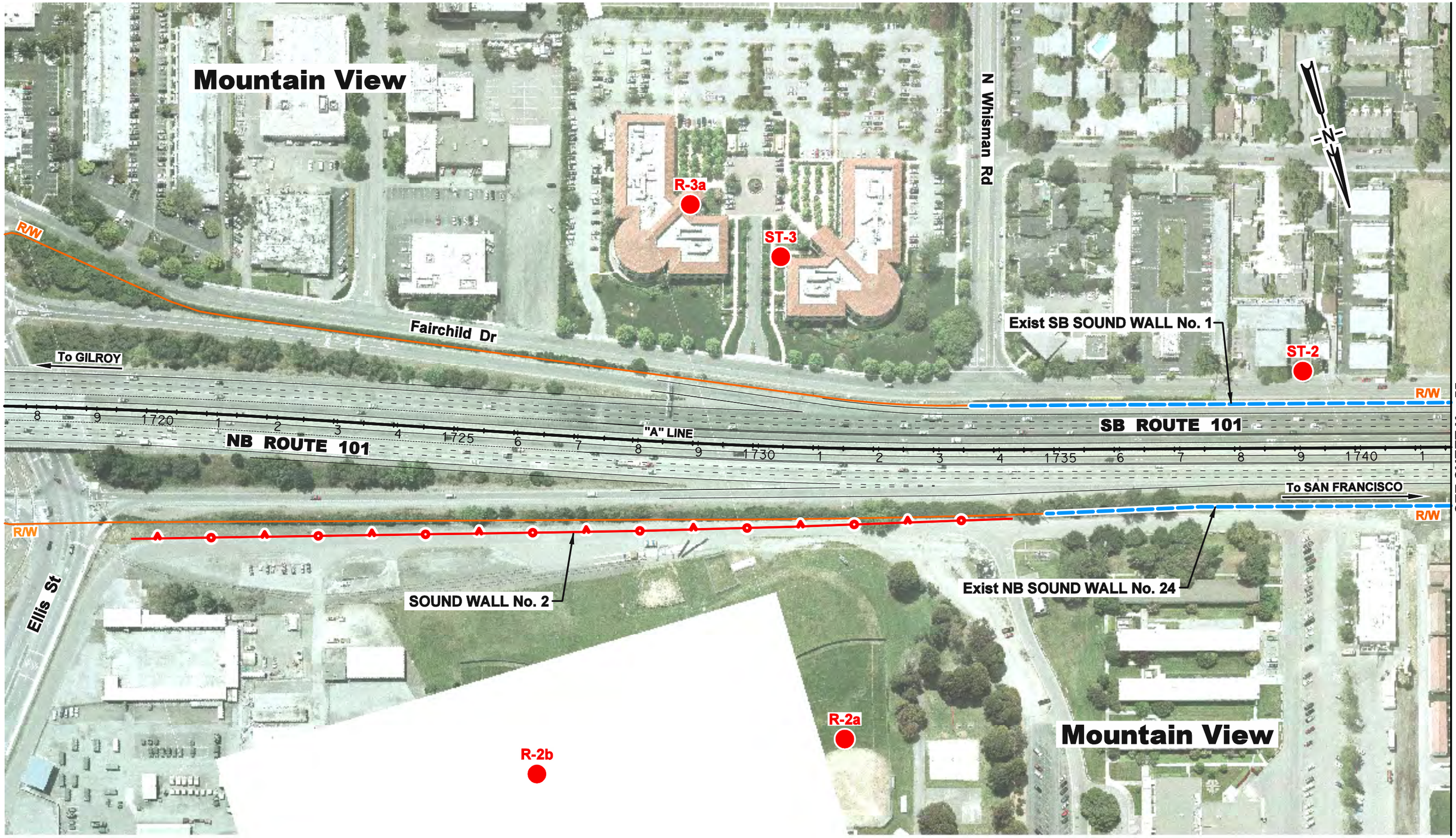


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

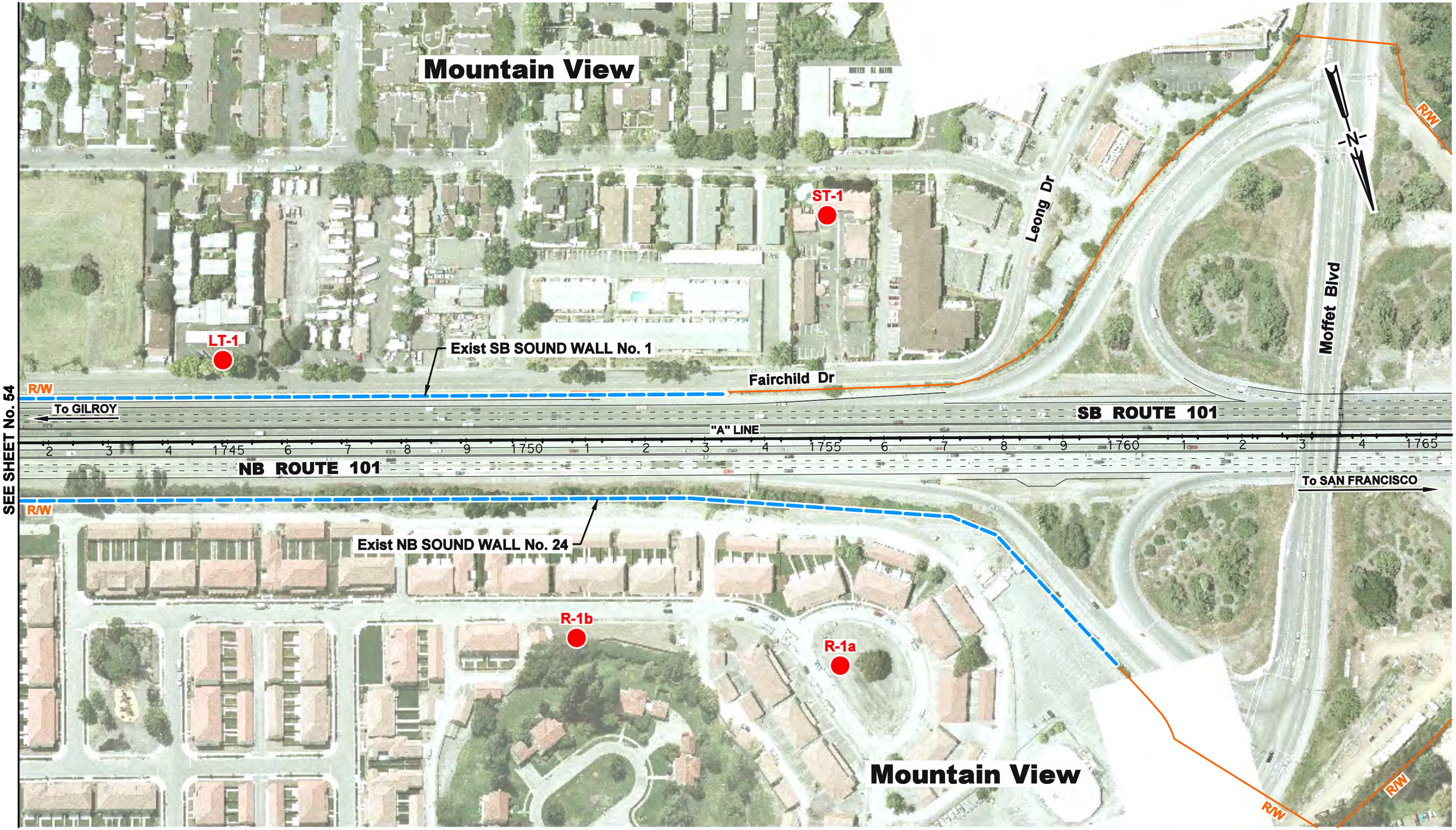


3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC. Acoustics • Air Quality



3/01/13

0 Ft 100 Ft 200 Ft 400 Ft 600 Ft 800 Ft 1000 Ft

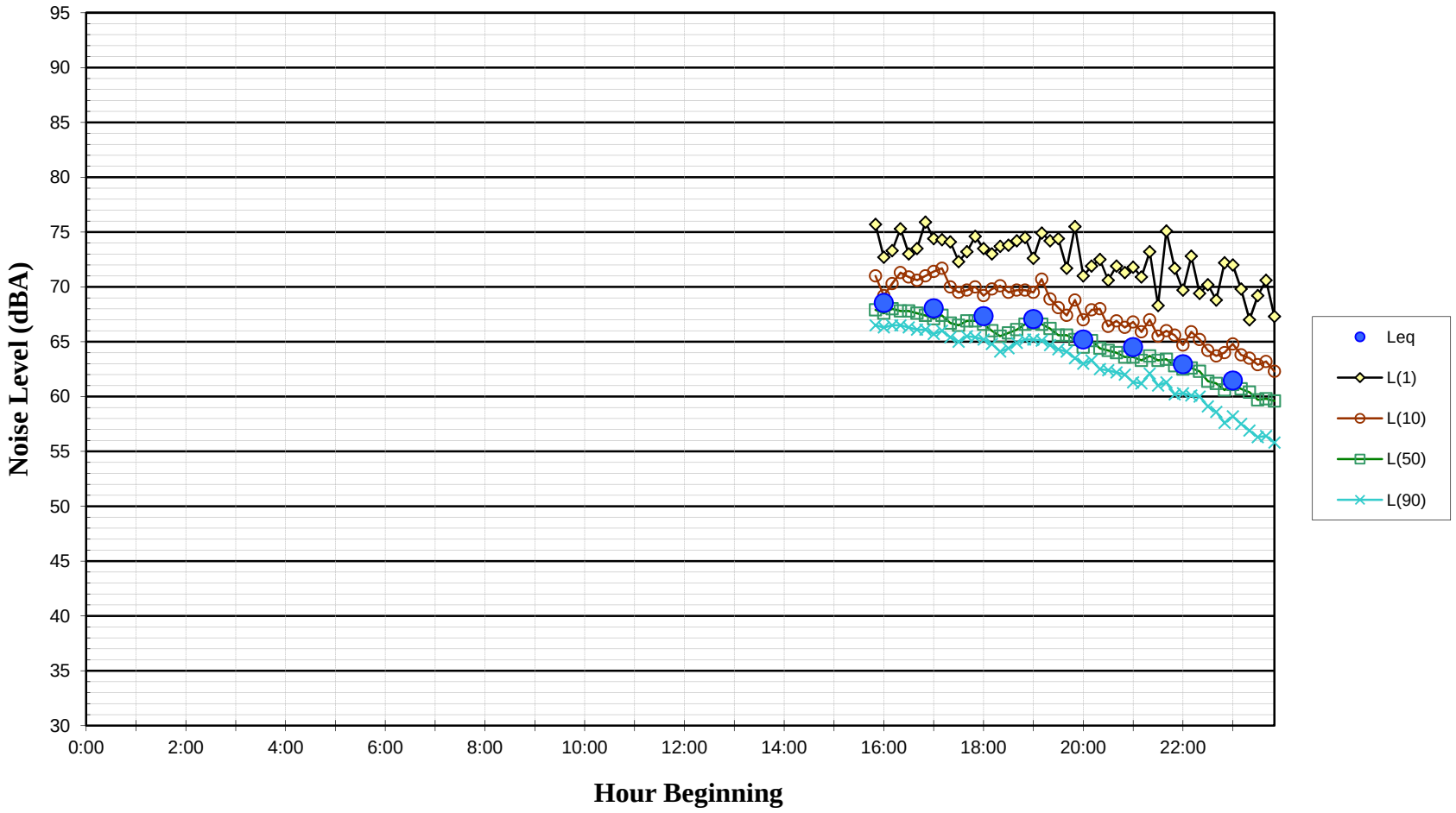
MODELED NOISE RECEPTOR & BARRIER LOCATION US 101 EXPRESS LANES PROJECT

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

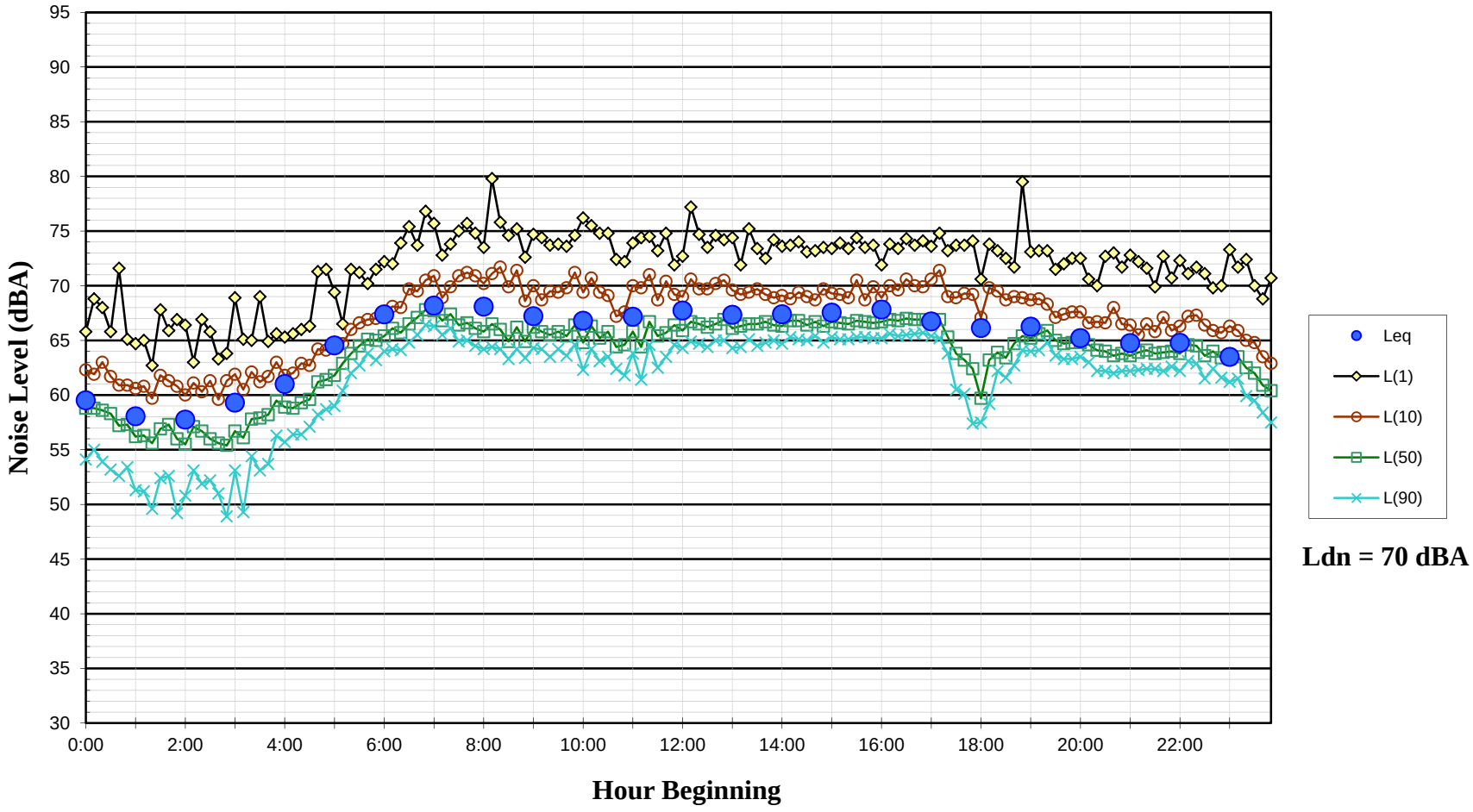
SHEET 55 OF 55

Appendix E
Long-Term Noise Data

Noise Levels at LT-1
159 Fairchild Avenue, Mountain View, CA
~ 135 feet from the Center of US 101
February 7, 2012

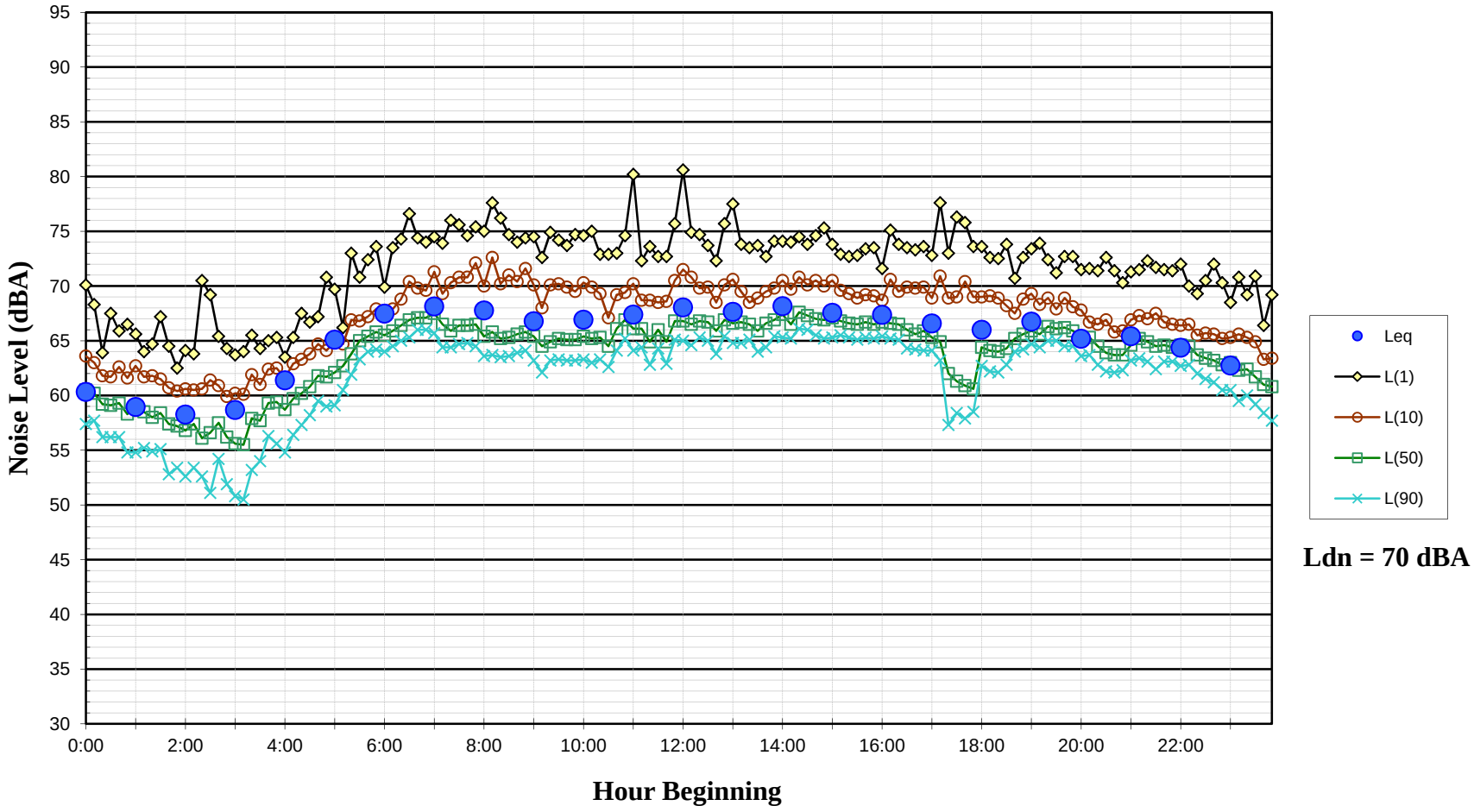


Noise Levels at LT-1
159 Fairchild Avenue, Mountain View, CA
~ 135 feet from the Center of US 101
February 8, 2012



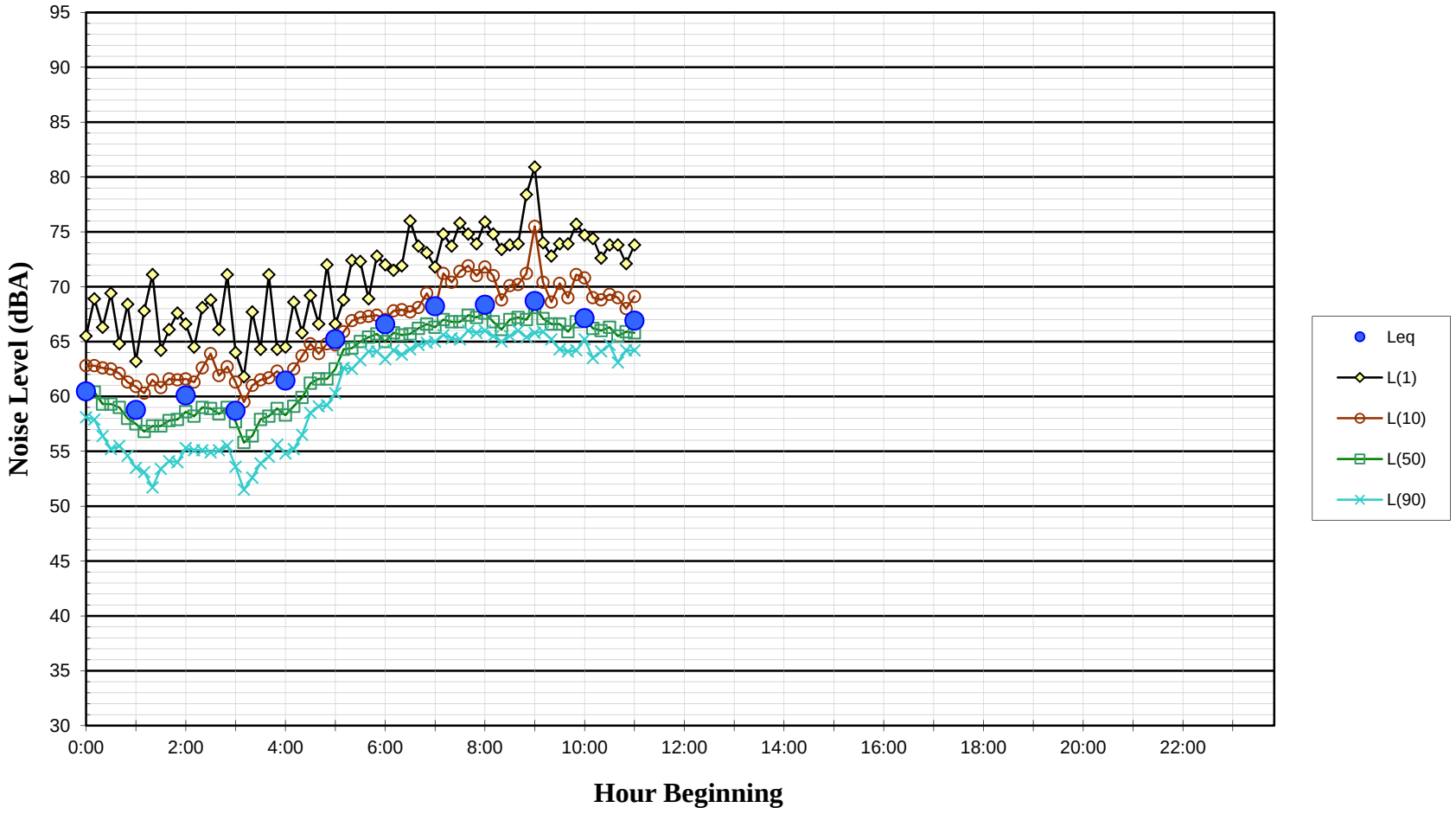
Ldn = 70 dBA

Noise Levels at LT-1
159 Fairchild Avenue, Mountain View, CA
~ 135 feet from the Center of US 101
February 9, 2012

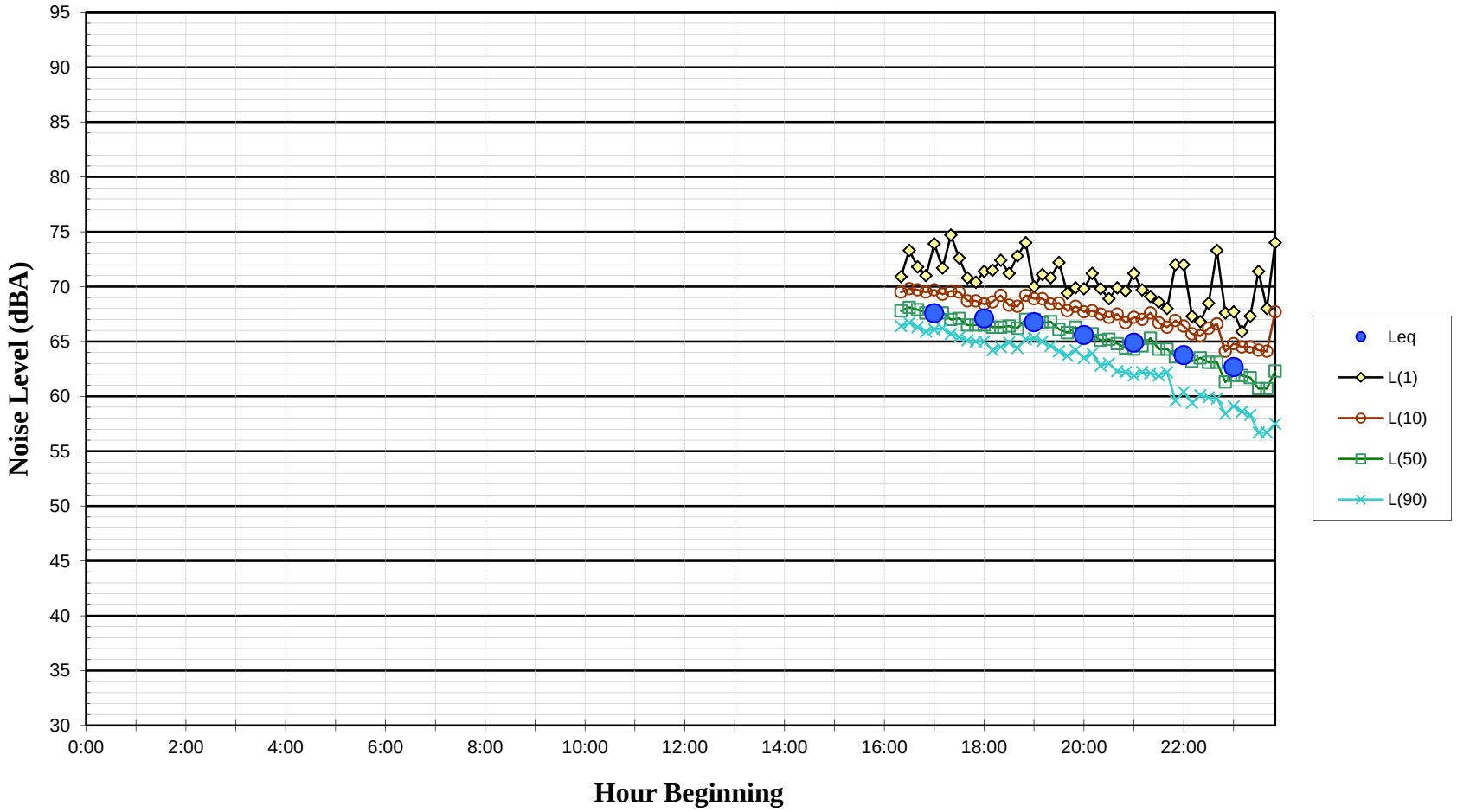


Ldn = 70 dBA

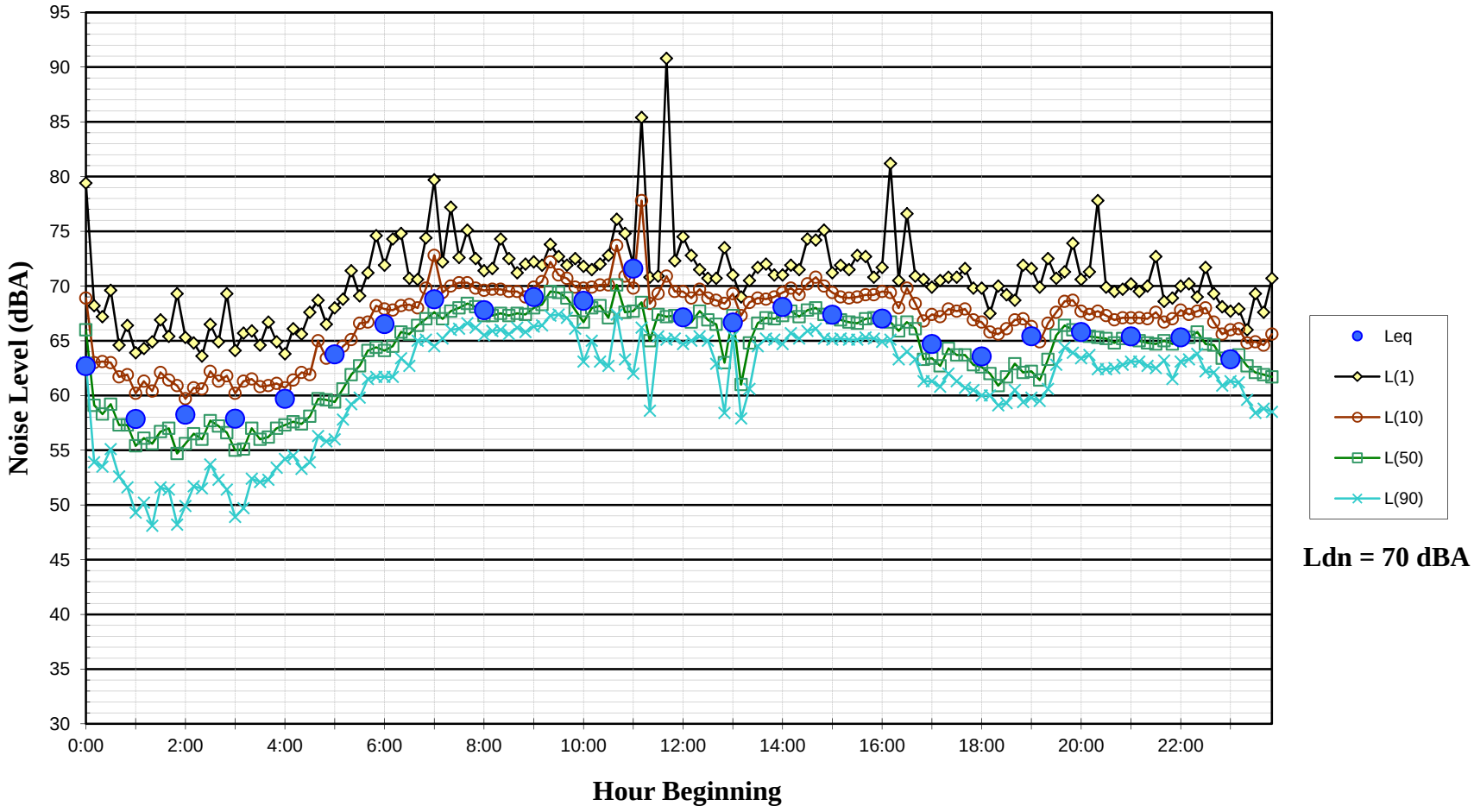
Noise Levels at LT-1
159 Fairchild Avenue, Mountain View, CA
~ 135 feet from the Center of US 101
February 10, 2012



Noise Levels at LT-2
Adjacent to 836 Ahwanee Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 7, 2012

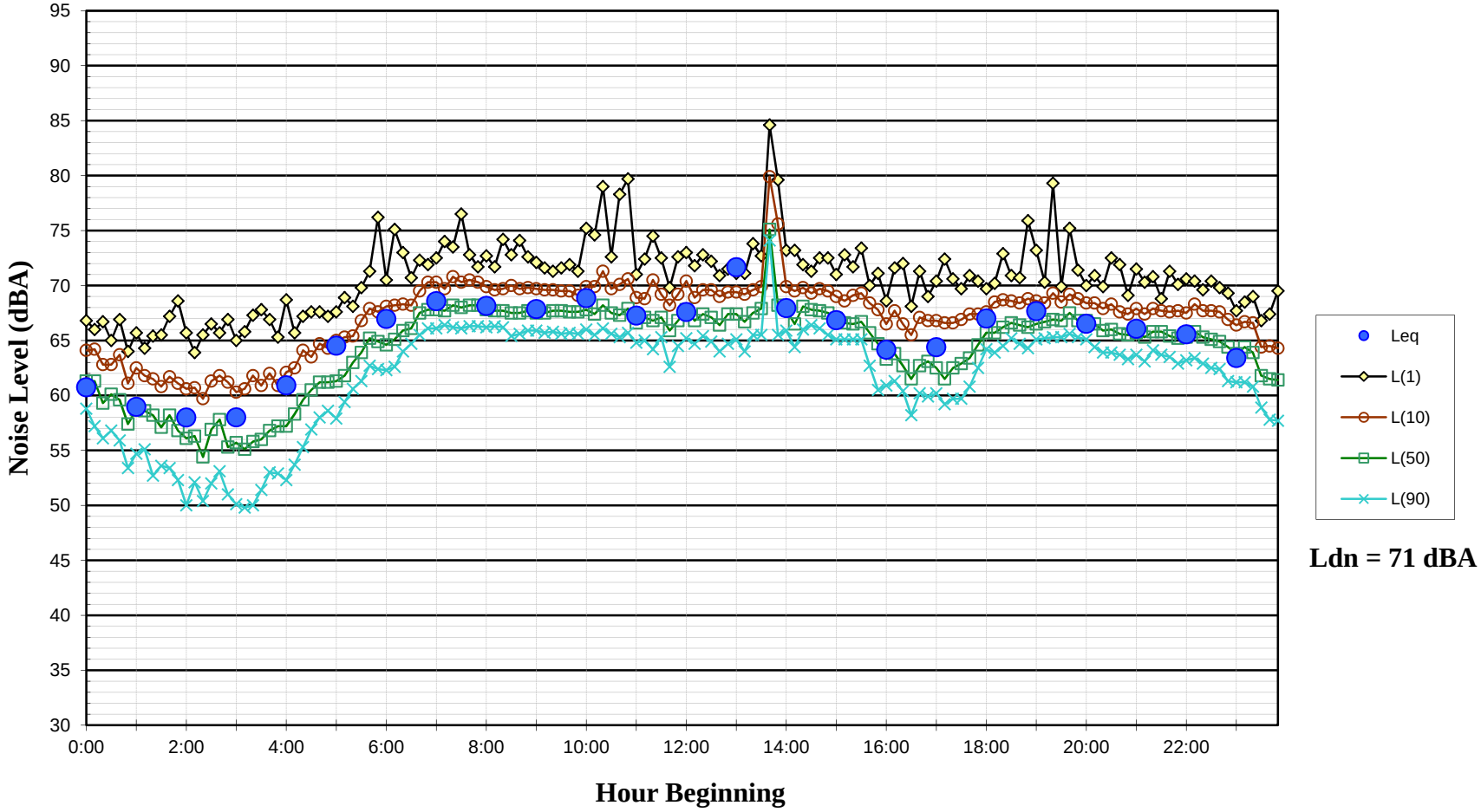


Noise Levels at LT-2
Adjacent to 836 Ahwanee Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 8, 2012



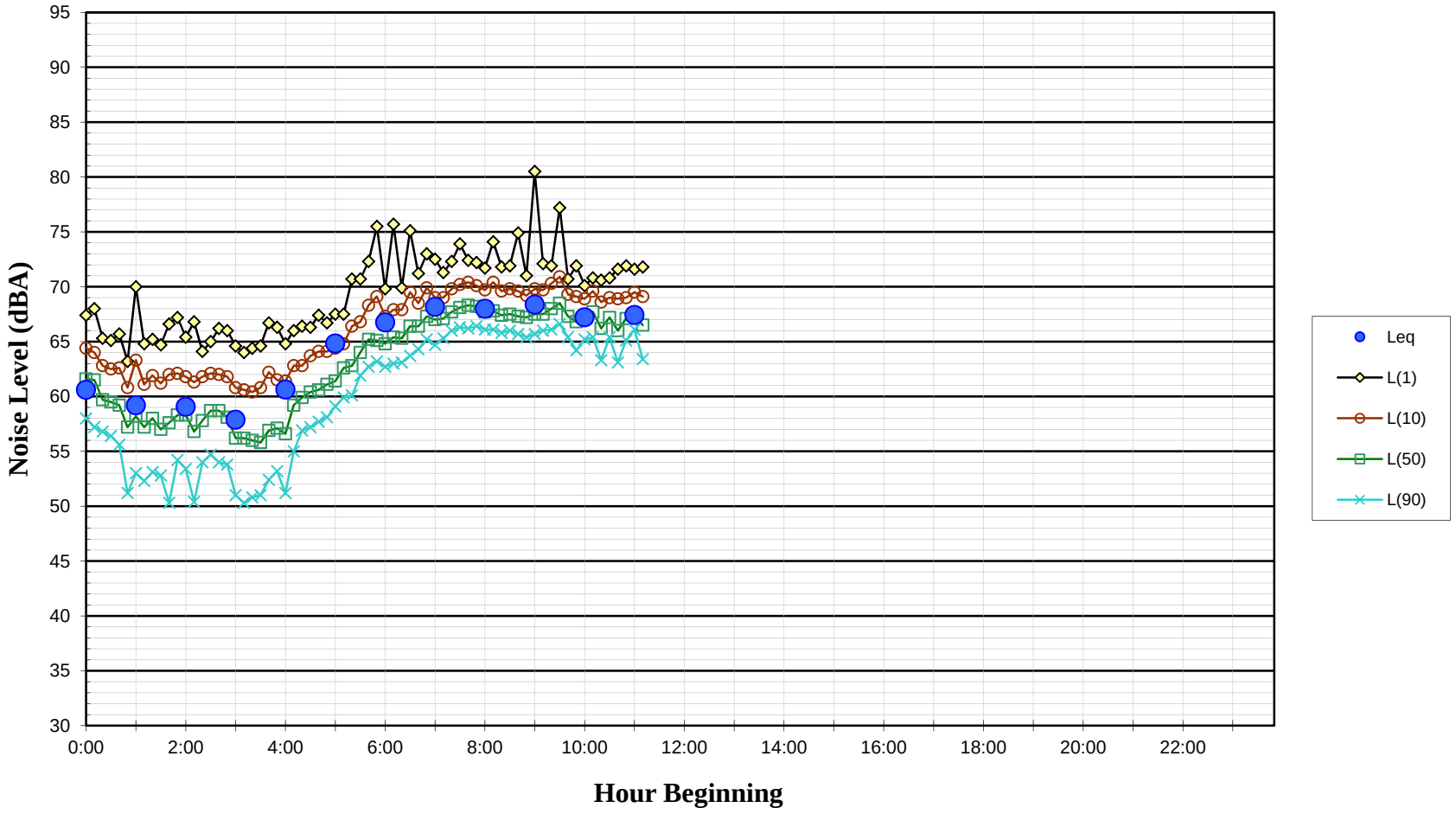
Ldn = 70 dBA

Noise Levels at LT-2
Adjacent to 836 Ahwanee Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 9, 2012

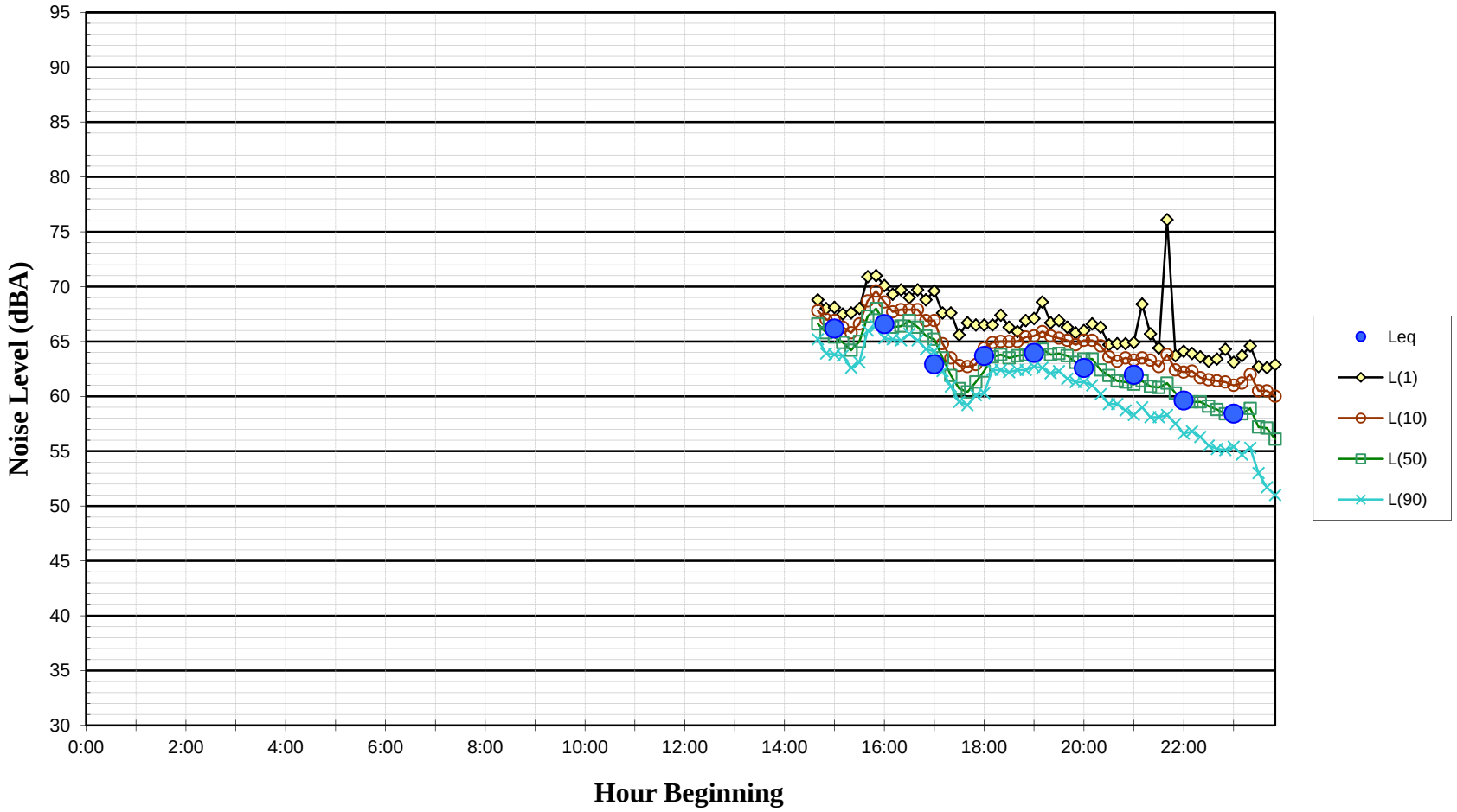


Ldn = 71 dBA

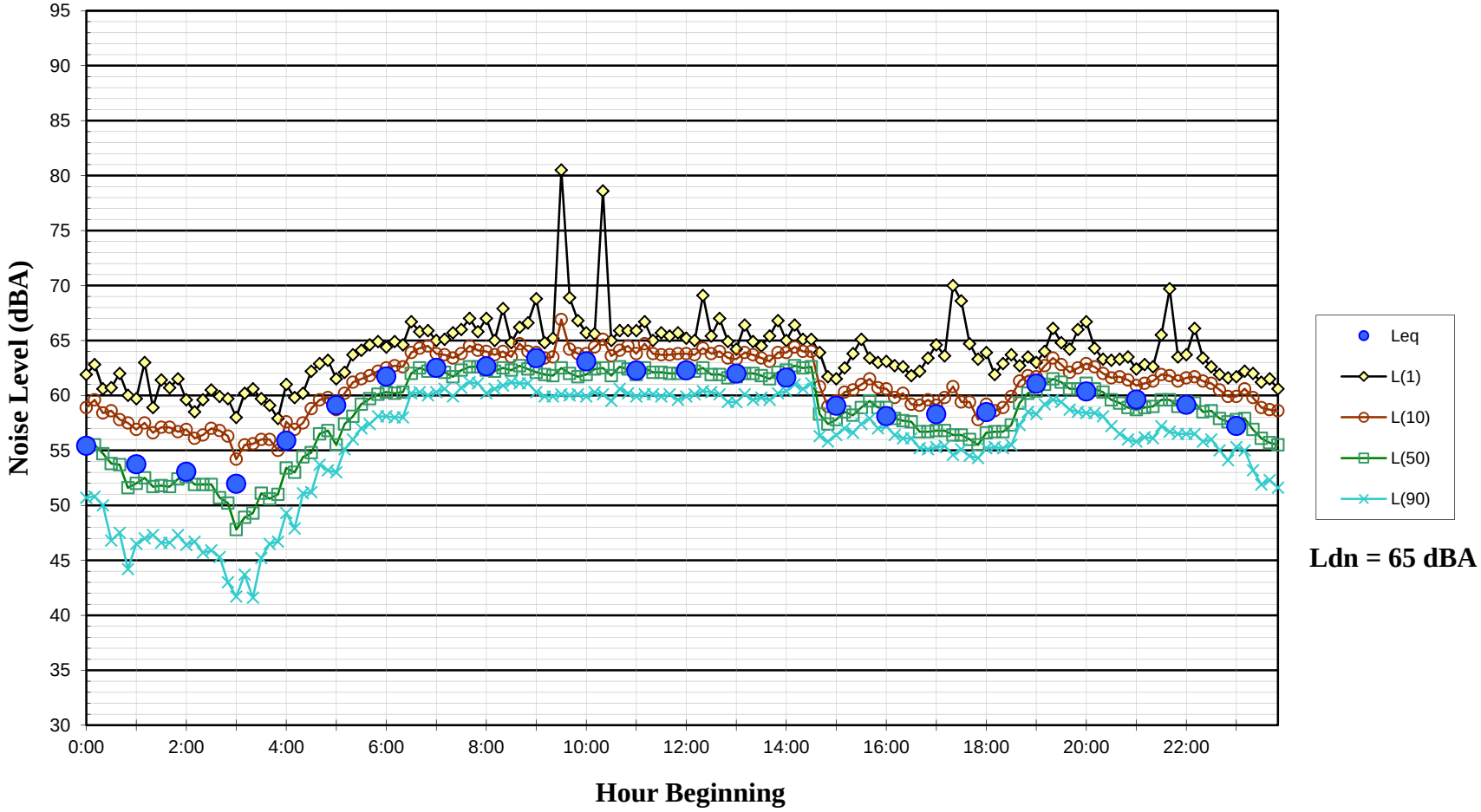
Noise Levels at LT-2
Adjacent to 836 Ahwanee Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 10, 2012



Noise Levels at LT-3
Rear Yard of 856 San Ramon Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 13, 2012

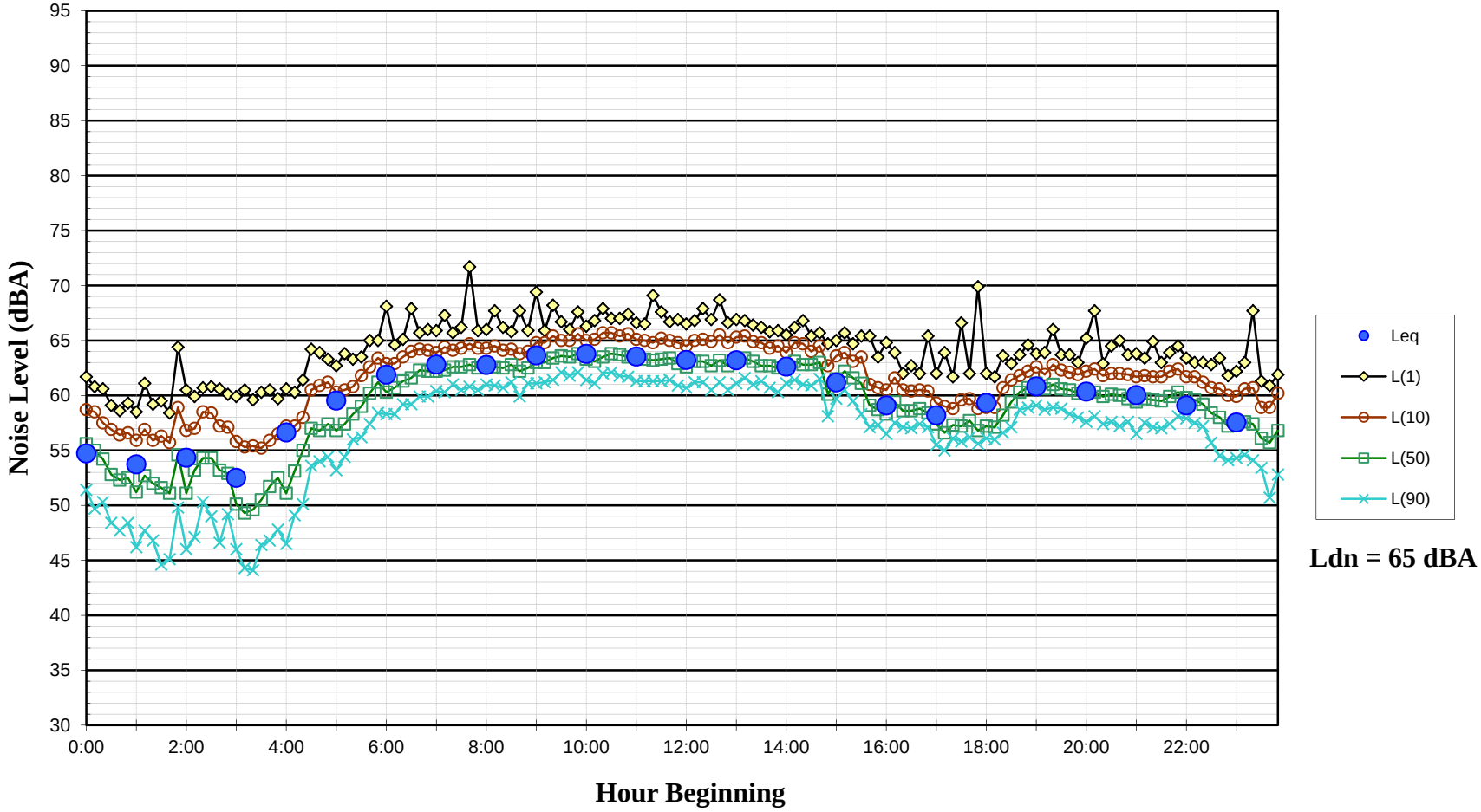


Noise Levels at LT-3
Rear Yard of 856 San Ramon Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 14, 2012



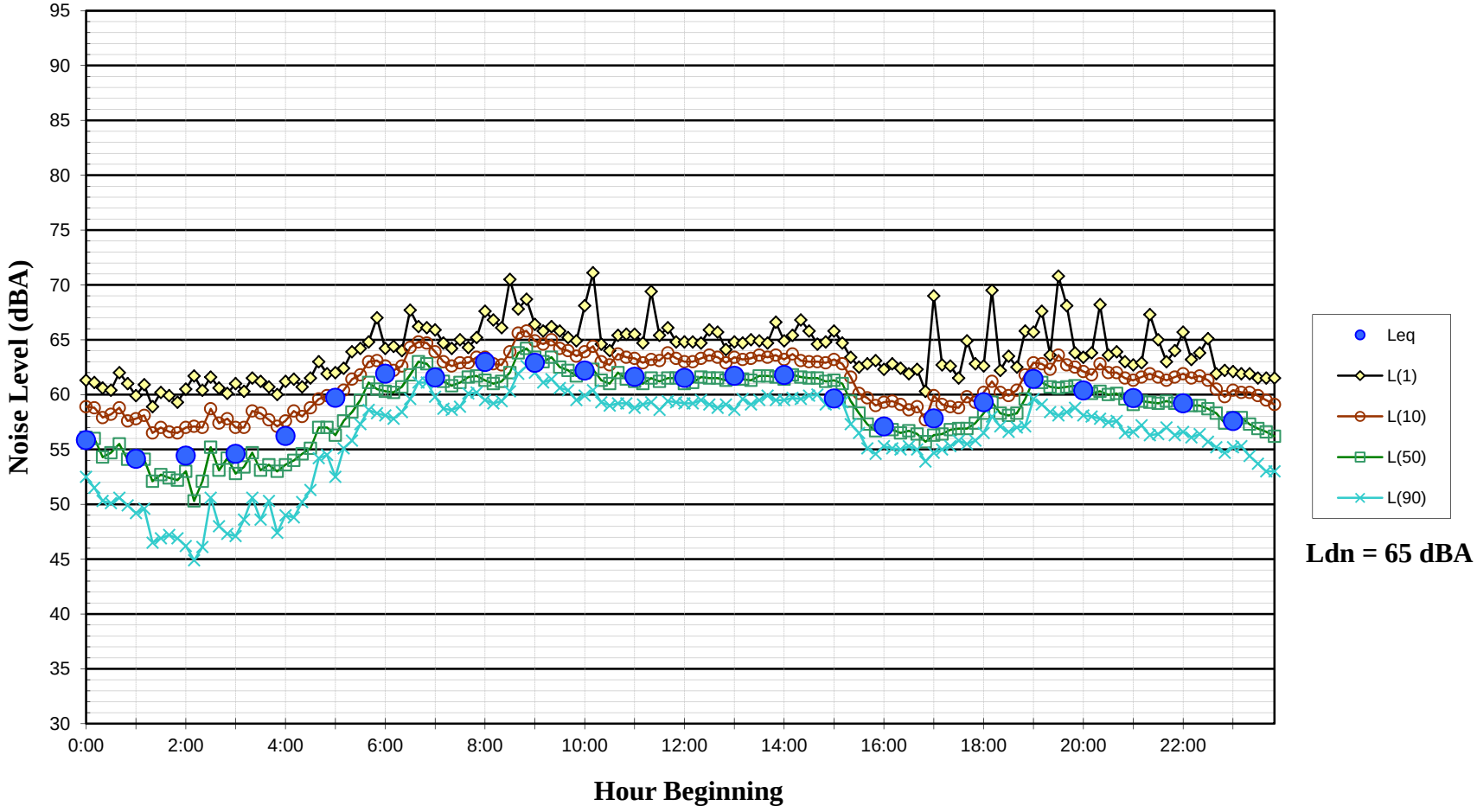
Ldn = 65 dBA

Noise Levels at LT-3
Rear Yard of 856 San Ramon Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 15, 2012



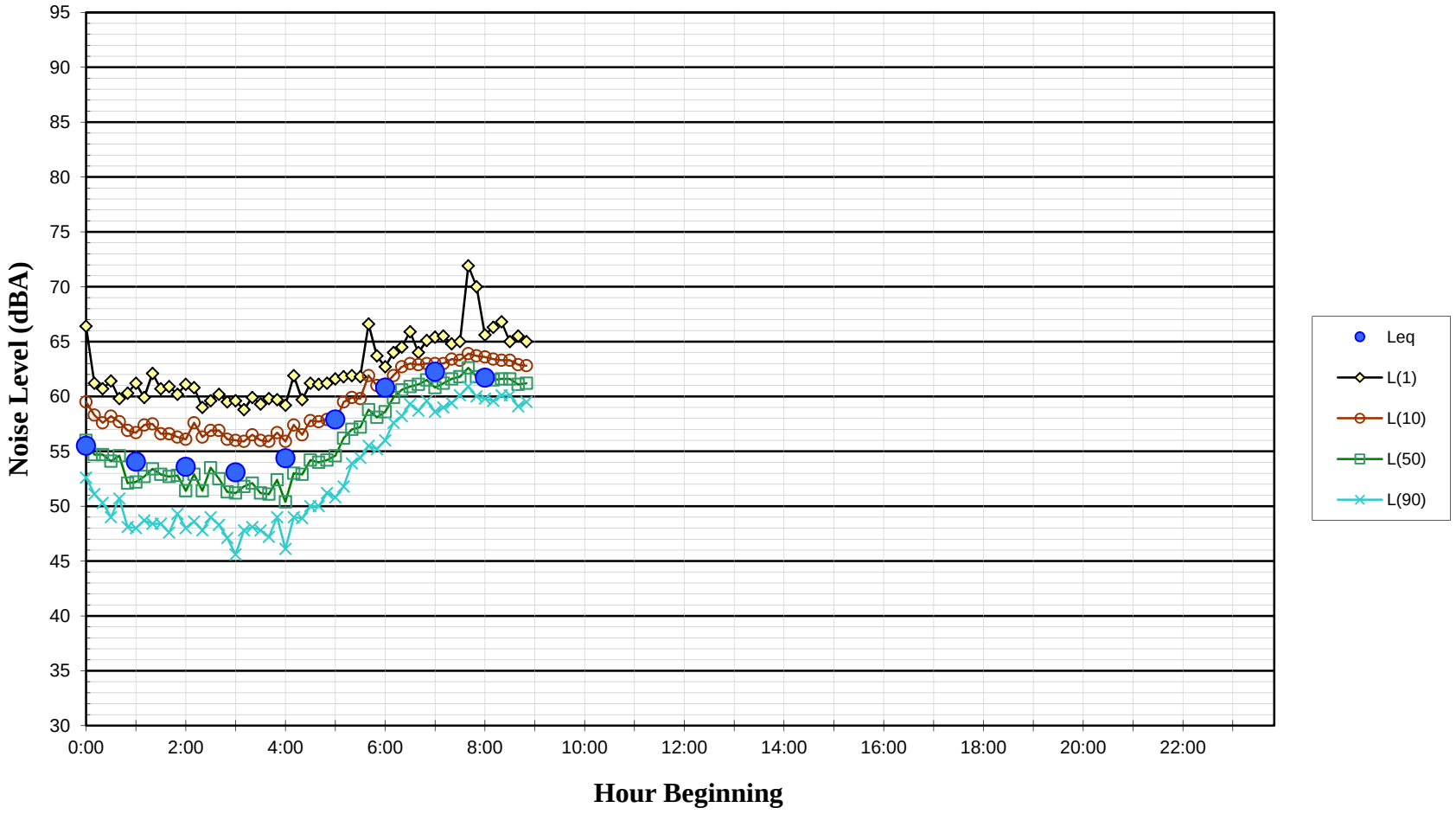
Ldn = 65 dBA

Noise Levels at LT-3
Rear Yard of 856 San Ramon Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 16, 2012

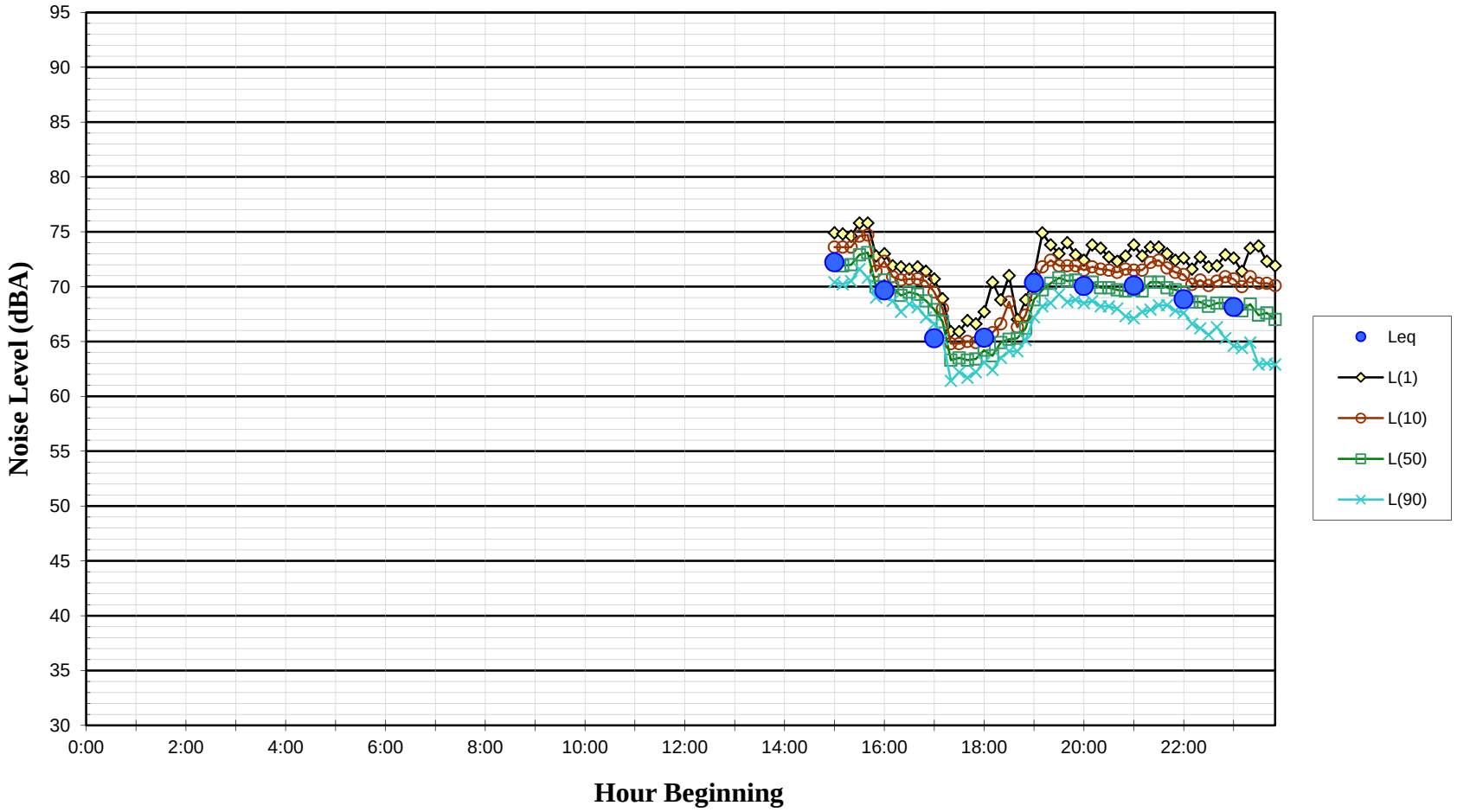


Ldn = 65 dBA

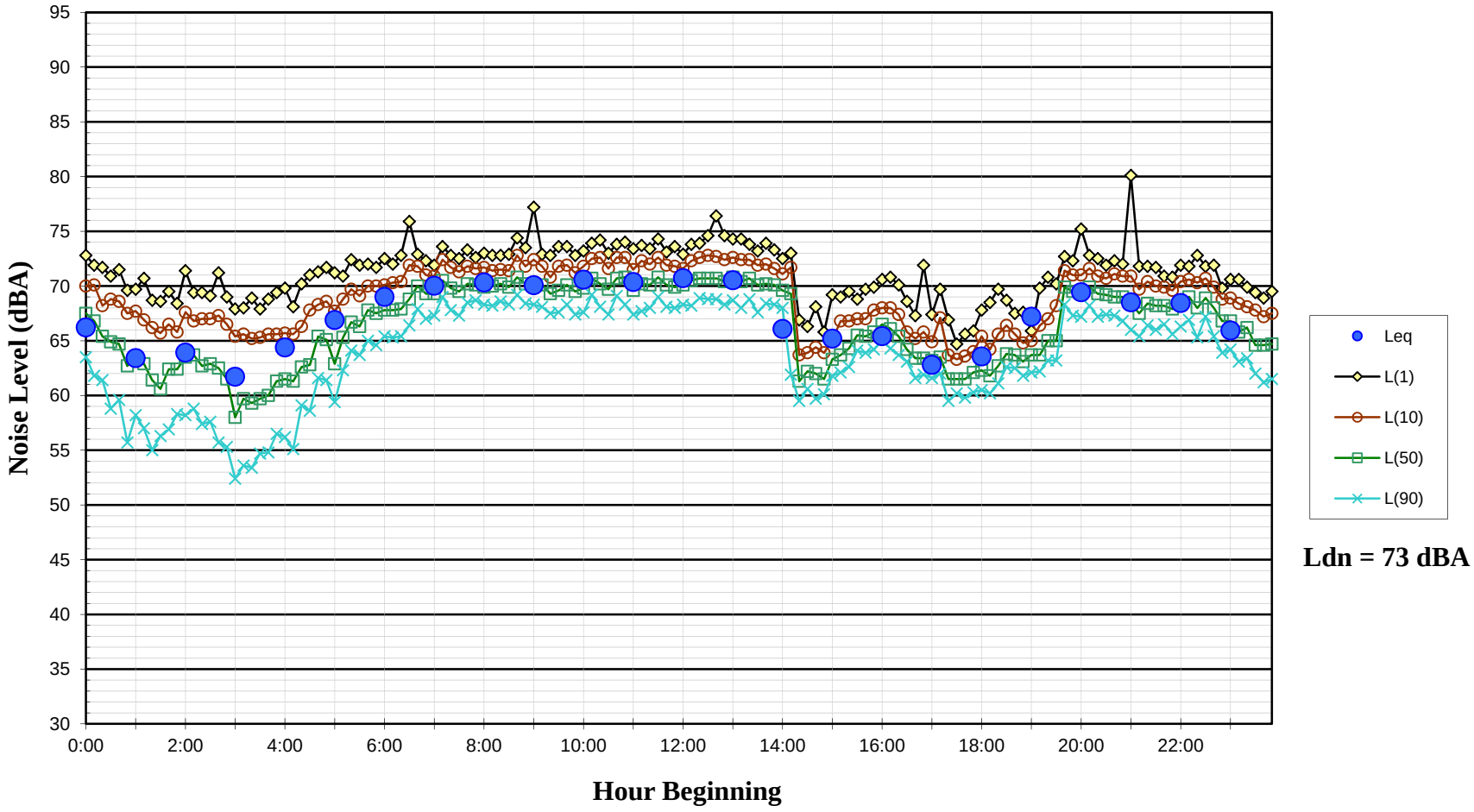
Noise Levels at LT-3
Rear Yard of 856 San Ramon Avenue, Sunnyvale, CA
~ 145 feet from the Center of US 101
February 17, 2012



Noise Levels at LT-4
San Tomas Aquino Trail, Santa Clara, CA
~ 270 feet from the Center of US 101
February 13, 2012

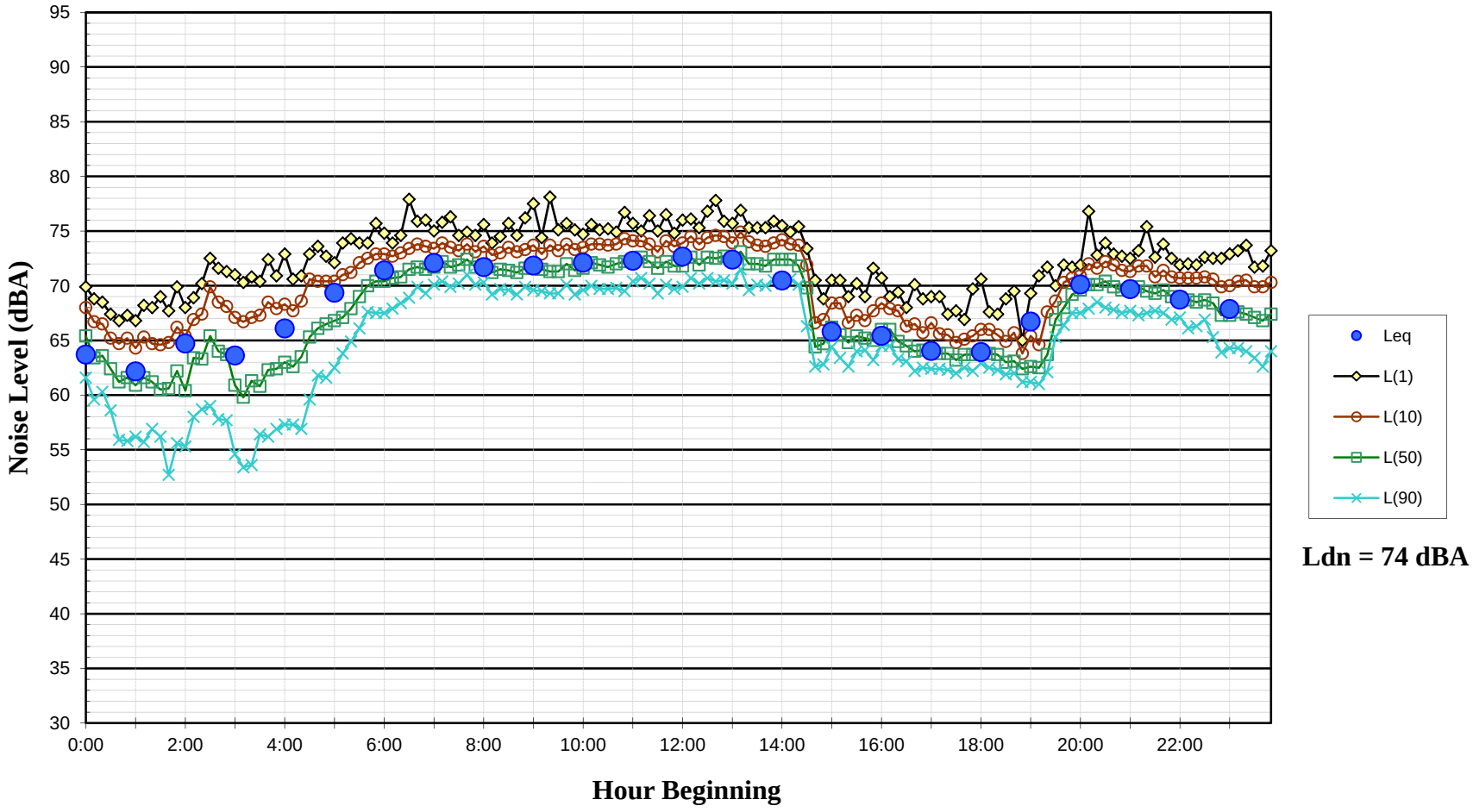


Noise Levels at LT-4
San Tomas Aquino Trail, Santa Clara, CA
~ 270 feet from the Center of US 101
February 14, 2012



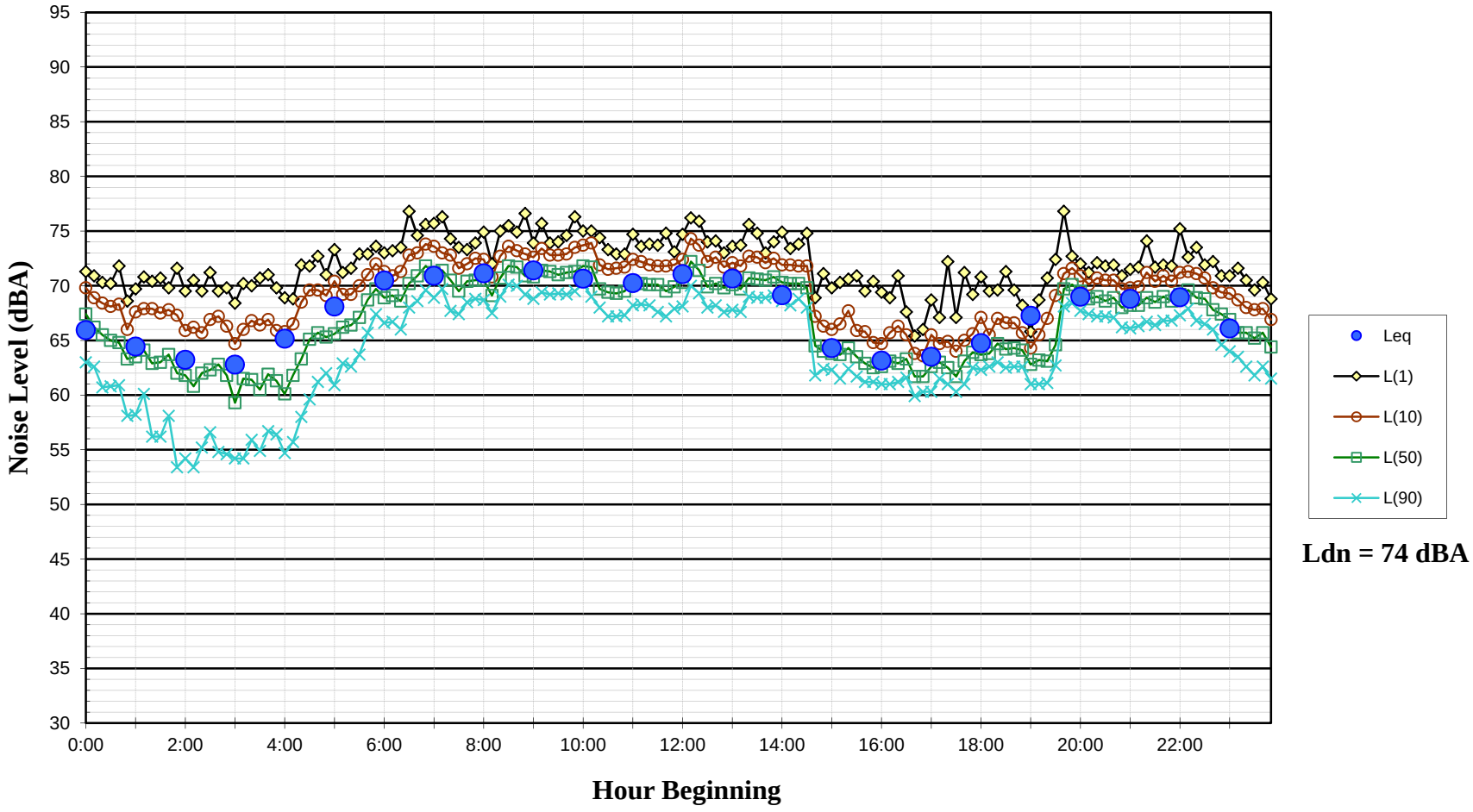
Ldn = 73 dBA

Noise Levels at LT-4
San Tomas Aquino Trail, Santa Clara, CA
~ 270 feet from the Center of US 101
February 15, 2012



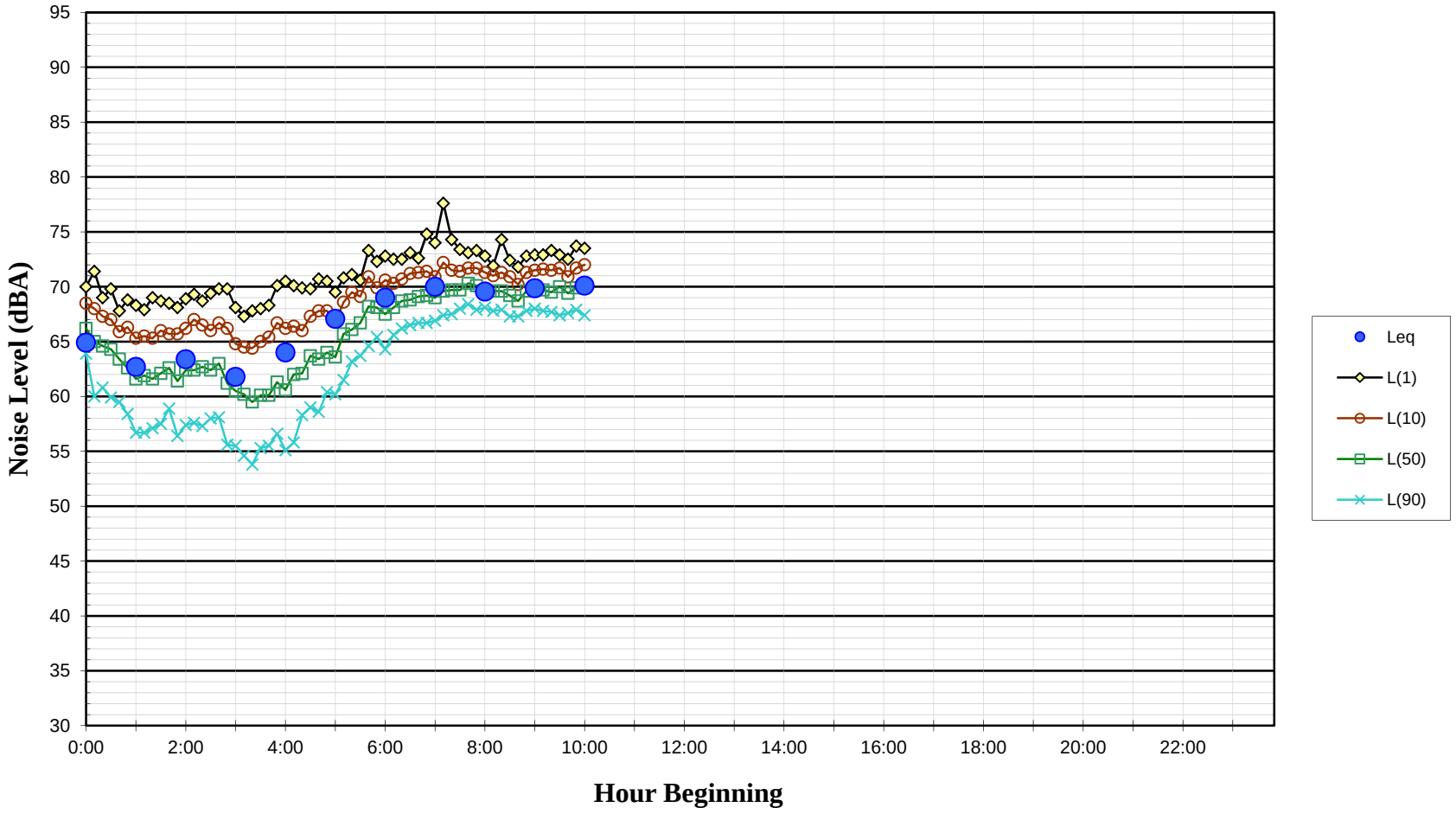
Ldn = 74 dBA

Noise Levels at LT-4
San Tomas Aquino Trail, Santa Clara, CA
~ 270 feet from the Center of US 101
February 16, 2012

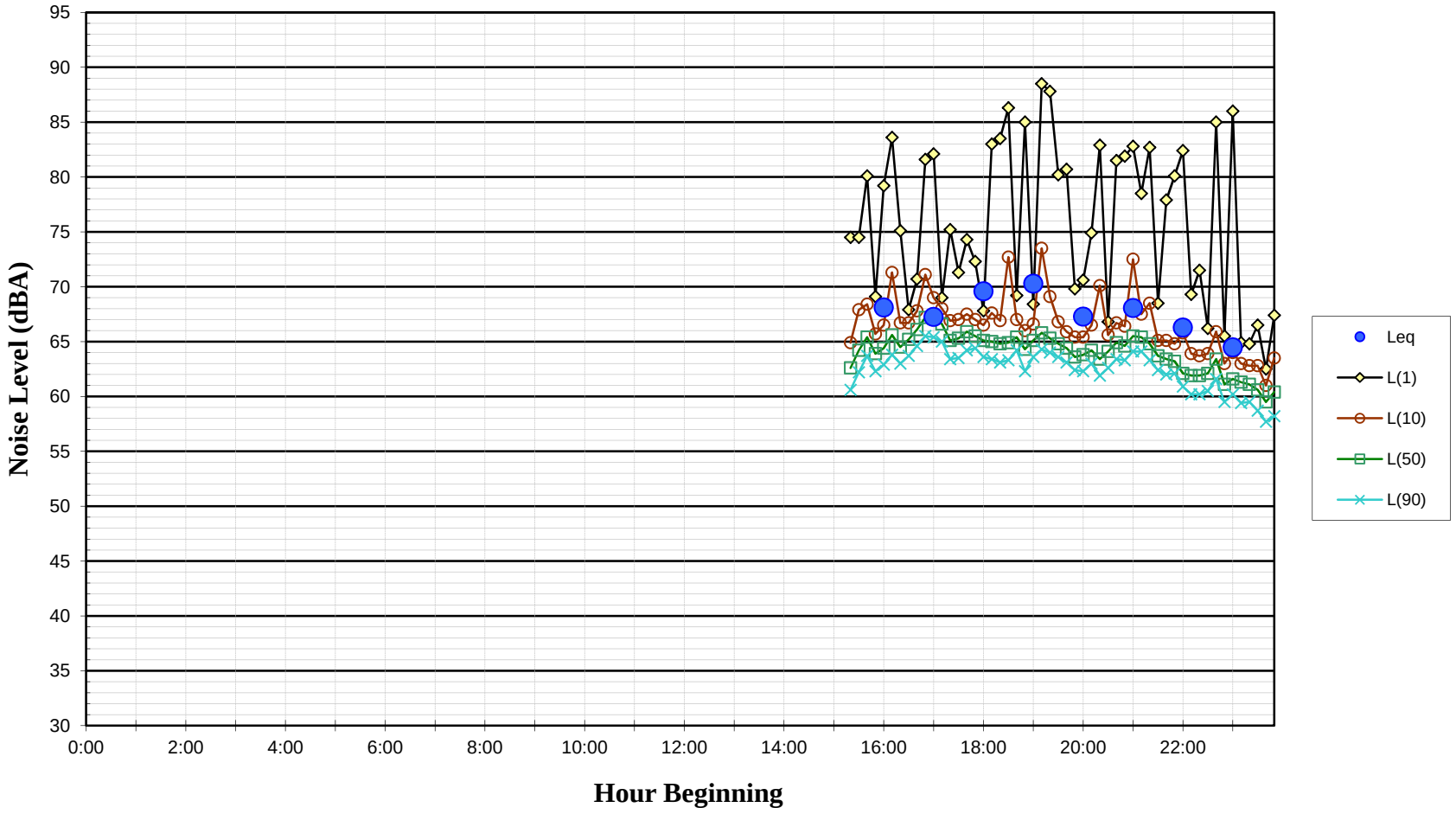


Ldn = 74 dBA

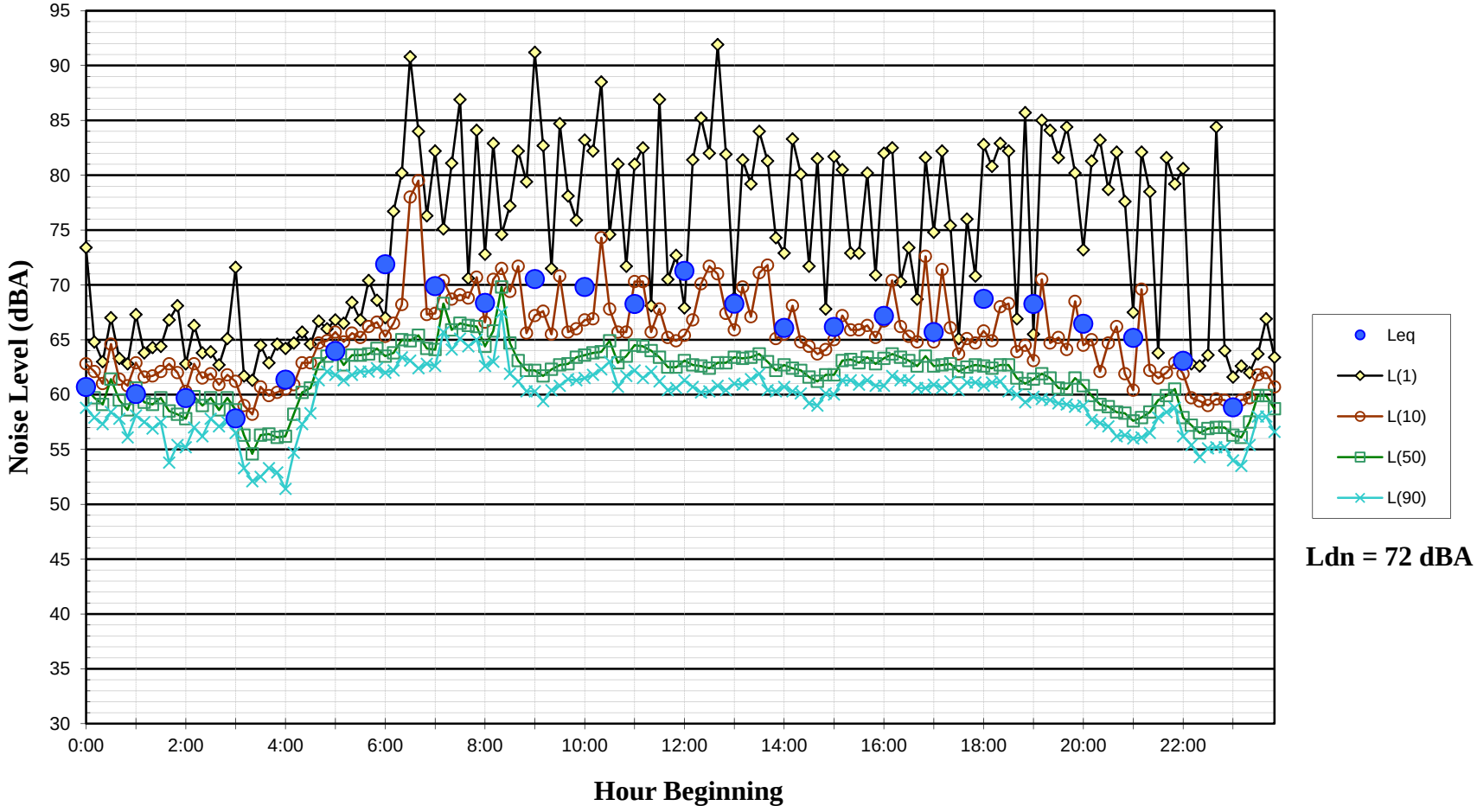
Noise Levels at LT-4
San Tomas Aquino Trail, Santa Clara, CA
~ 270 feet from the Center of US 101
February 17, 2012



Noise Levels at LT-5
Pool Area of La Quinta Inn, San Jose, CA
~ 515 feet from the Center of US 101
February 13, 2012

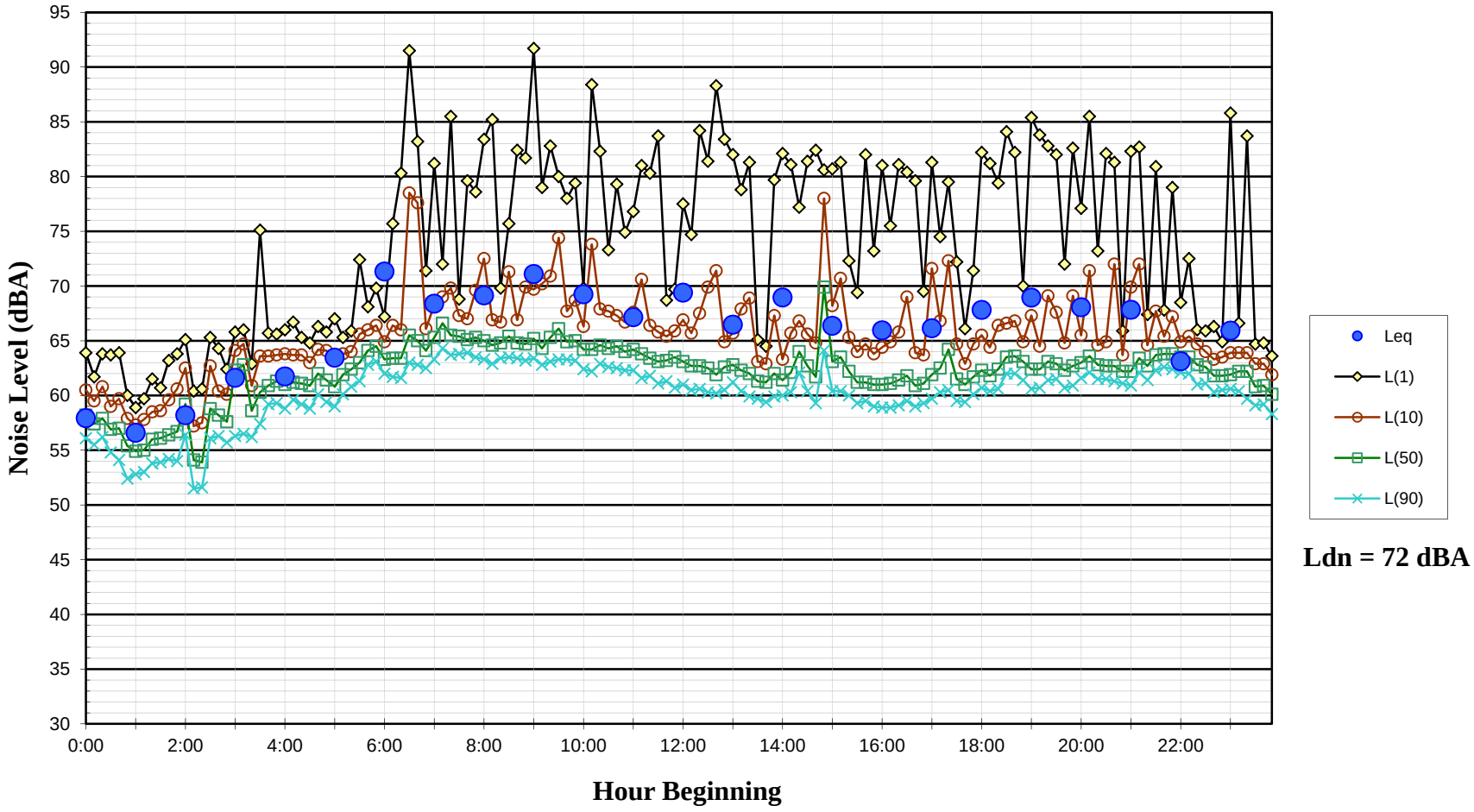


Noise Levels at LT-5
Pool Area of La Quinta Inn, San Jose, CA
~ 515 feet from the Center of US 101
February 14, 2012



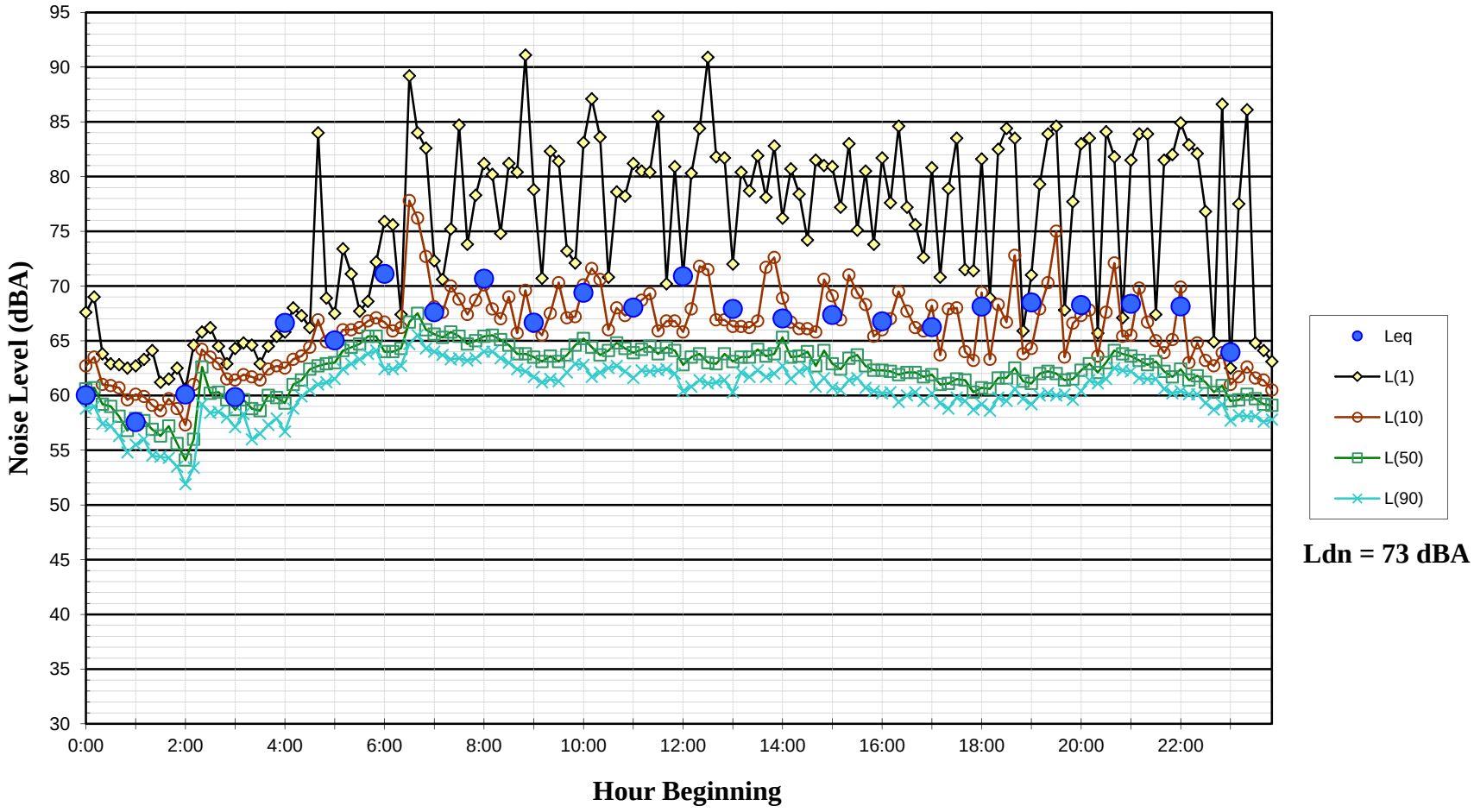
Ldn = 72 dBA

Noise Levels at LT-5
Pool Area of La Quinta Inn, San Jose, CA
~ 515 feet from the Center of US 101
February 15, 2012



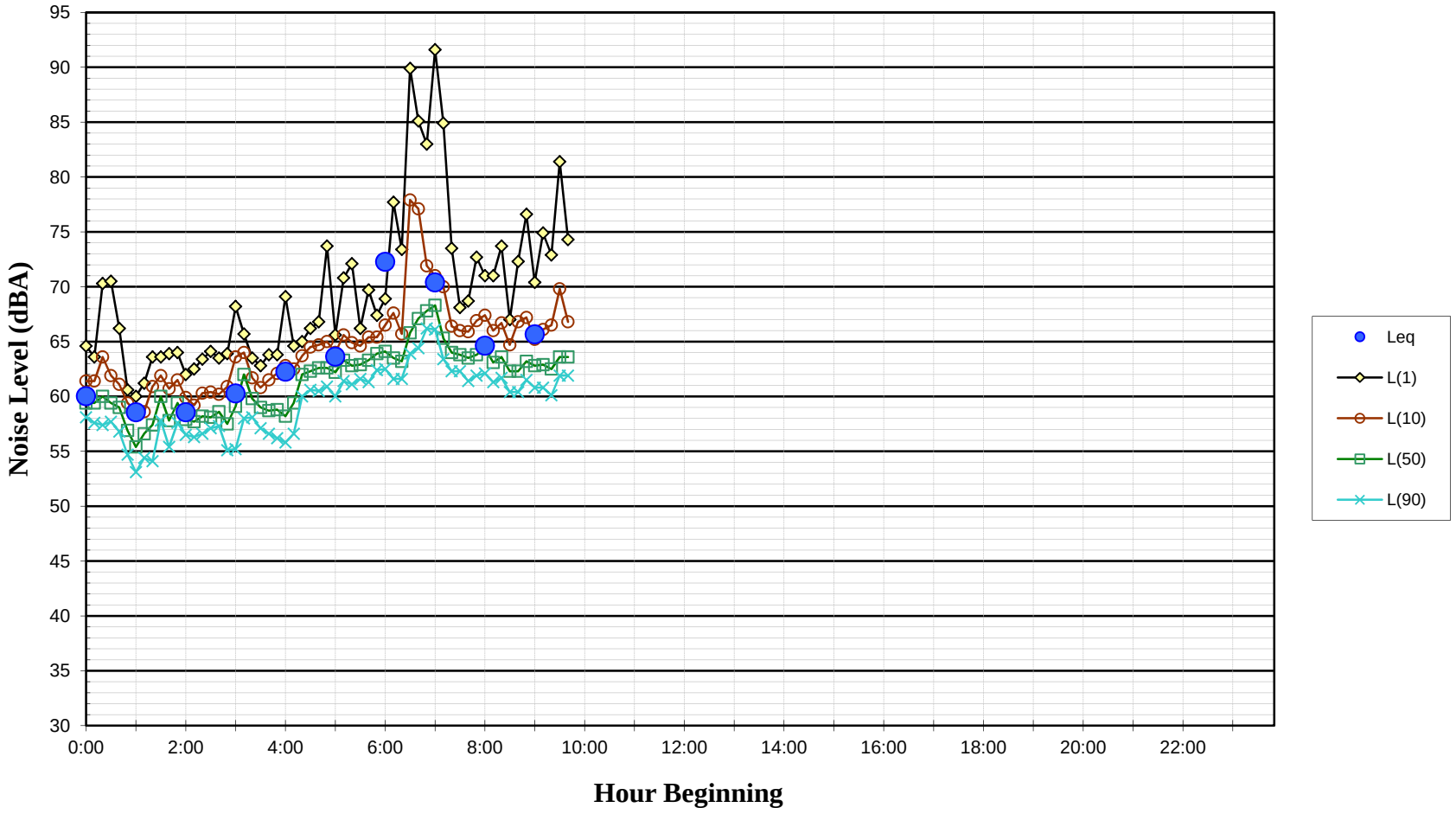
Ldn = 72 dBA

Noise Levels at LT-5
Pool Area of La Quinta Inn, San Jose, CA
~ 515 feet from the Center of US 101
February 16, 2012

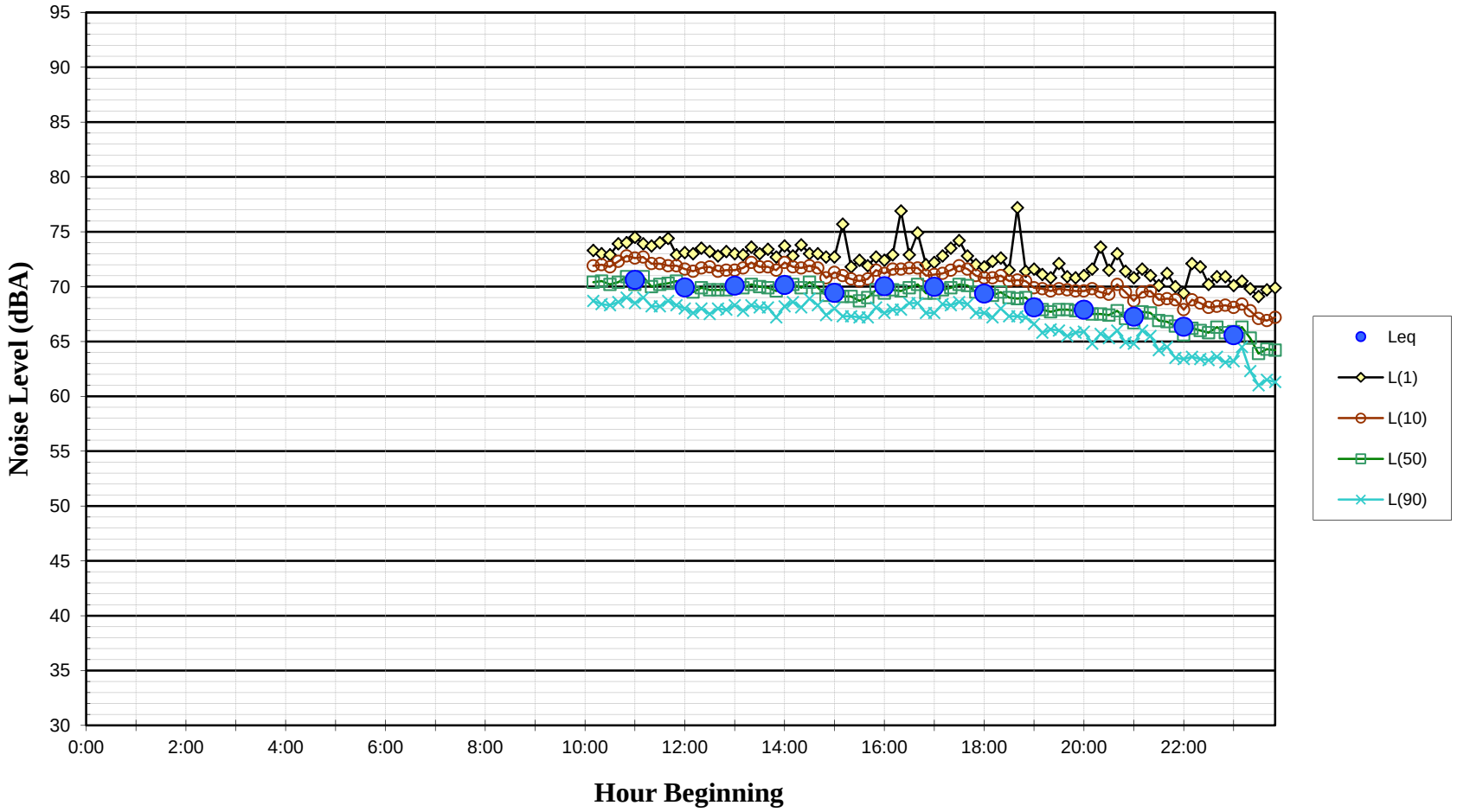


Ldn = 73 dBA

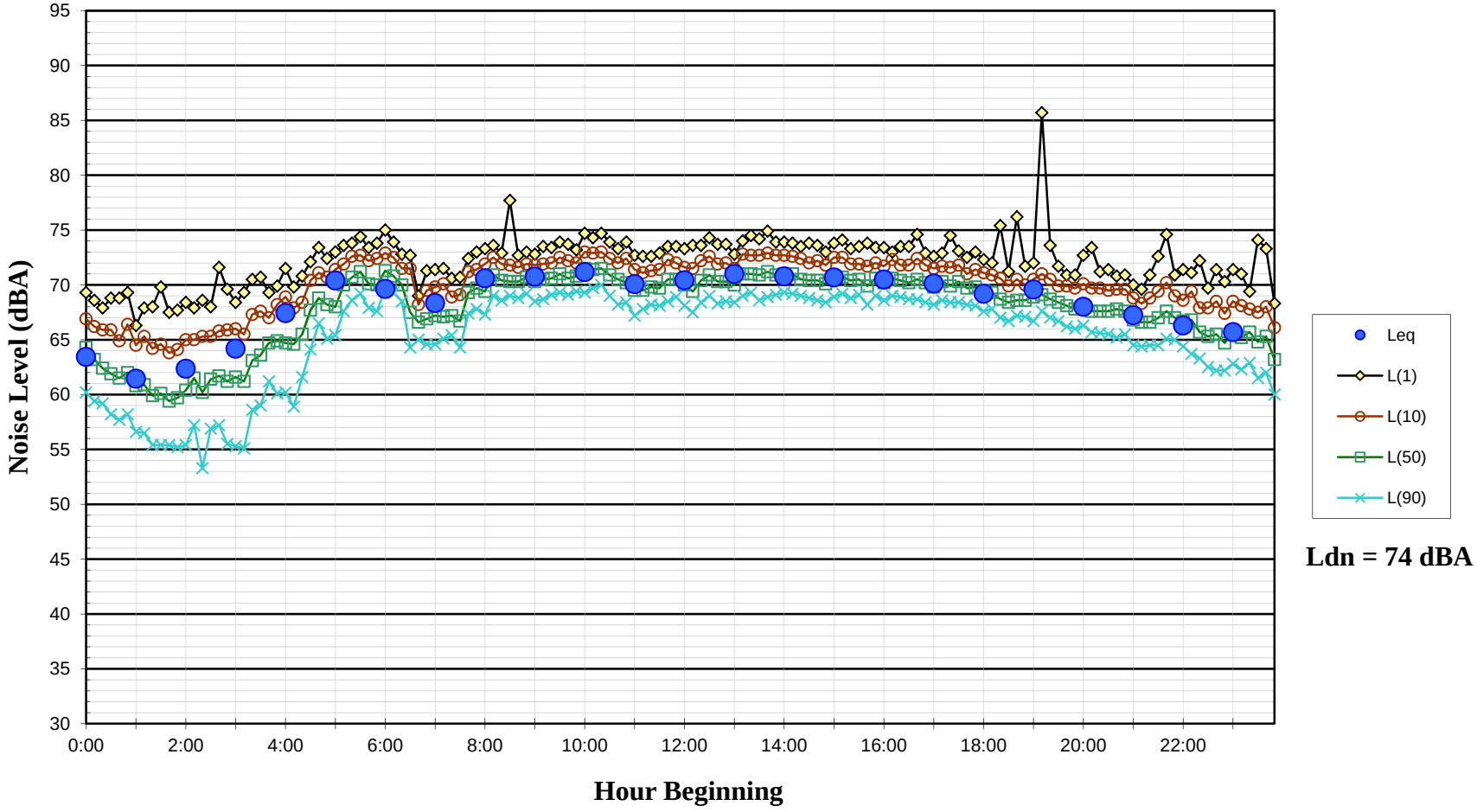
Noise Levels at LT-5
Pool Area of La Quinta Inn, San Jose, CA
~ 515 feet from the Center of US 101
February 17, 2012



Noise Levels at LT-6
75 N. 31st Street, San Jose, CA
~ 225 feet from the Center of US 101
February 21, 2012

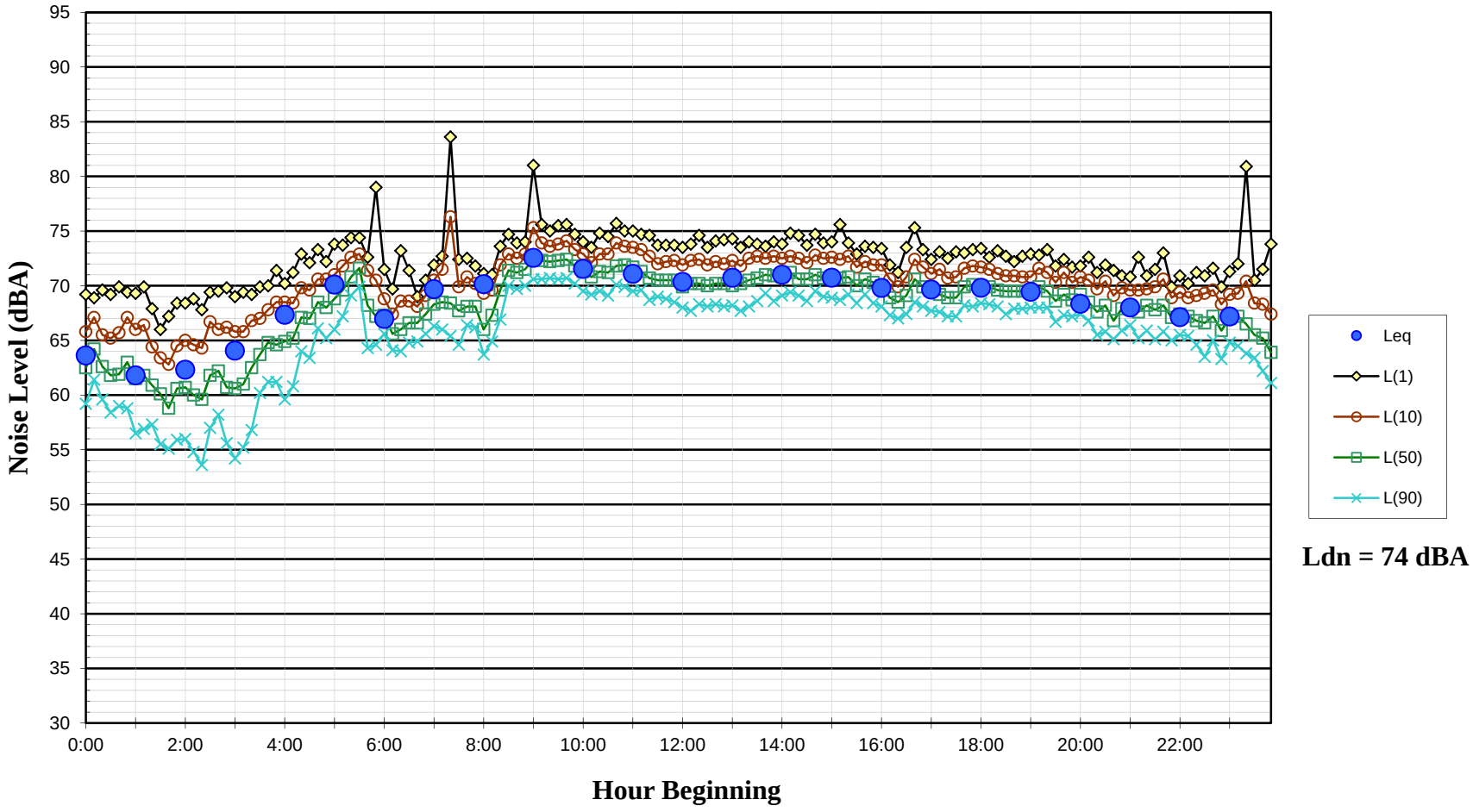


Noise Levels at LT-6
75 N. 31st Street, San Jose, CA
~ 225 feet from the Center of US 101
February 22, 2012



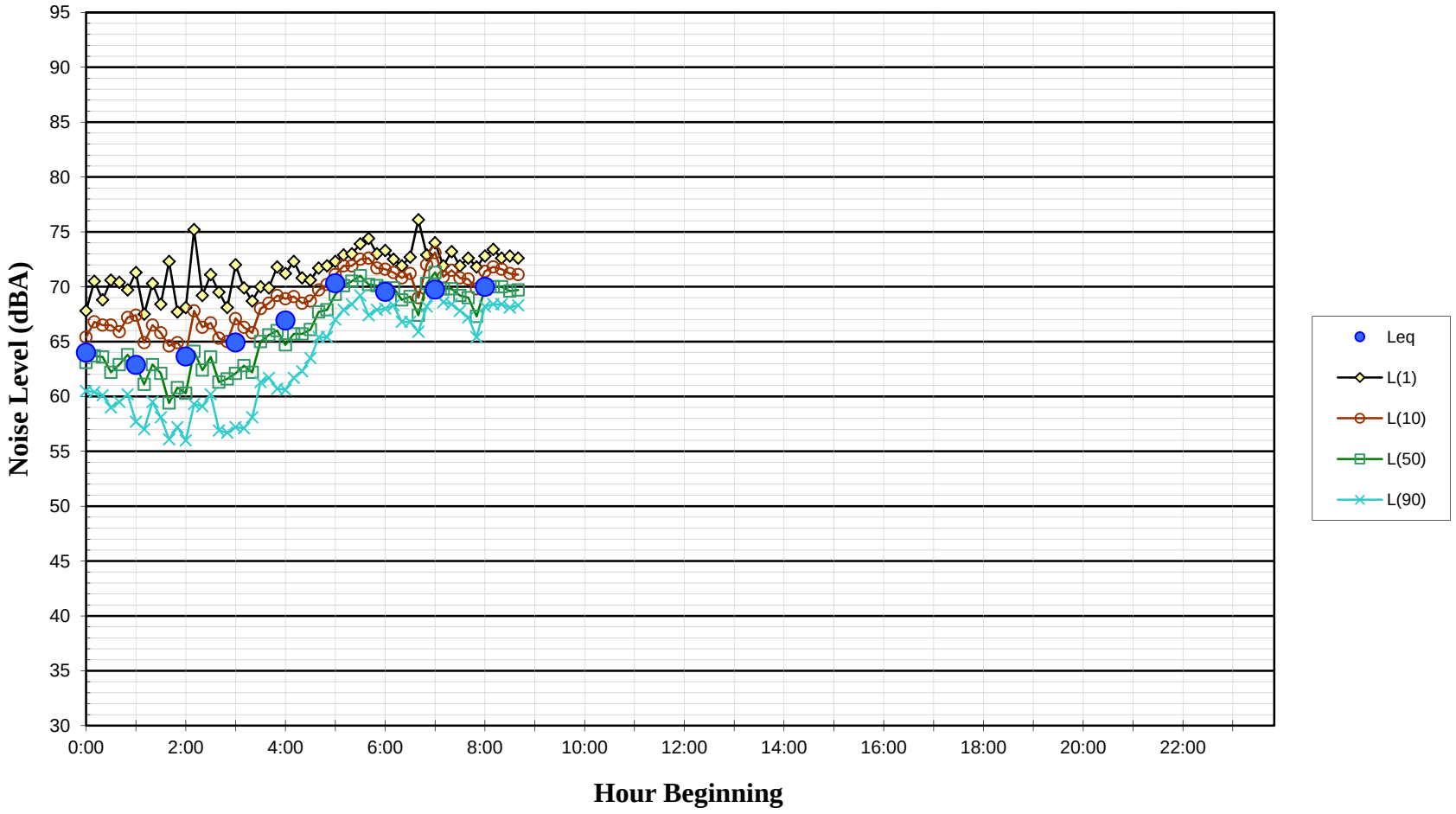
Ldn = 74 dBA

Noise Levels at LT-6
75 N. 31st Street, San Jose, CA
~ 225 feet from the Center of US 101
February 23, 2012

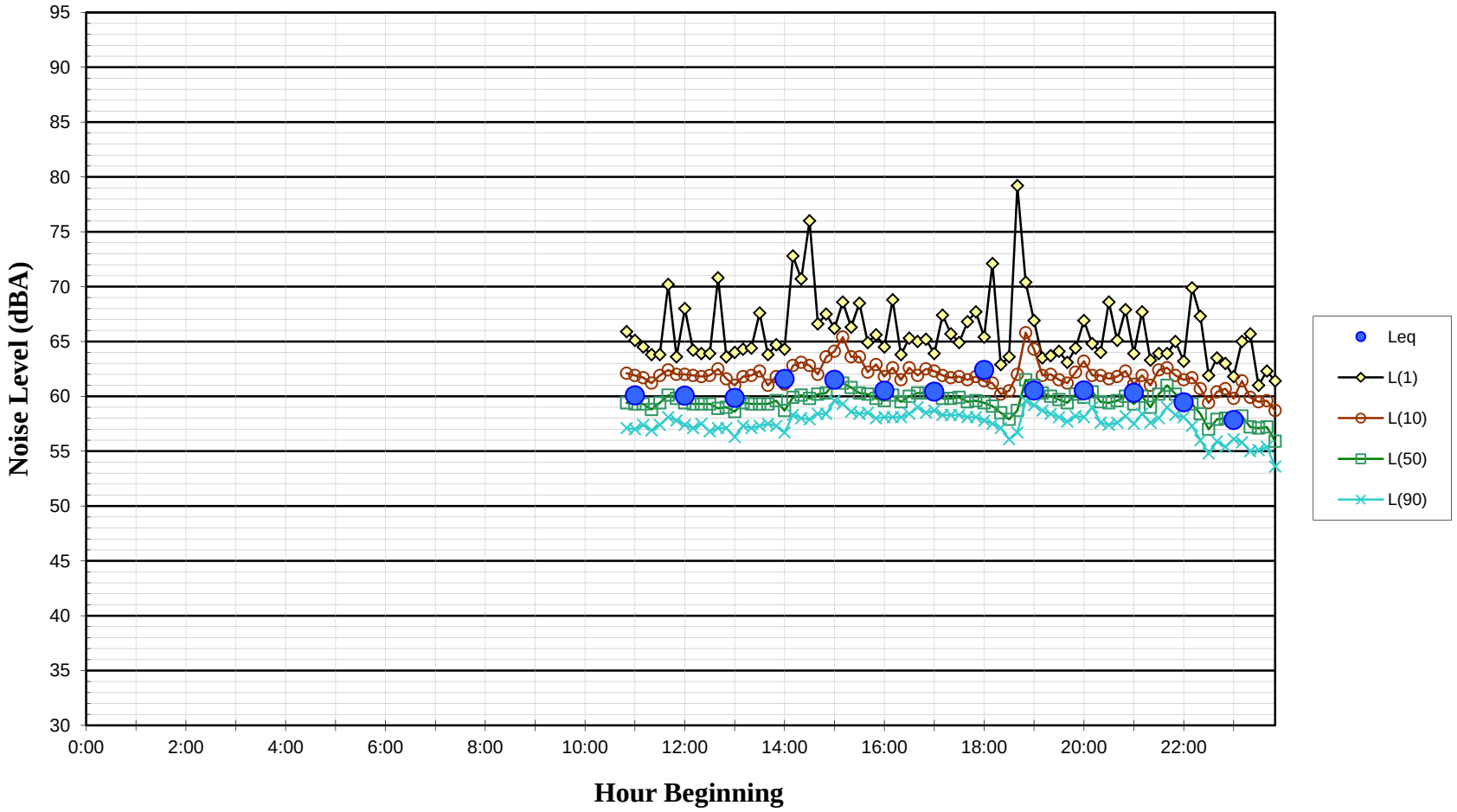


Ldn = 74 dBA

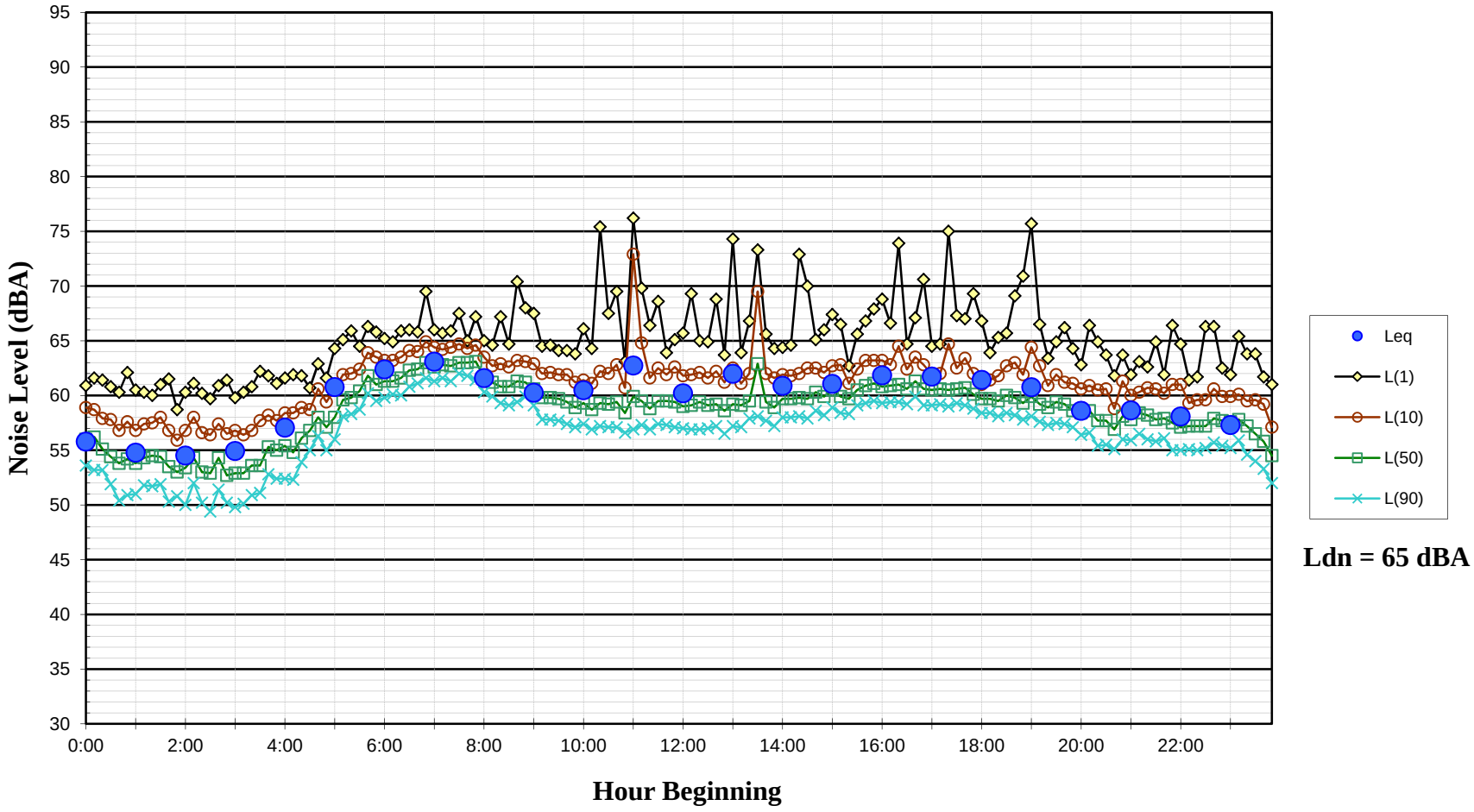
Noise Levels at LT-6
75 N. 31st Street, San Jose, CA
~ 225 feet from the Center of US 101
February 24, 2012



Noise Levels at LT-7
Cul-de-sac of Sunny Court, San Jose, CA
~ 200 feet from the Center of US 101
February 21, 2012

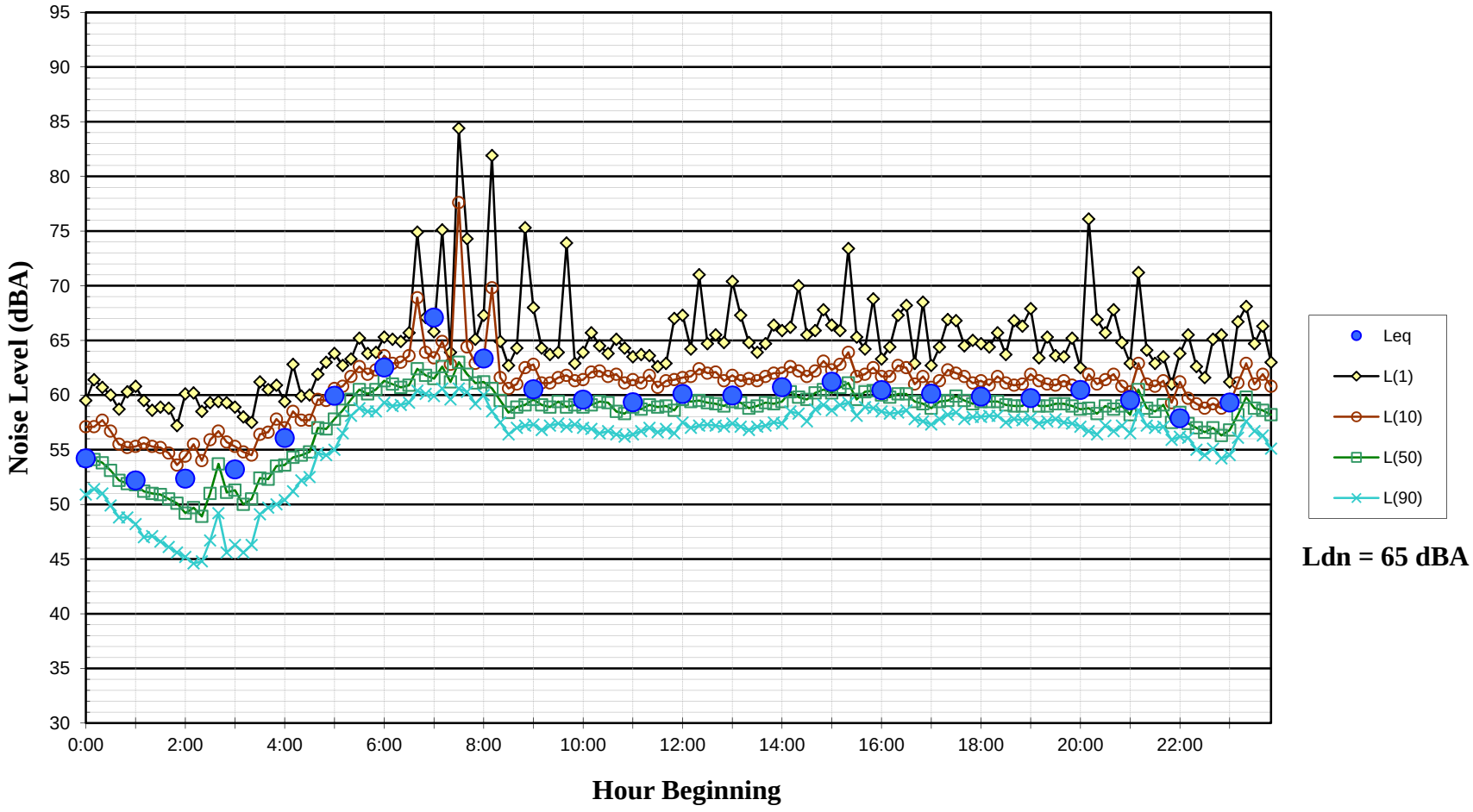


Noise Levels at LT-7
Cul-de-sac of Sunny Court, San Jose, CA
~ 200 feet from the Center of US 101
February 22, 2012



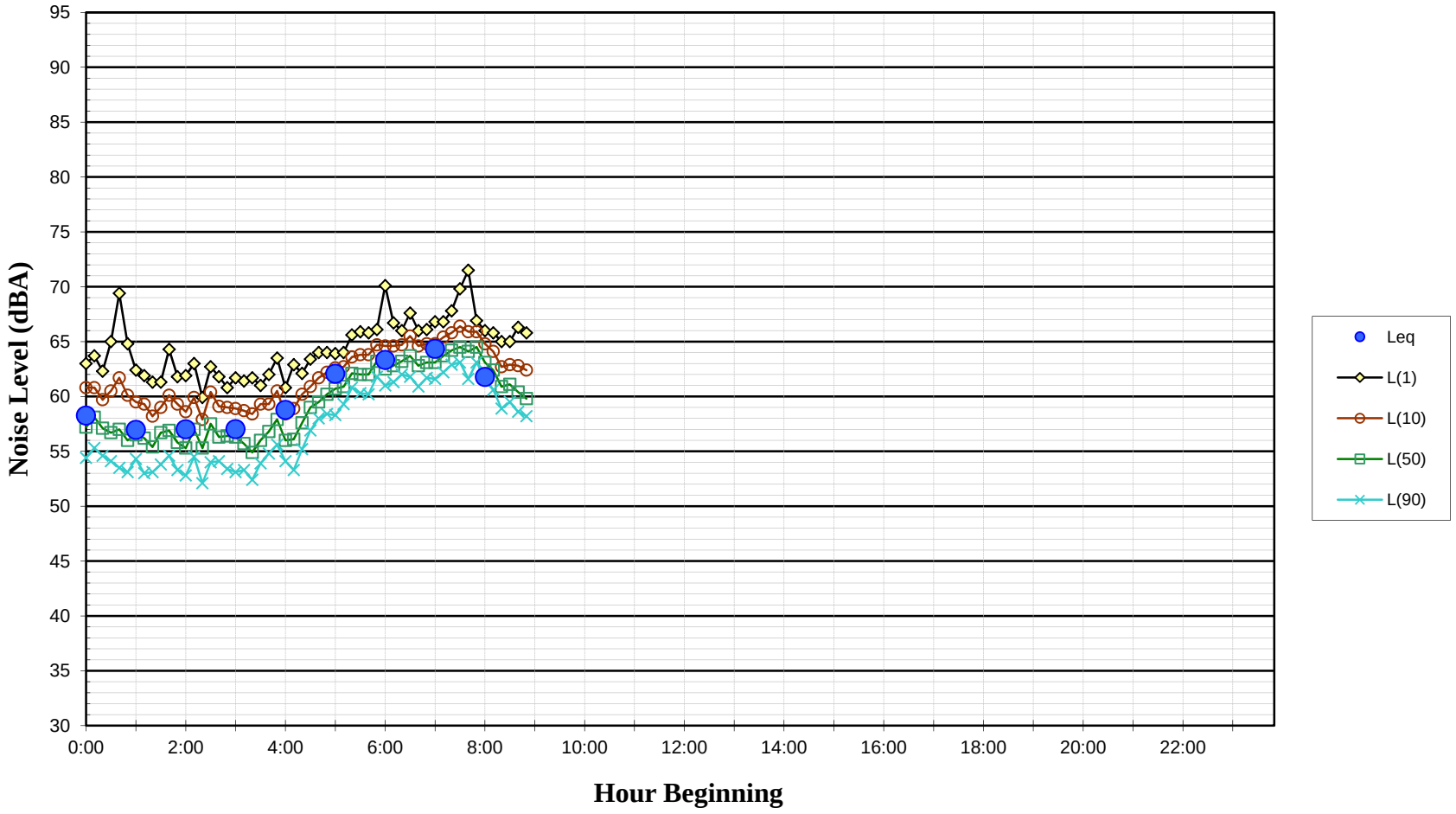
Ldn = 65 dBA

Noise Levels at LT-7
Cul-de-sac of Sunny Court, San Jose, CA
~ 200 feet from the Center of US 101
February 23, 2012

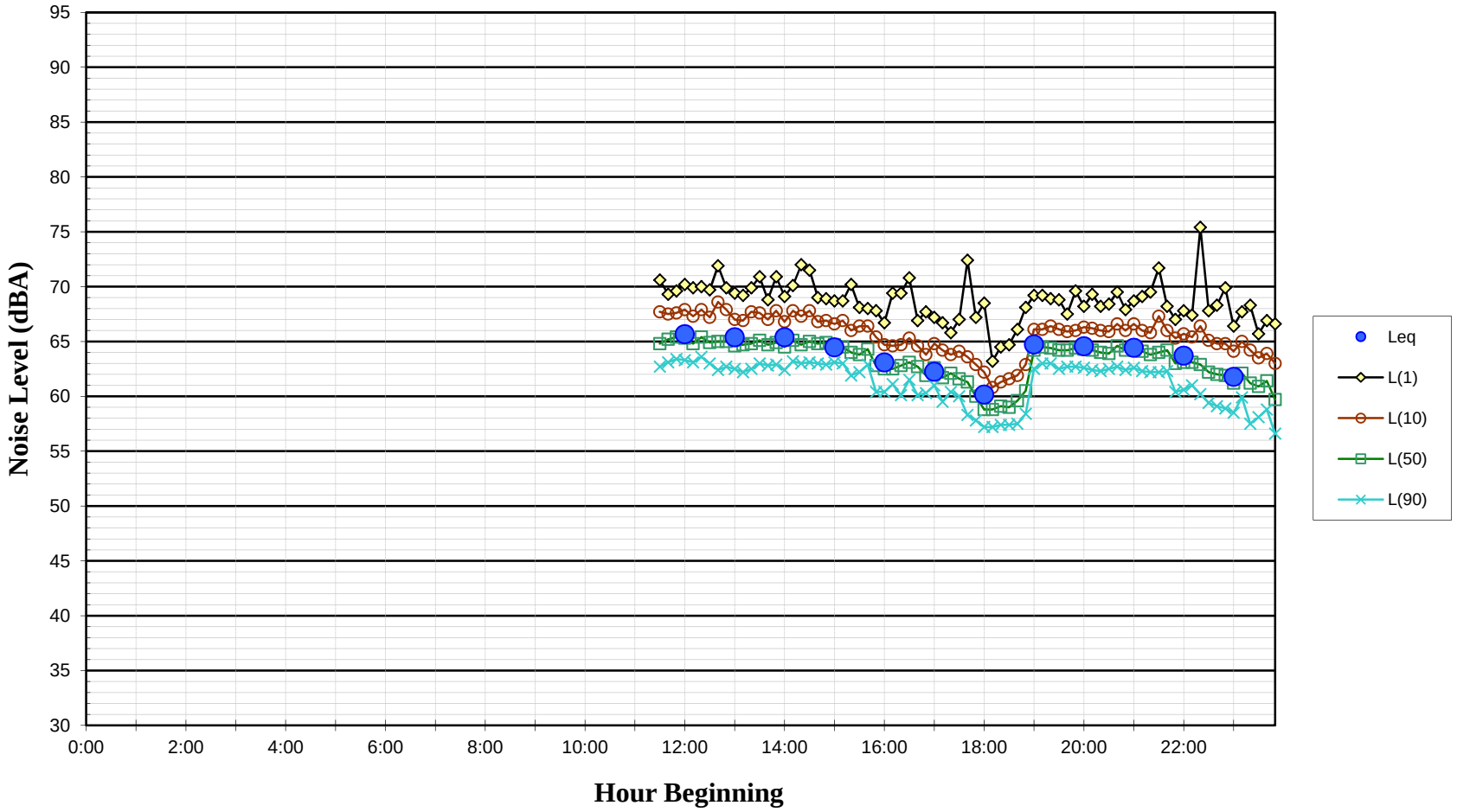


Ldn = 65 dBA

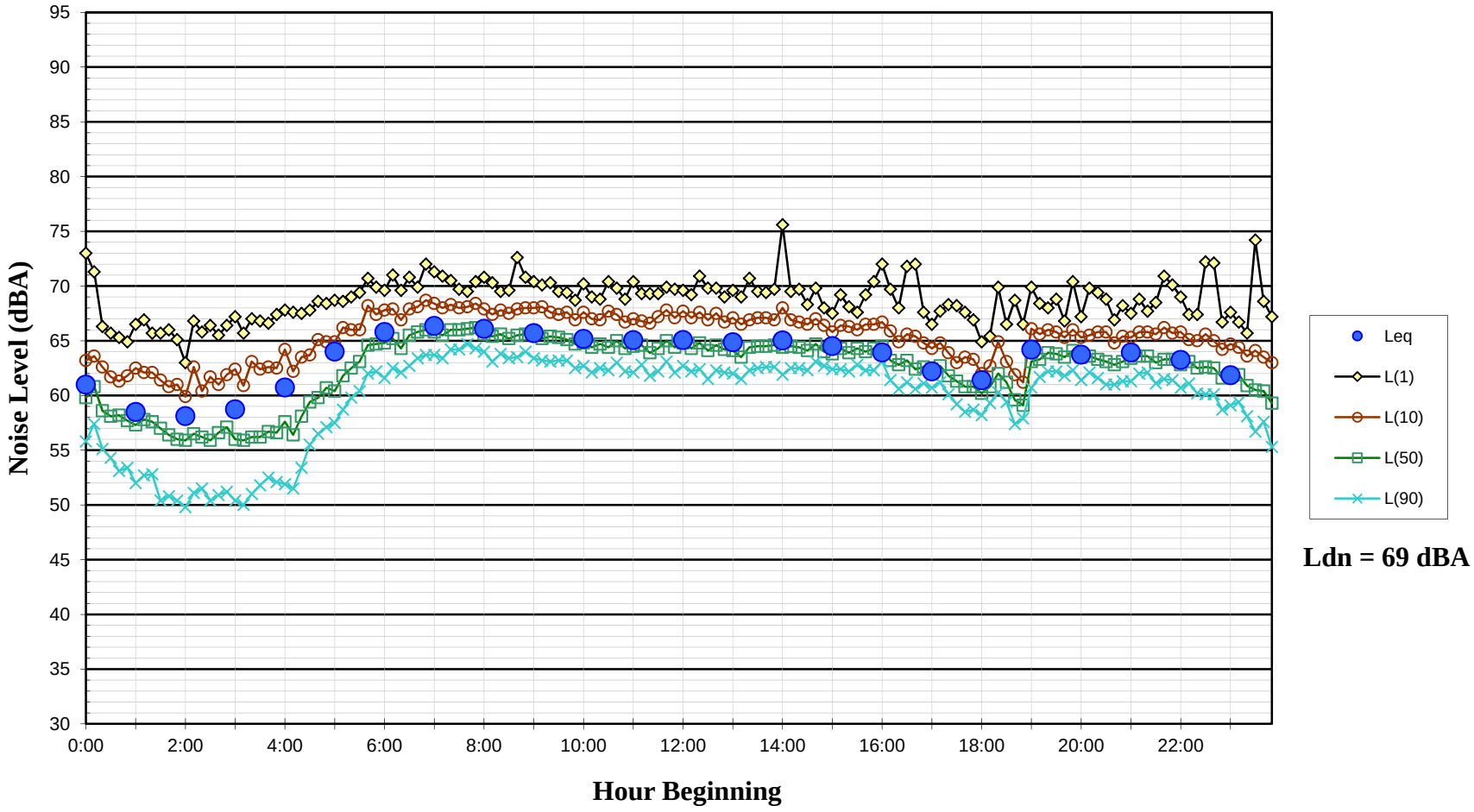
Noise Levels at LT-7
Cul-de-sac of Sunny Court, San Jose, CA
~ 200 feet from the Center of US 101
February 24, 2012



Noise Levels at LT-8
Rear Yard of 1442 Dornoch Avenue, San Jose, CA
~ 120 feet from the Center of US 101
February 21, 2012

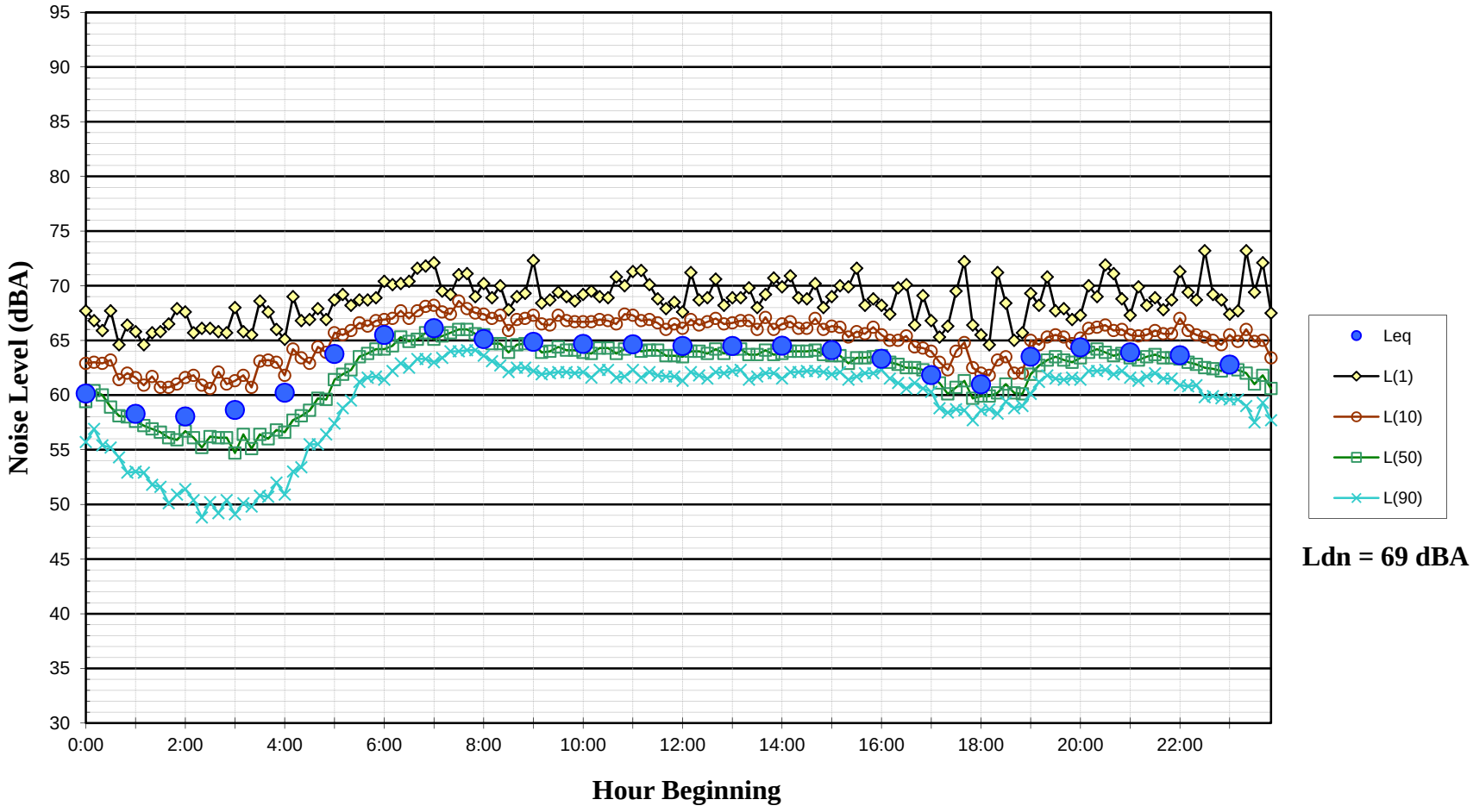


Noise Levels at LT-8
Rear Yard of 1442 Dornoch Avenue, San Jose, CA
~ 120 feet from the Center of US 101
February 22, 2012



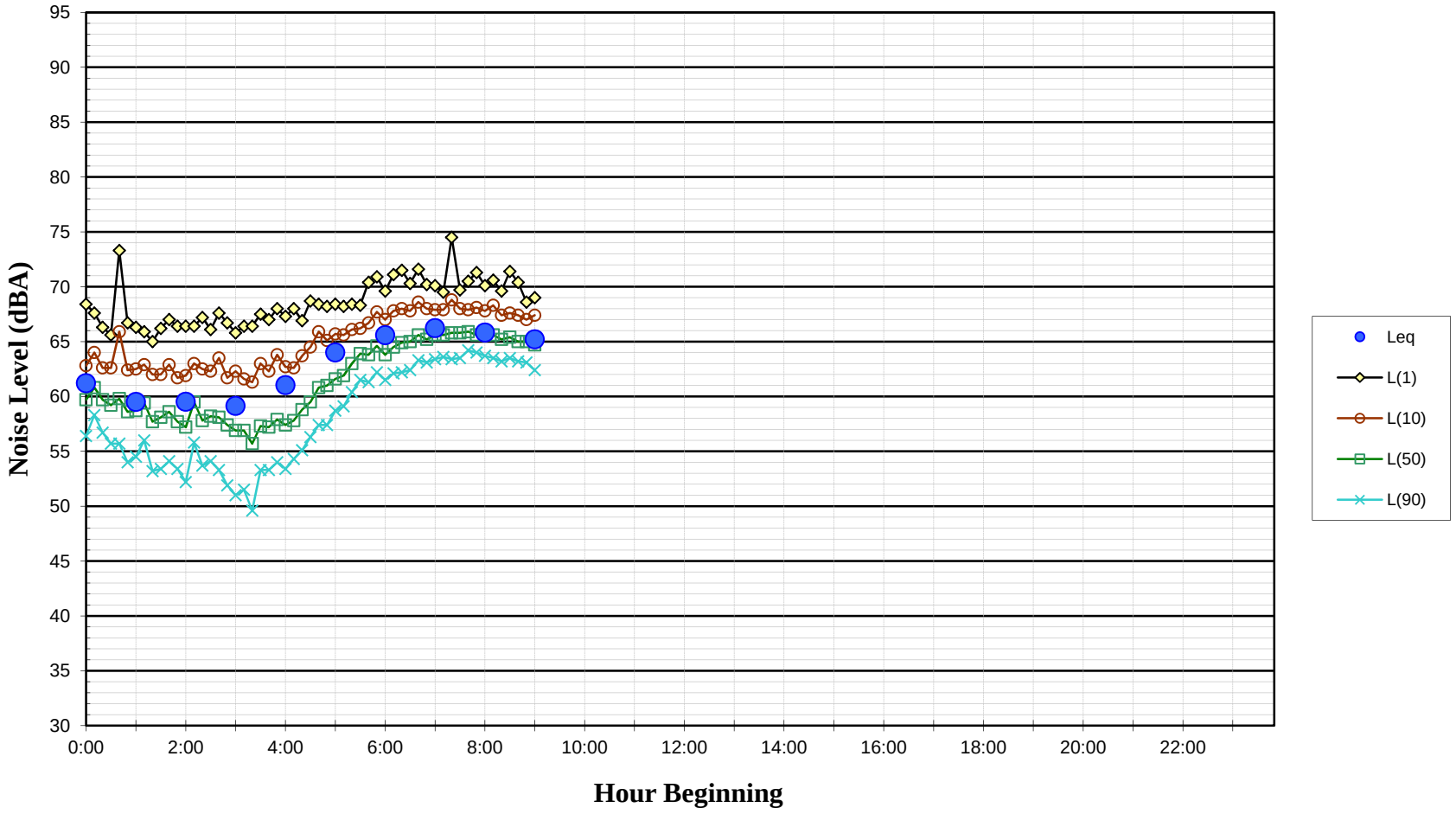
Ldn = 69 dBA

Noise Levels at LT-8
Rear Yard of 1442 Dornoch Avenue, San Jose, CA
~ 120 feet from the Center of US 101
February 23, 2012

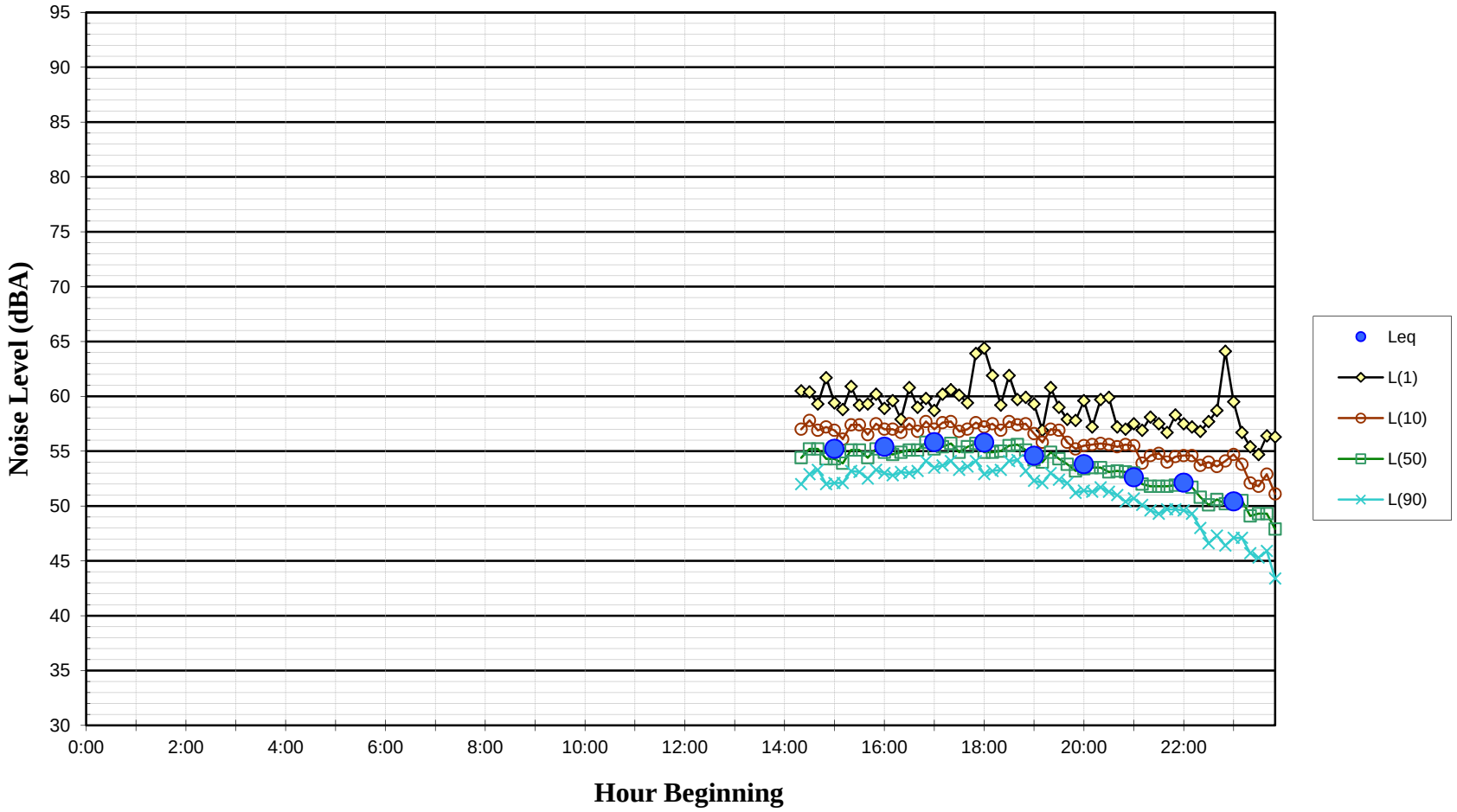


Ldn = 69 dBA

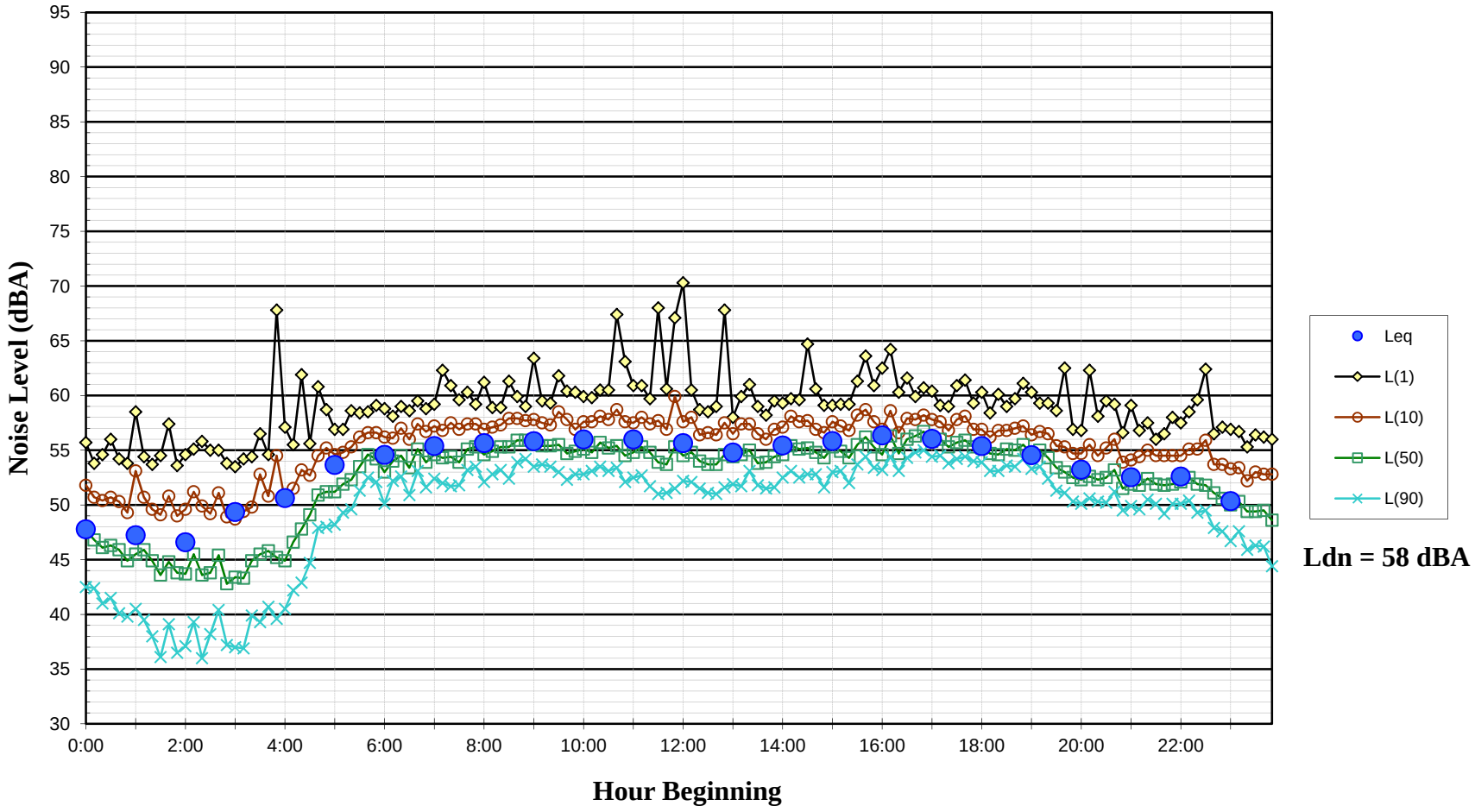
Noise Levels at LT-8
Rear Yard of 1442 Dornoch Avenue, San Jose, CA
~ 120 feet from the Center of US 101
February 24, 2012



Noise Levels at LT-9
Rear Yard of 1337 Isengard Court, San Jose, CA
~ 180 feet from the Center of US 101
March 19, 2012

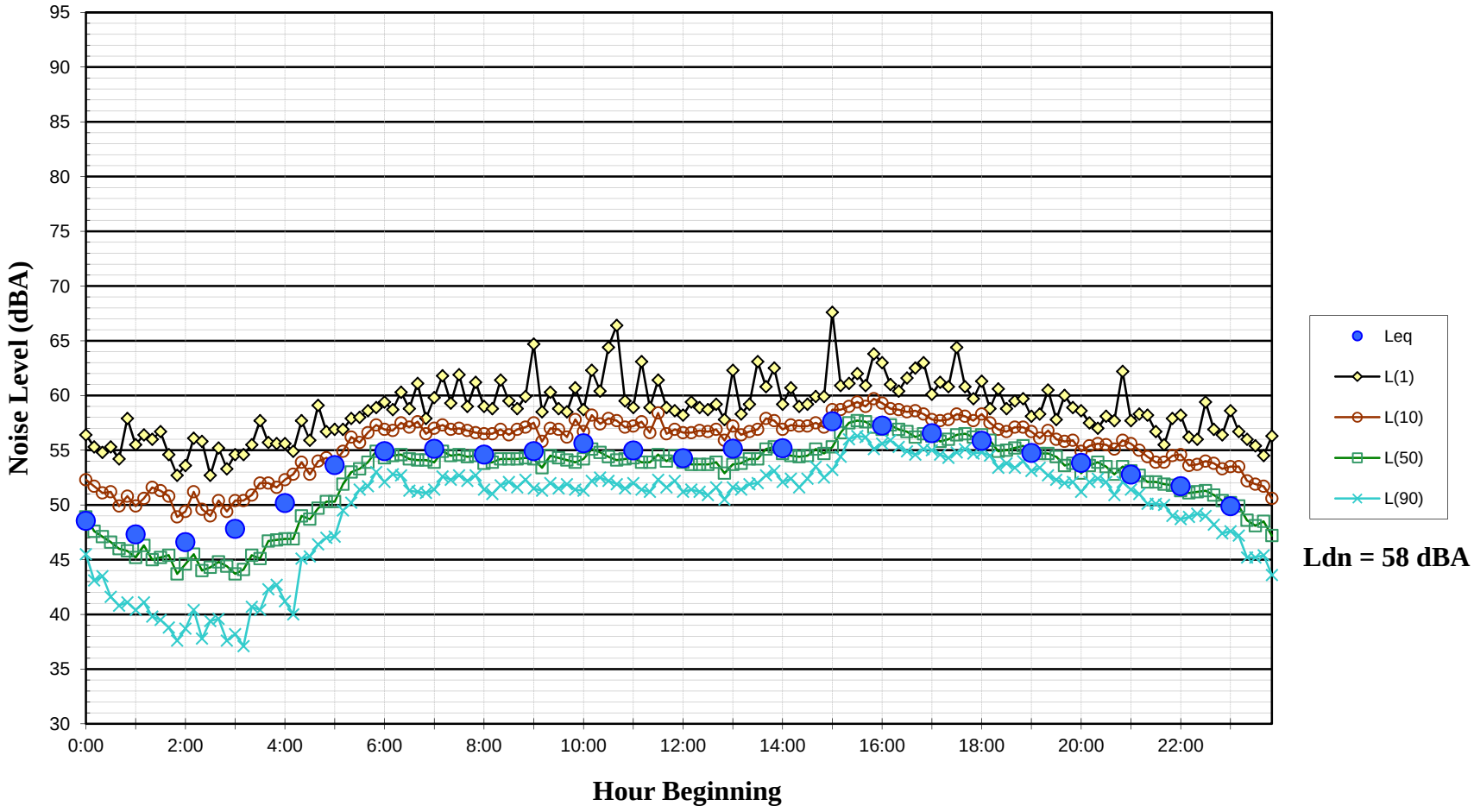


Noise Levels at LT-9
Rear Yard of 1337 Isengard Court, San Jose, CA
~ 180 feet from the Center of US 101
March 20, 2012



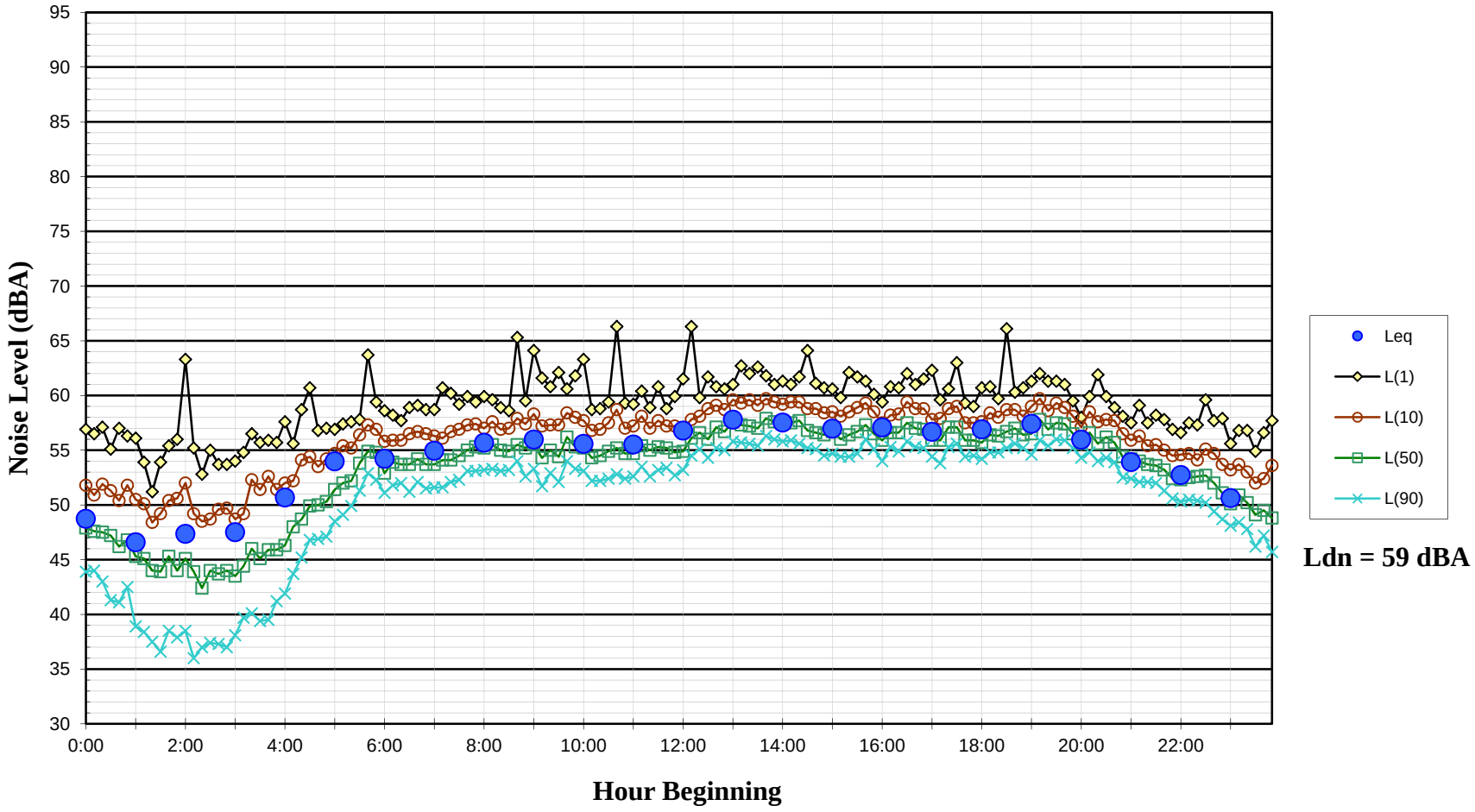
Ldn = 58 dBA

Noise Levels at LT-9
Rear Yard of 1337 Isengard Court, San Jose, CA
~ 180 feet from the Center of US 101
March 21, 2012



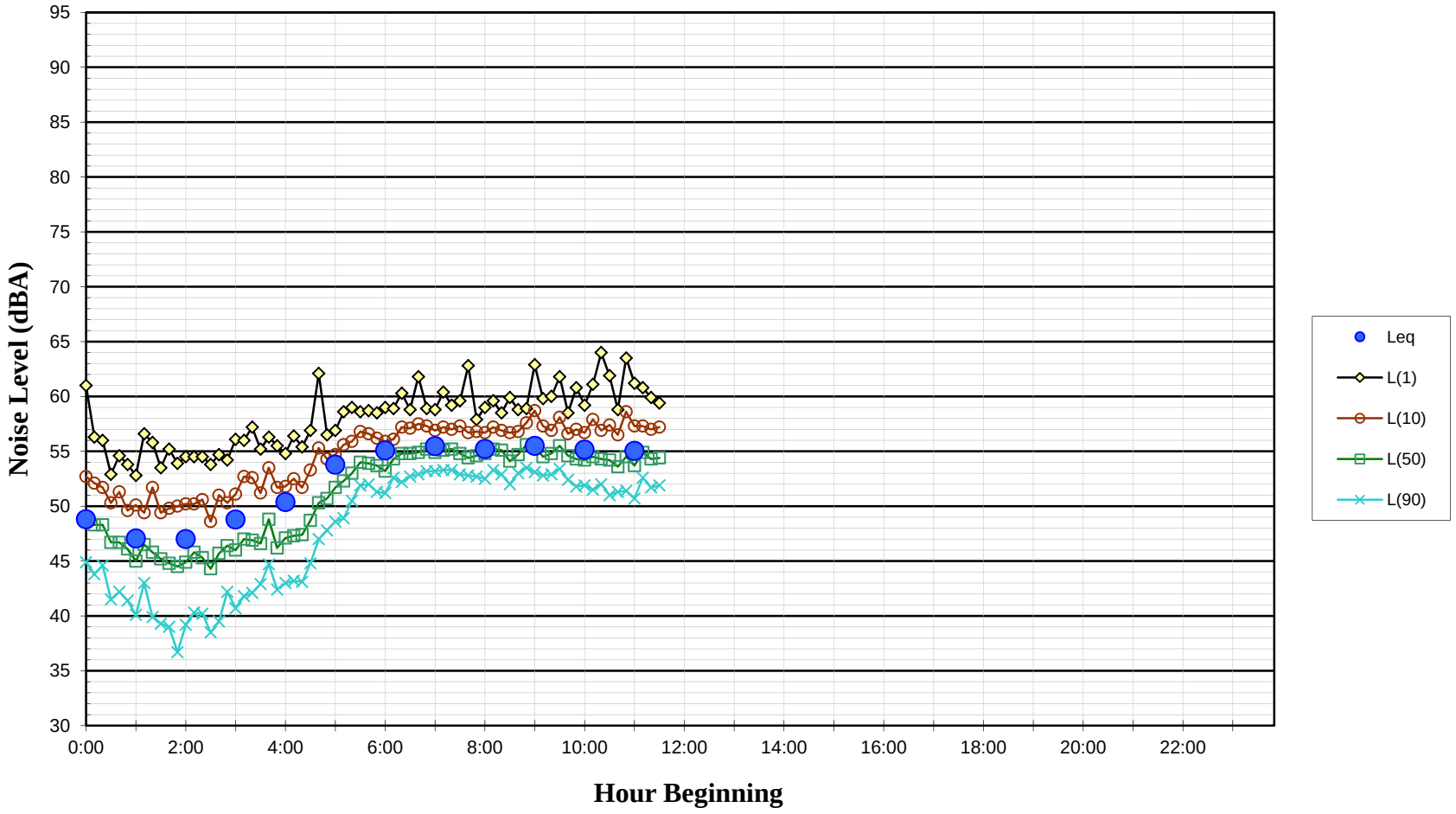
Ldn = 58 dBA

Noise Levels at LT-9
Rear Yard of 1337 Isengard Court, San Jose, CA
~ 180 feet from the Center of US 101
March 22, 2012

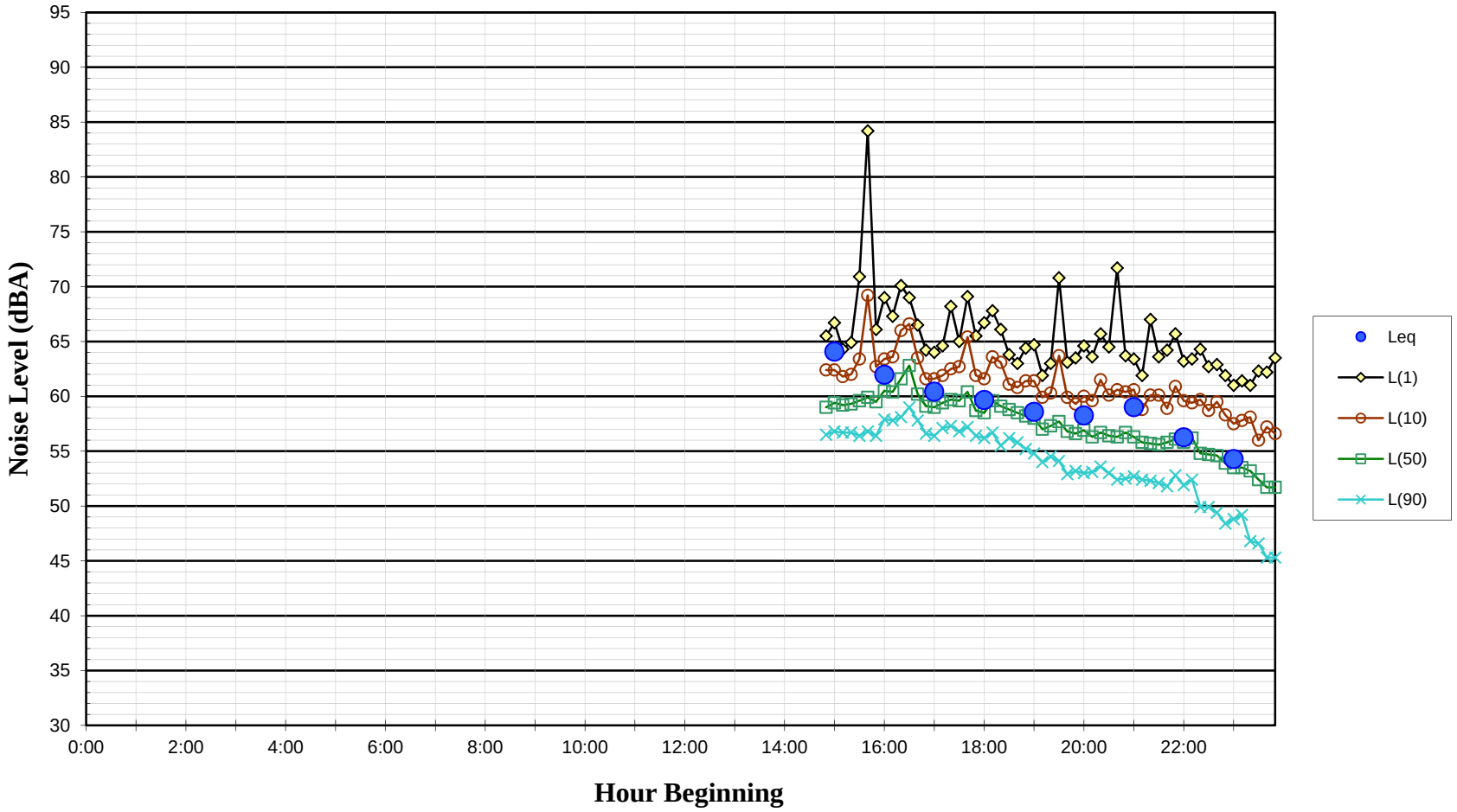


Ldn = 59 dBA

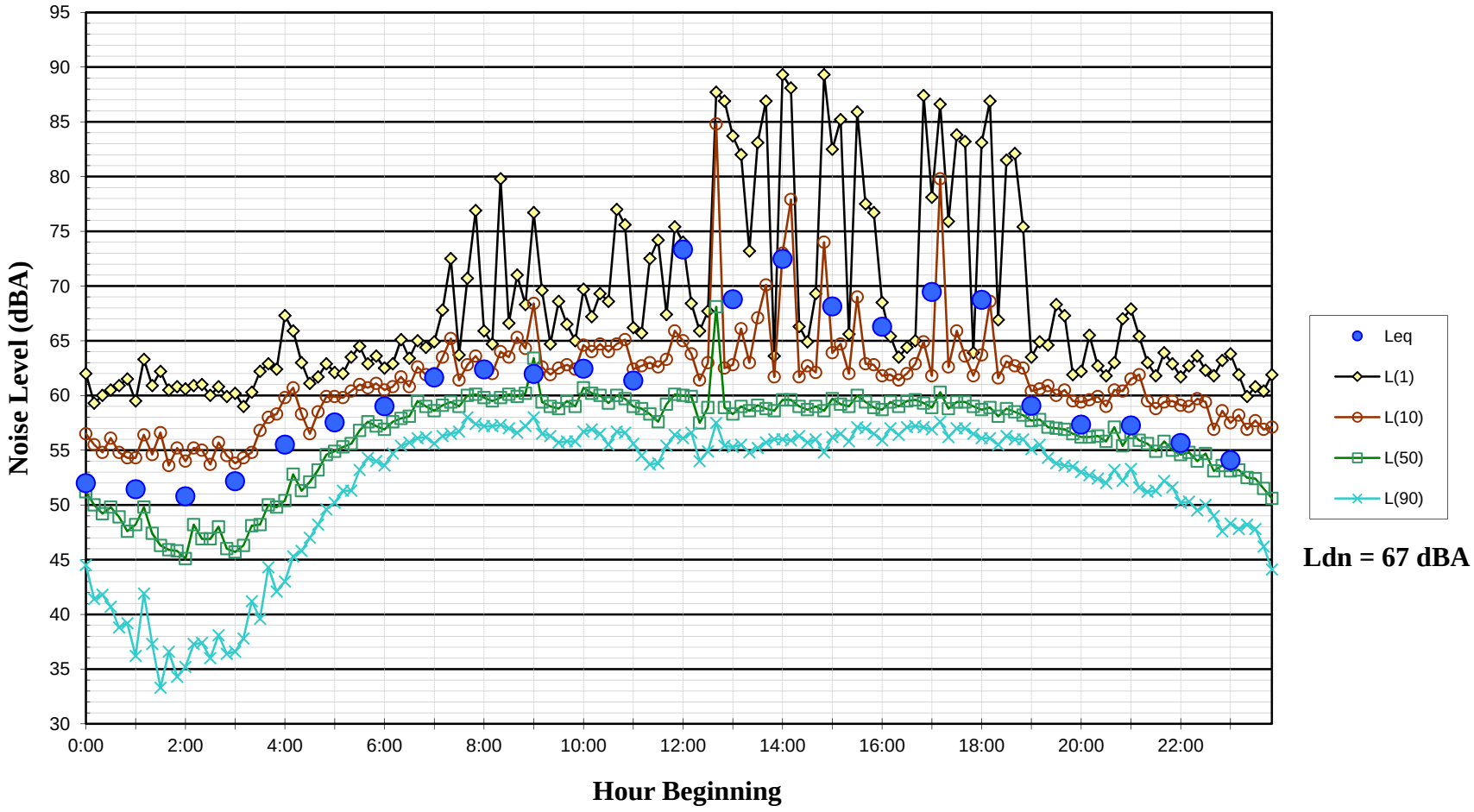
Noise Levels at LT-9
Rear Yard of 1337 Isengard Court, San Jose, CA
~ 180 feet from the Center of US 101
March 23, 2012



Noise Levels at LT-10
Rear Yard of 4885 Snow Drive, San Jose, CA
~ 145 feet from the Center of US 101
March 19, 2012

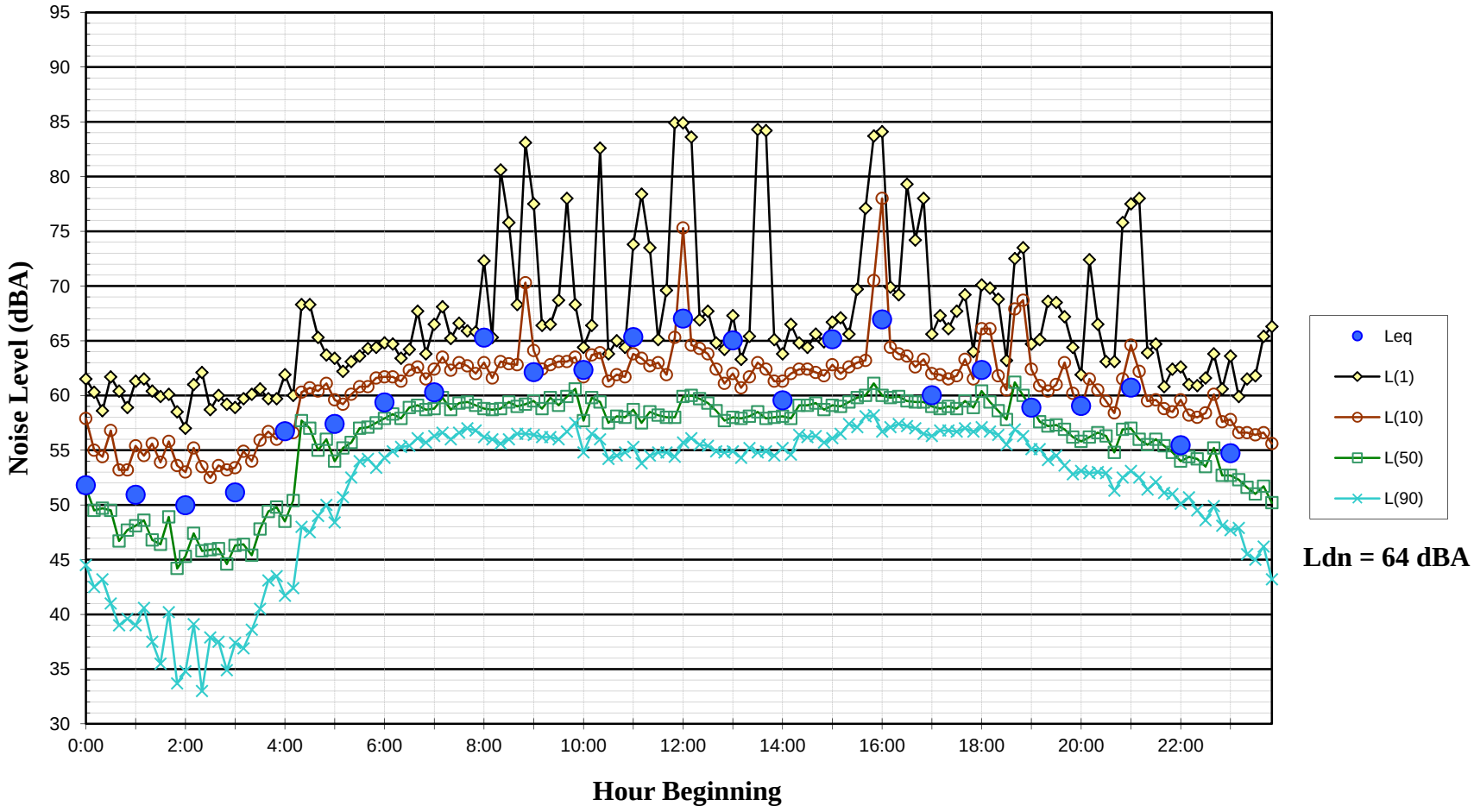


Noise Levels at LT-10
Rear Yard of 4885 Snow Drive, San Jose, CA
~ 145 feet from the Center of US 101
March 20, 2012



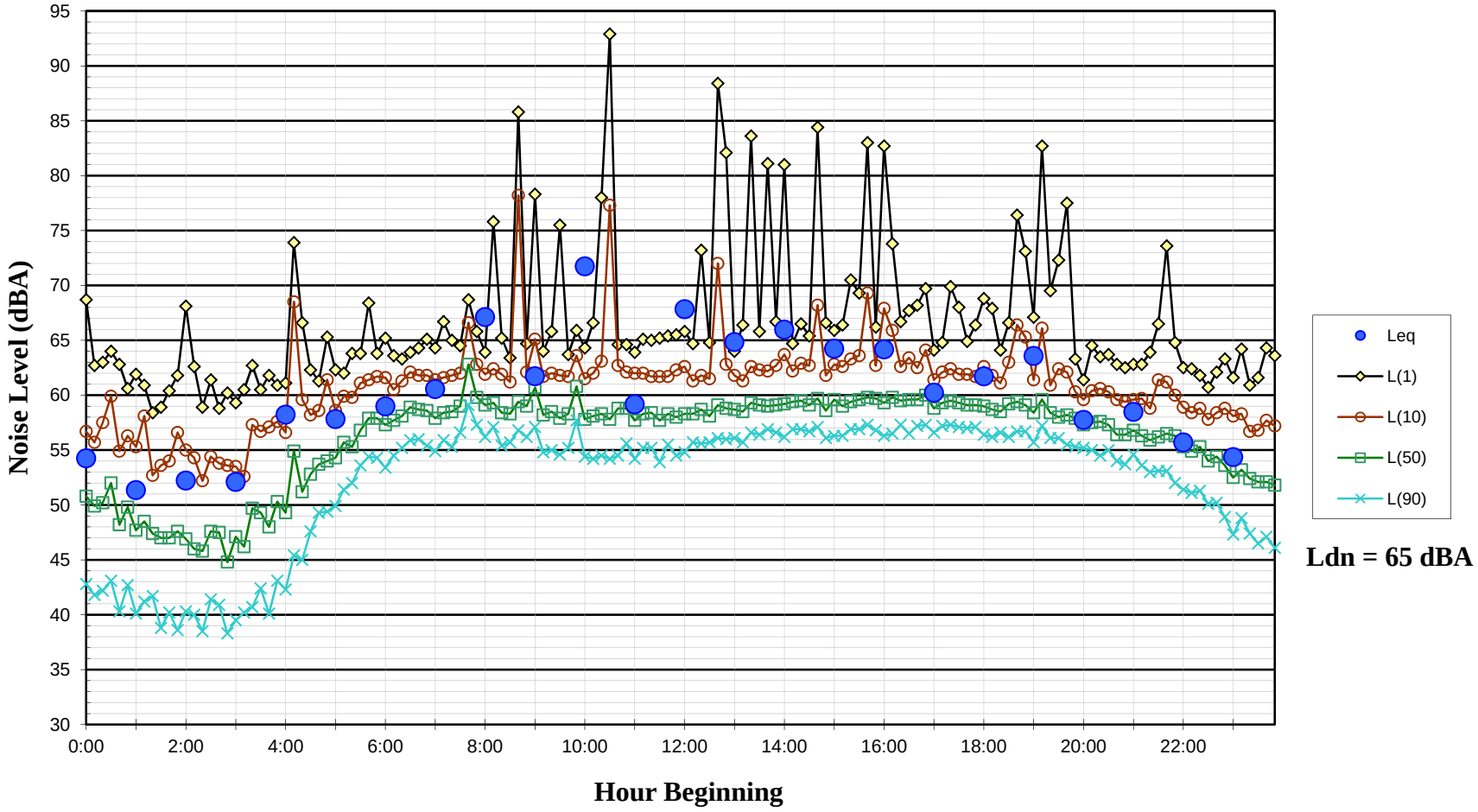
Ldn = 67 dBA

Noise Levels at LT-10
Rear Yard of 4885 Snow Drive, San Jose, CA
~ 145 feet from the Center of US 101
March 21, 2012



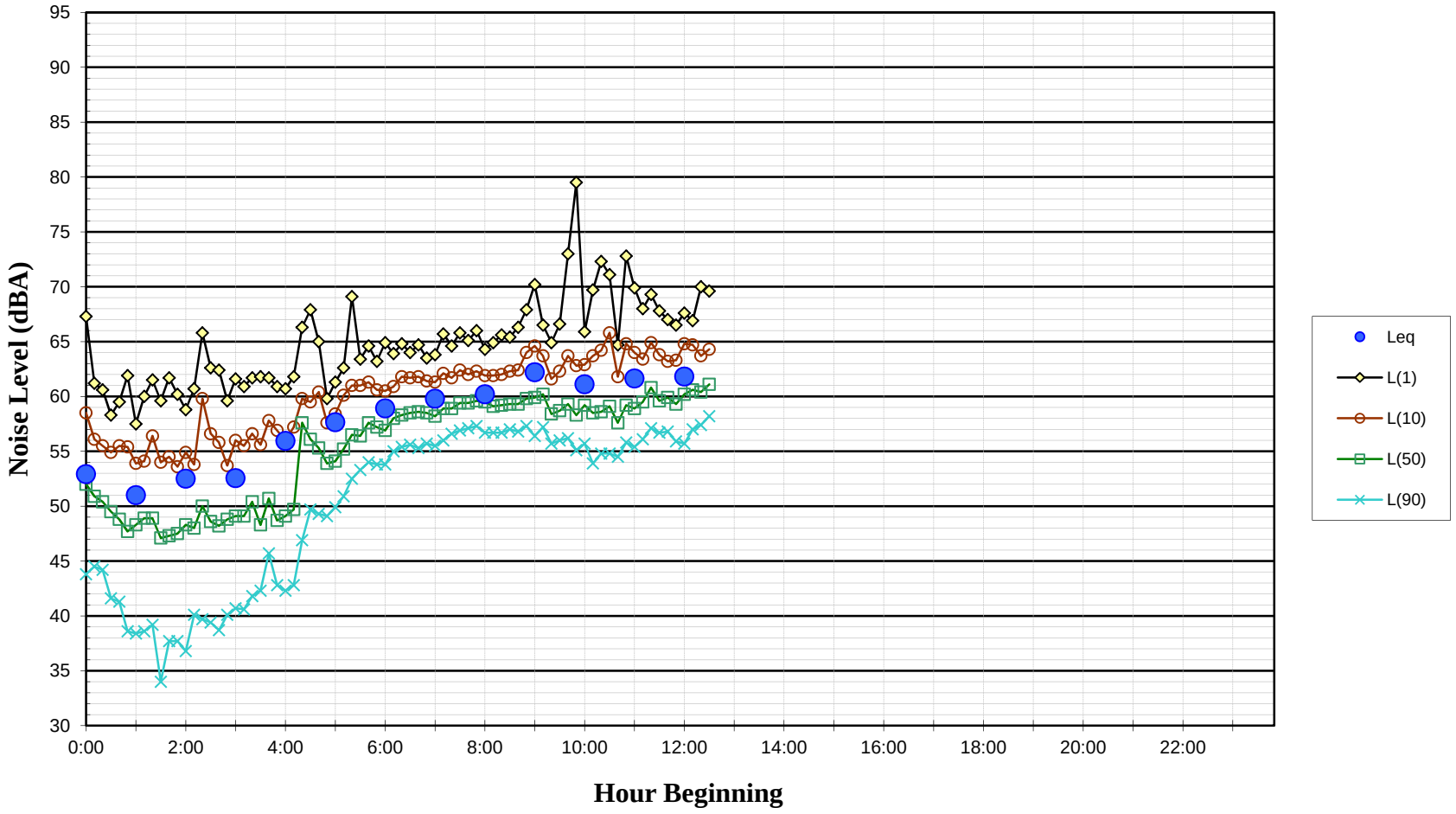
Ldn = 64 dBA

Noise Levels at LT-10
Rear Yard of 4885 Snow Drive, San Jose, CA
~ 145 feet from the Center of US 101
March 22, 2012

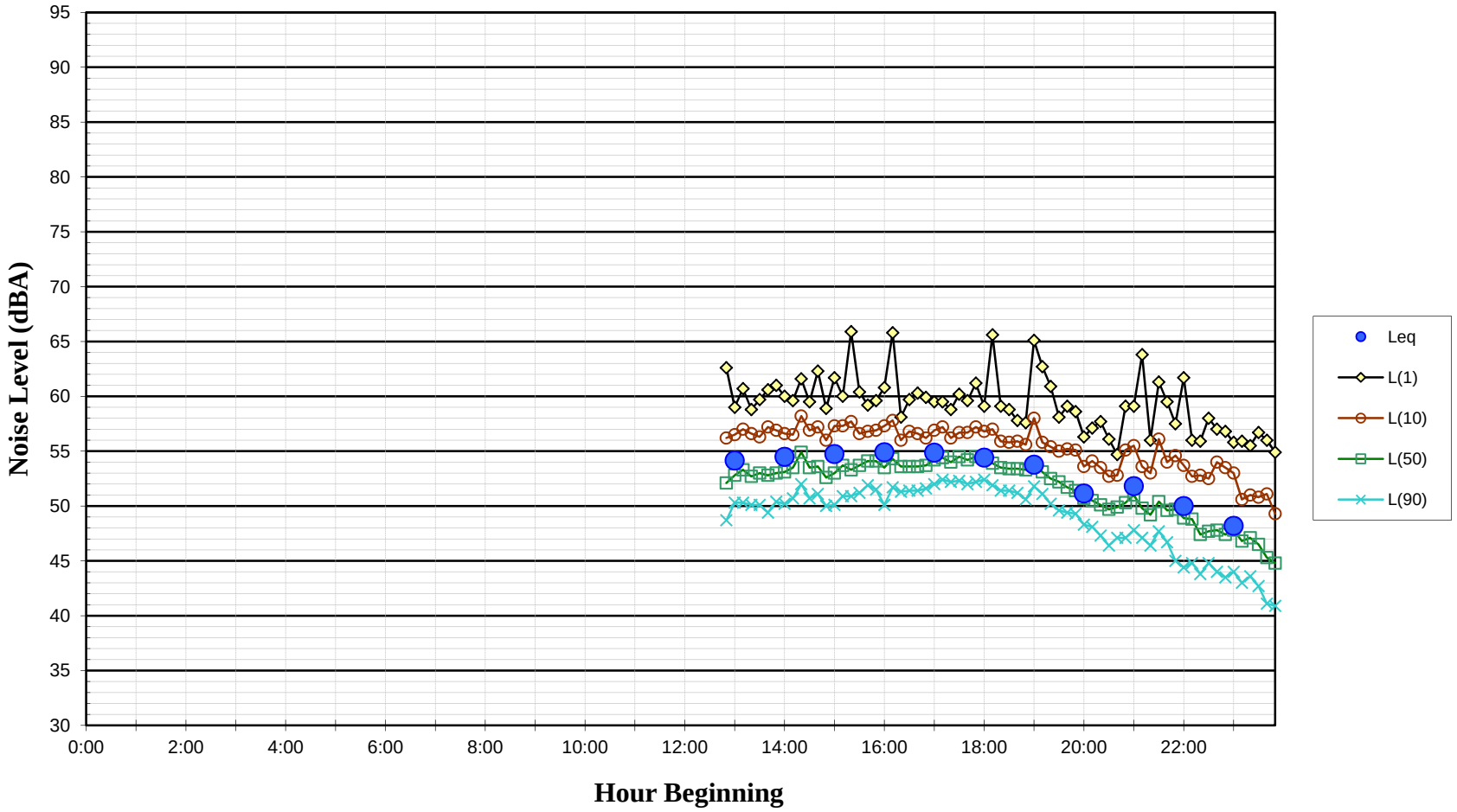


Ldn = 65 dBA

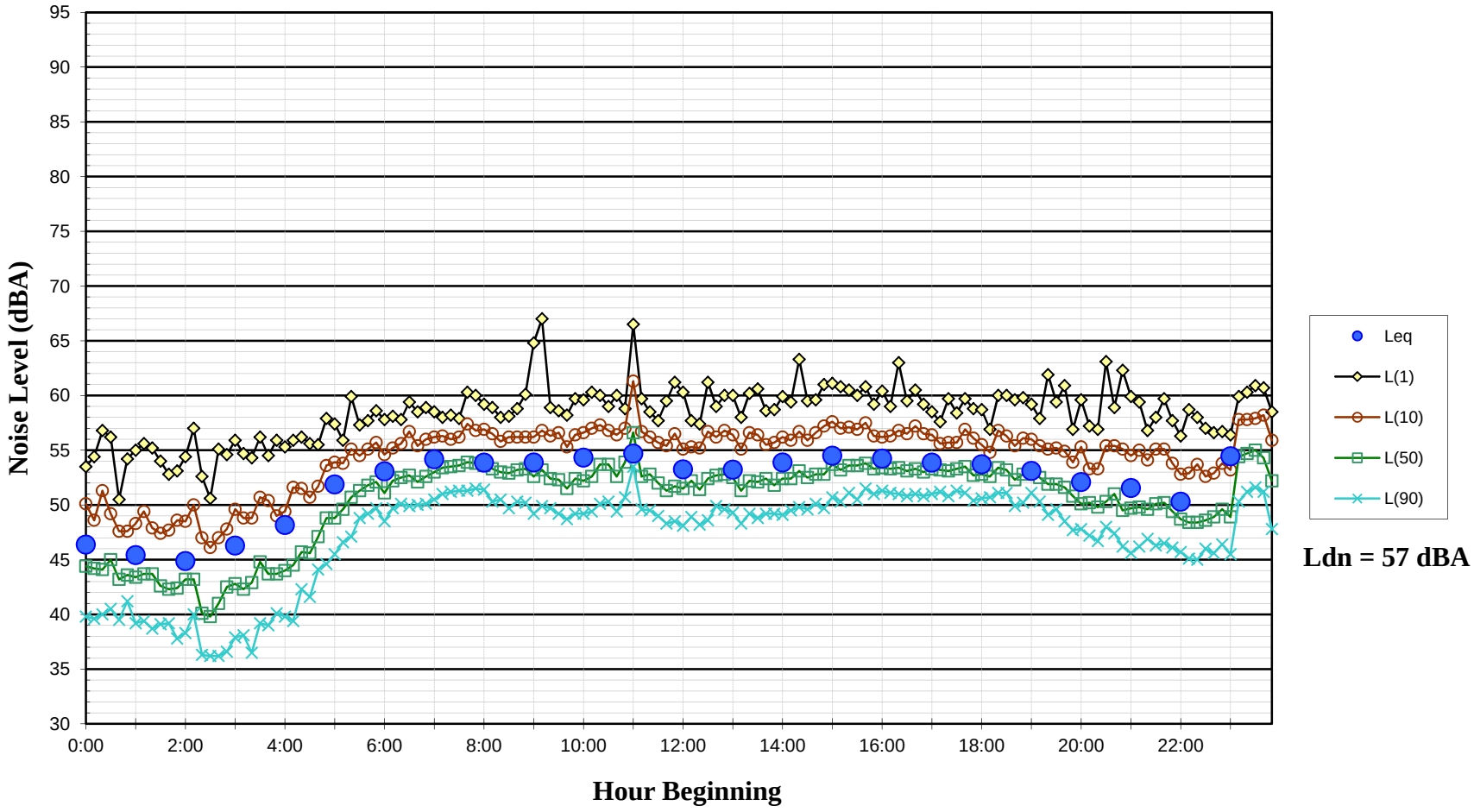
Noise Levels at LT-10
Rear Yard of 4885 Snow Drive, San Jose, CA
~ 145 feet from the Center of US 101
March 23, 2012



Noise Levels at LT-11
Rear Yard of 139 Mosswell Court, San Jose, CA
~ 160 feet from the Center of US 101
April 2, 2012

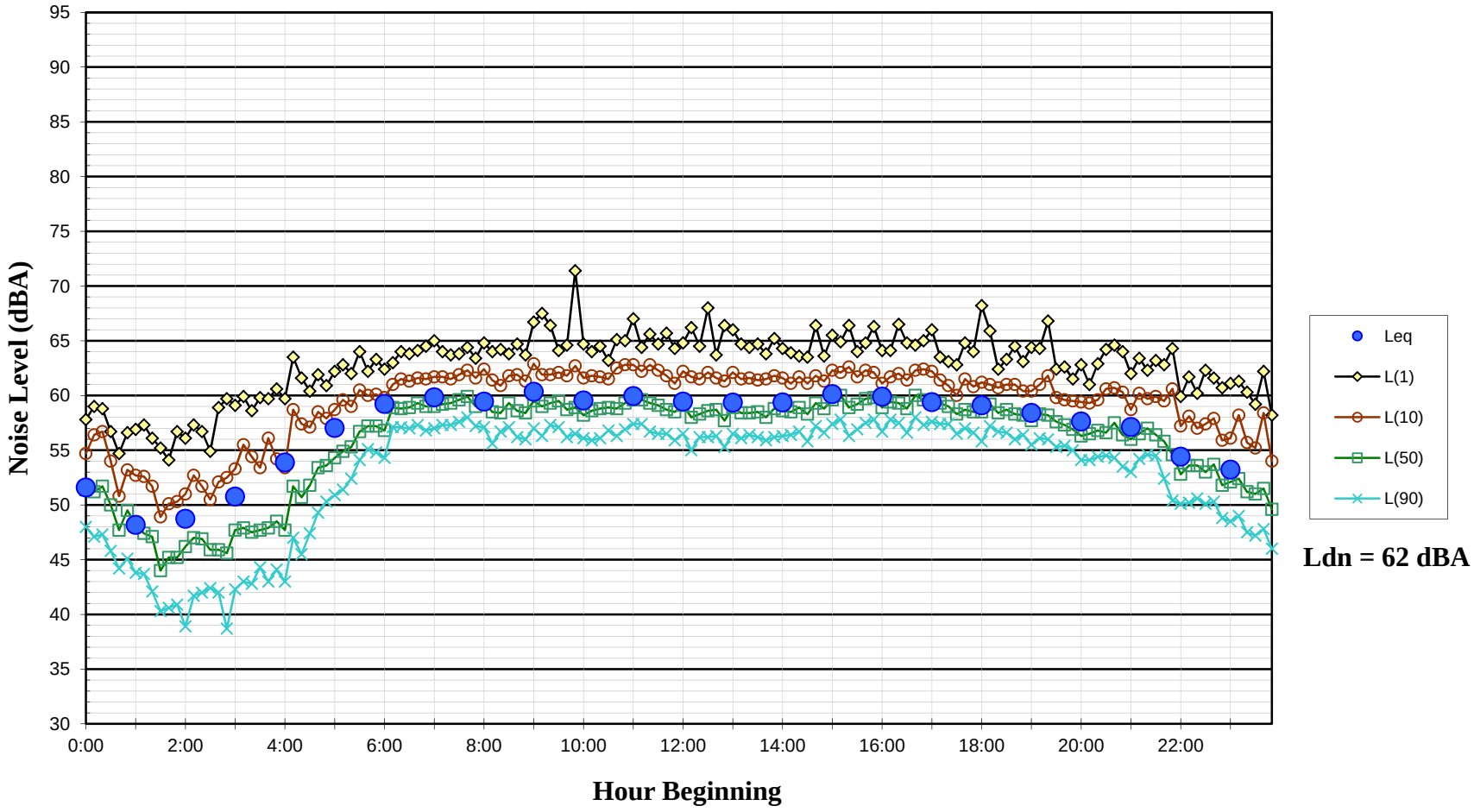


Noise Levels at LT-11
Rear Yard of 139 Mosswell Court, San Jose, CA
~ 160 feet from the Center of US 101
April 3, 2012



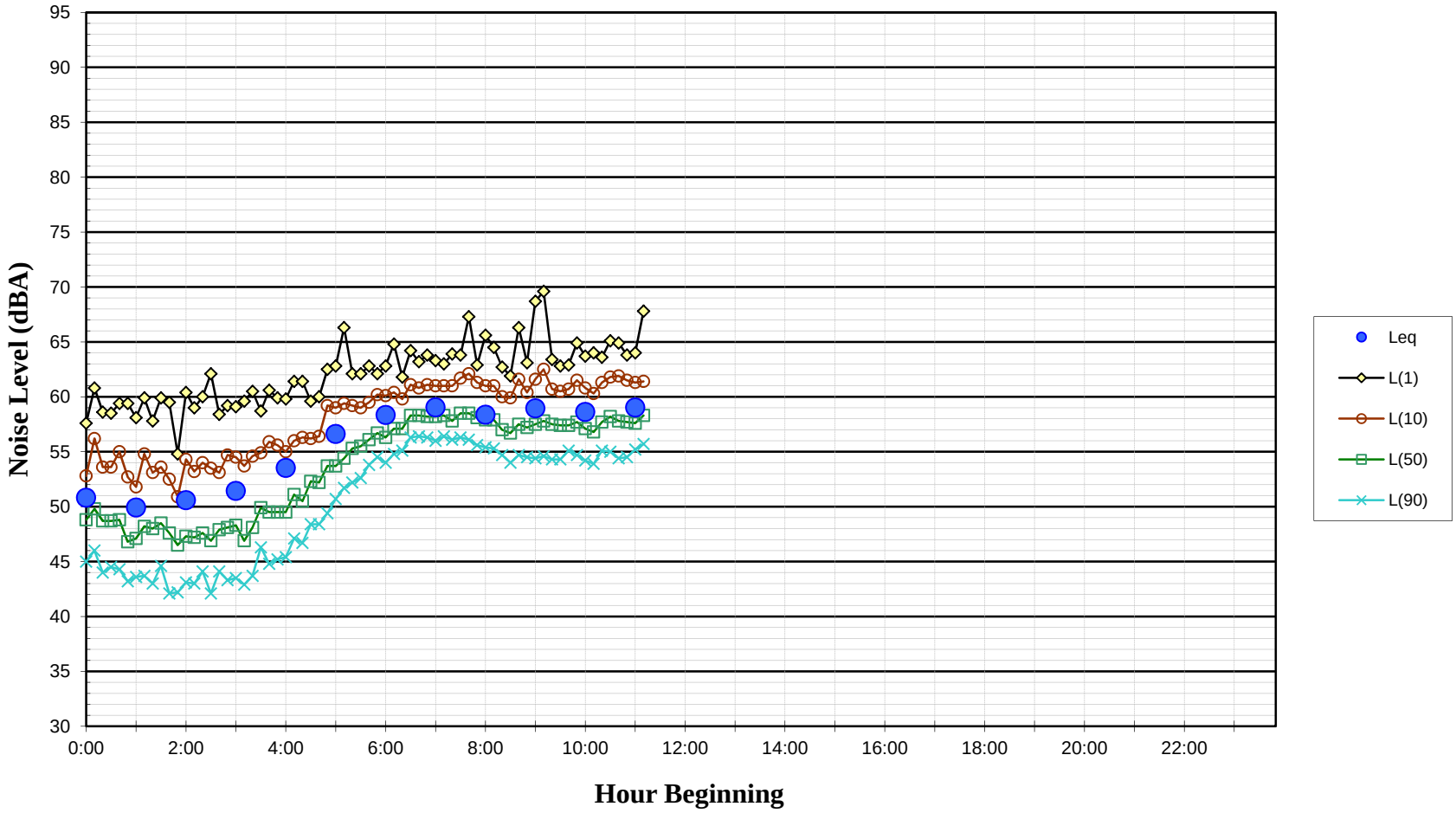
Ldn = 57 dBA

Noise Levels at LT-11
Rear Yard of 139 Mosswell Court, San Jose, CA
~ 160 feet from the Center of US 101
April 4, 2012

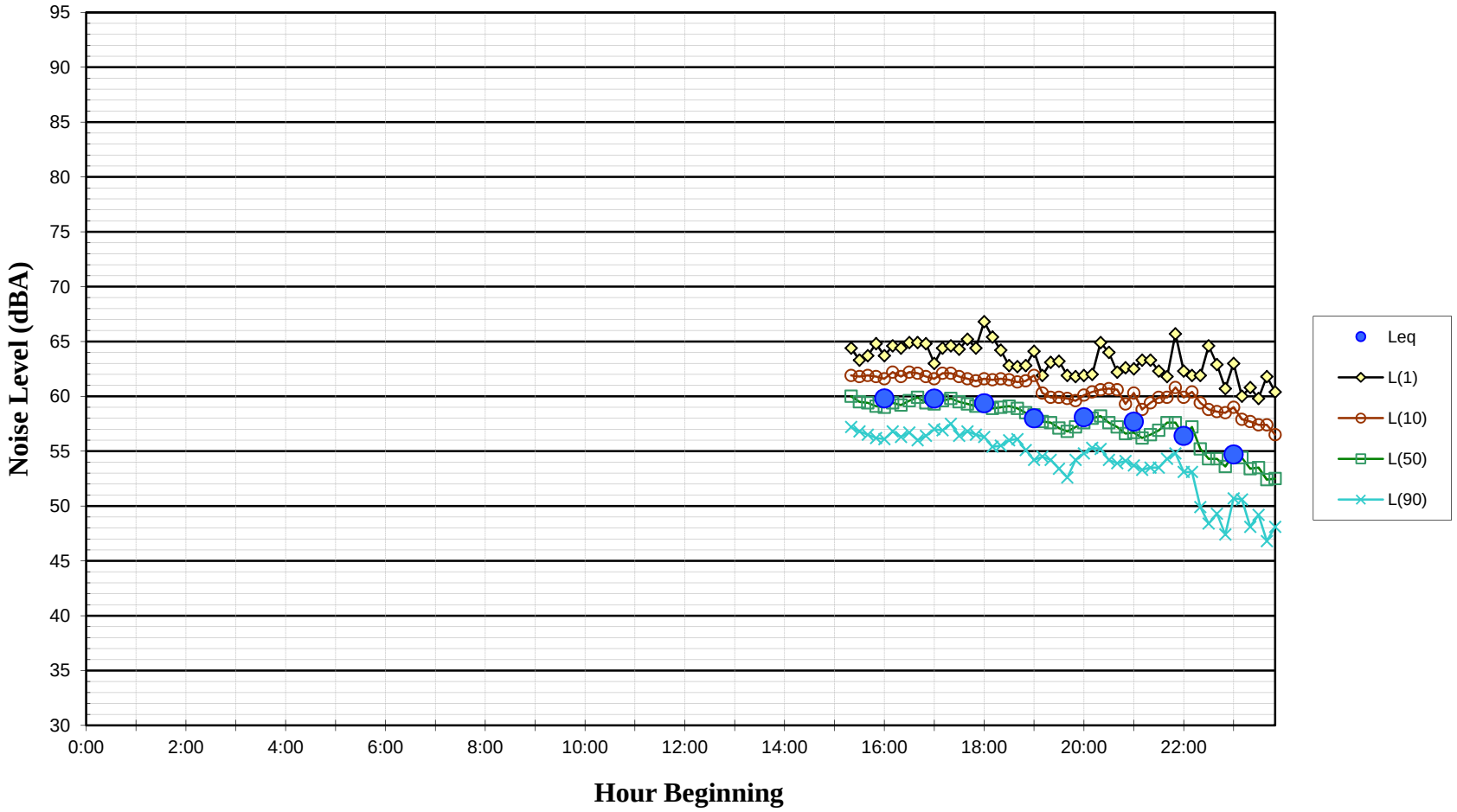


Ldn = 62 dBA

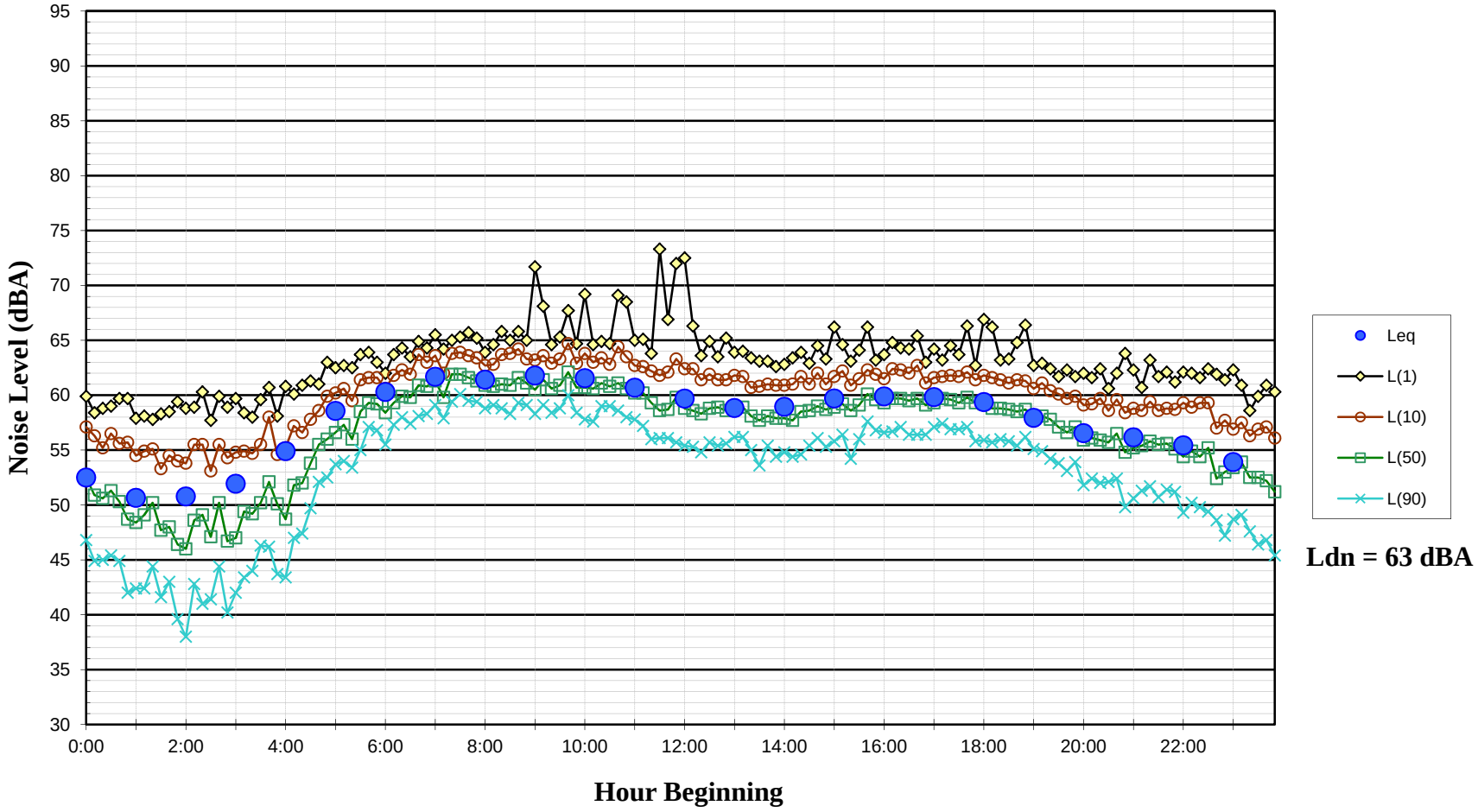
Noise Levels at LT-11
Rear Yard of 139 Mosswell Court, San Jose, CA
~ 160 feet from the Center of US 101
April 5, 2012



Noise Levels at LT-12
Rear Yard of 148 Flintwell Court, San Jose, CA
~ 190 feet from the Center of US 101
March 19, 2012

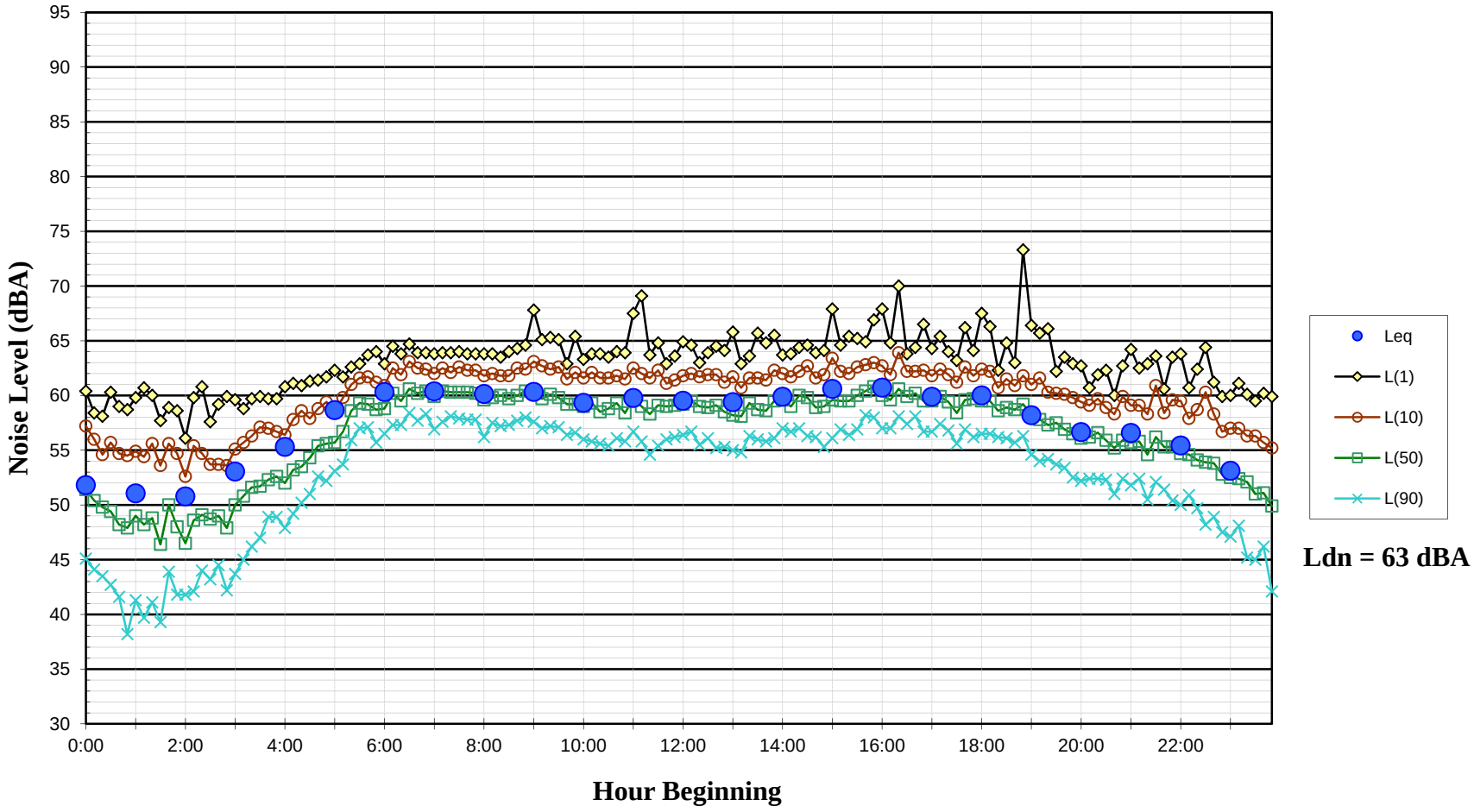


Noise Levels at LT-12
Rear Yard of 148 Flintwell Court, San Jose, CA
~ 190 feet from the Center of US 101
March 20, 2012



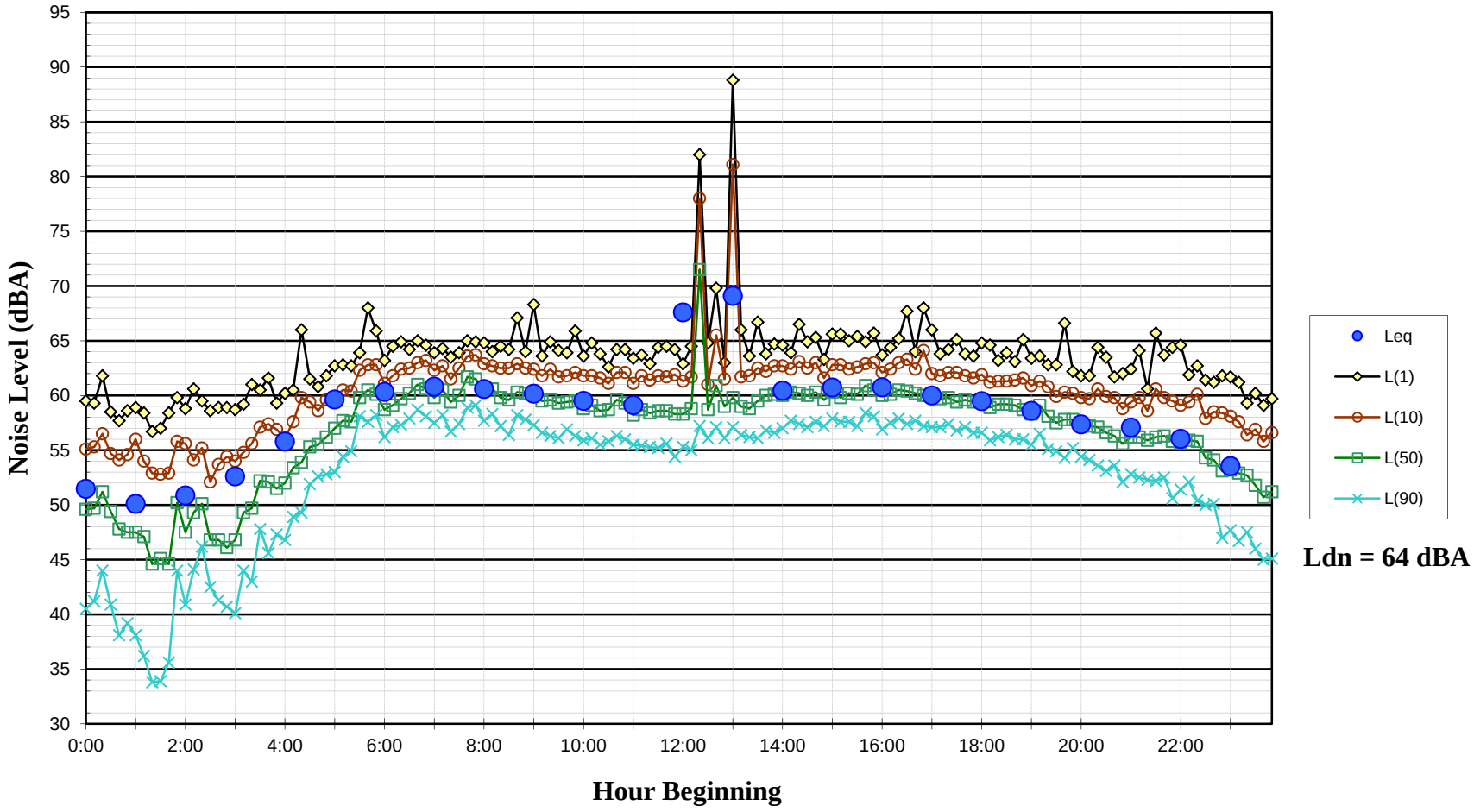
Ldn = 63 dBA

Noise Levels at LT-12
Rear Yard of 148 Flintwell Court, San Jose, CA
~ 190 feet from the Center of US 101
March 21, 2012



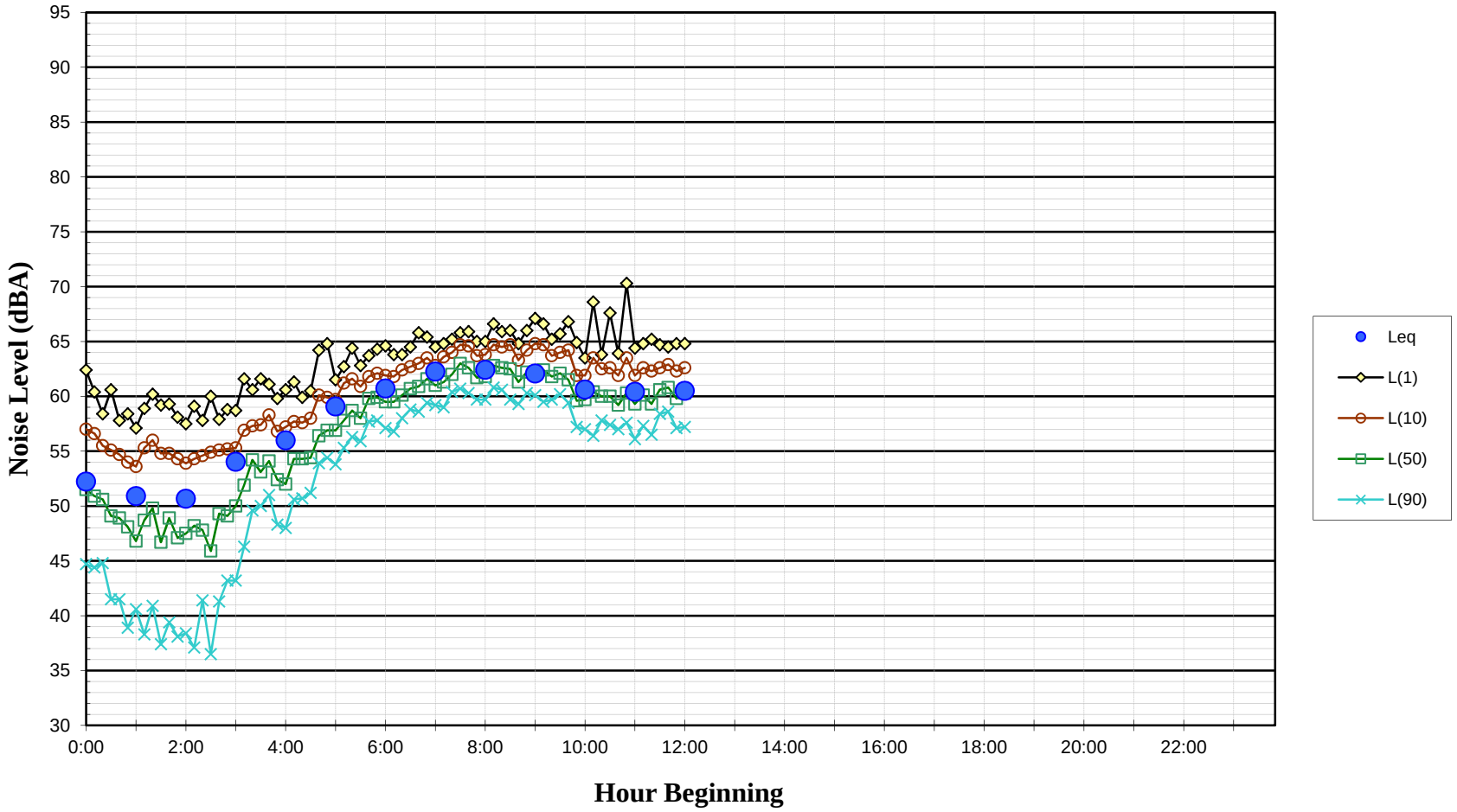
Ldn = 63 dBA

Noise Levels at LT-12
Rear Yard of 148 Flintwell Court, San Jose, CA
~ 190 feet from the Center of US 101
March 22, 2012

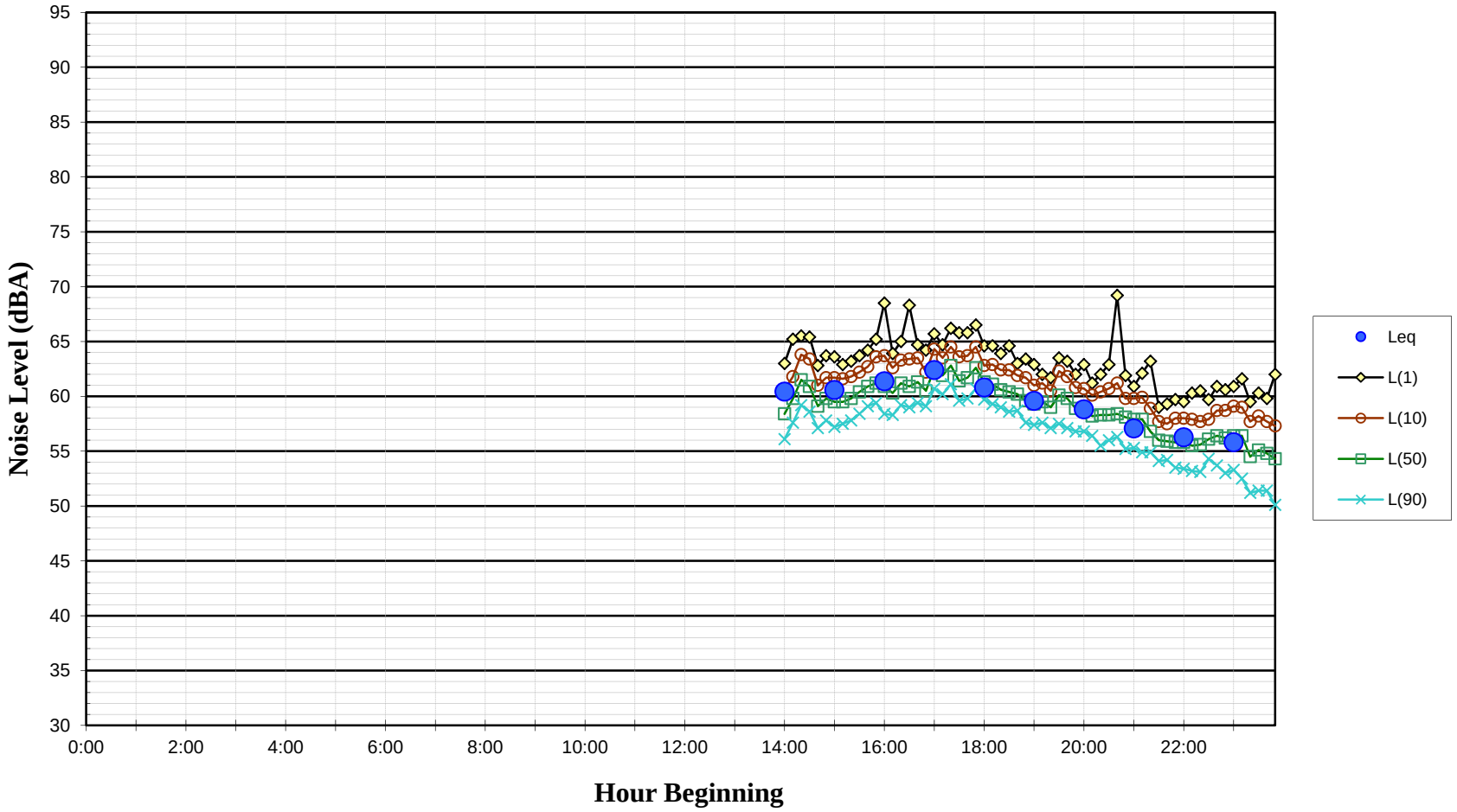


Ldn = 64 dBA

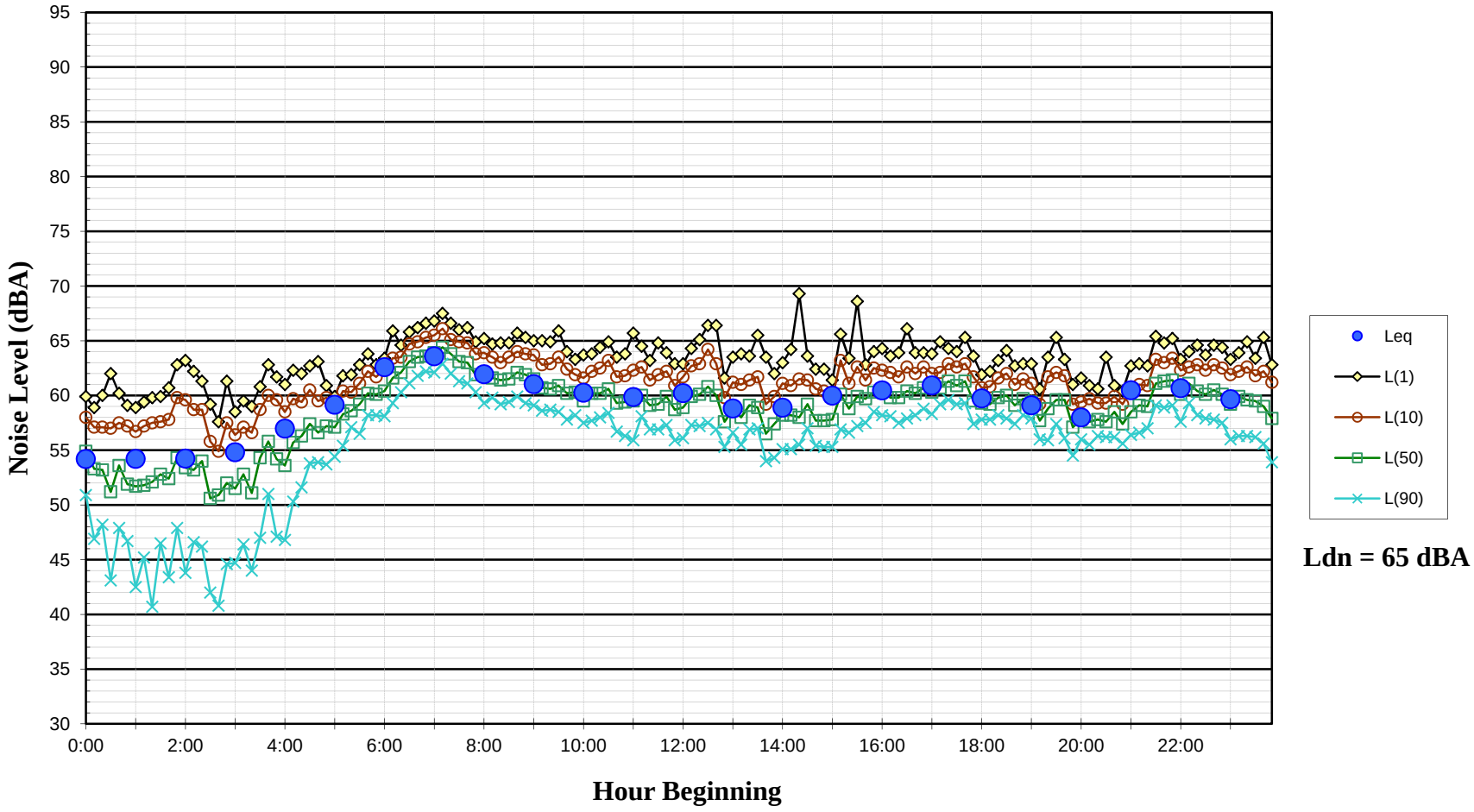
Noise Levels at LT-12
Rear Yard of 148 Flintwell Court, San Jose, CA
~ 190 feet from the Center of US 101
March 23, 2012



Noise Levels at LT-13
Rear Yard of 251 Crestridge Court, San Jose, CA
~ 340 feet from the Center of US 101
March 6, 2012

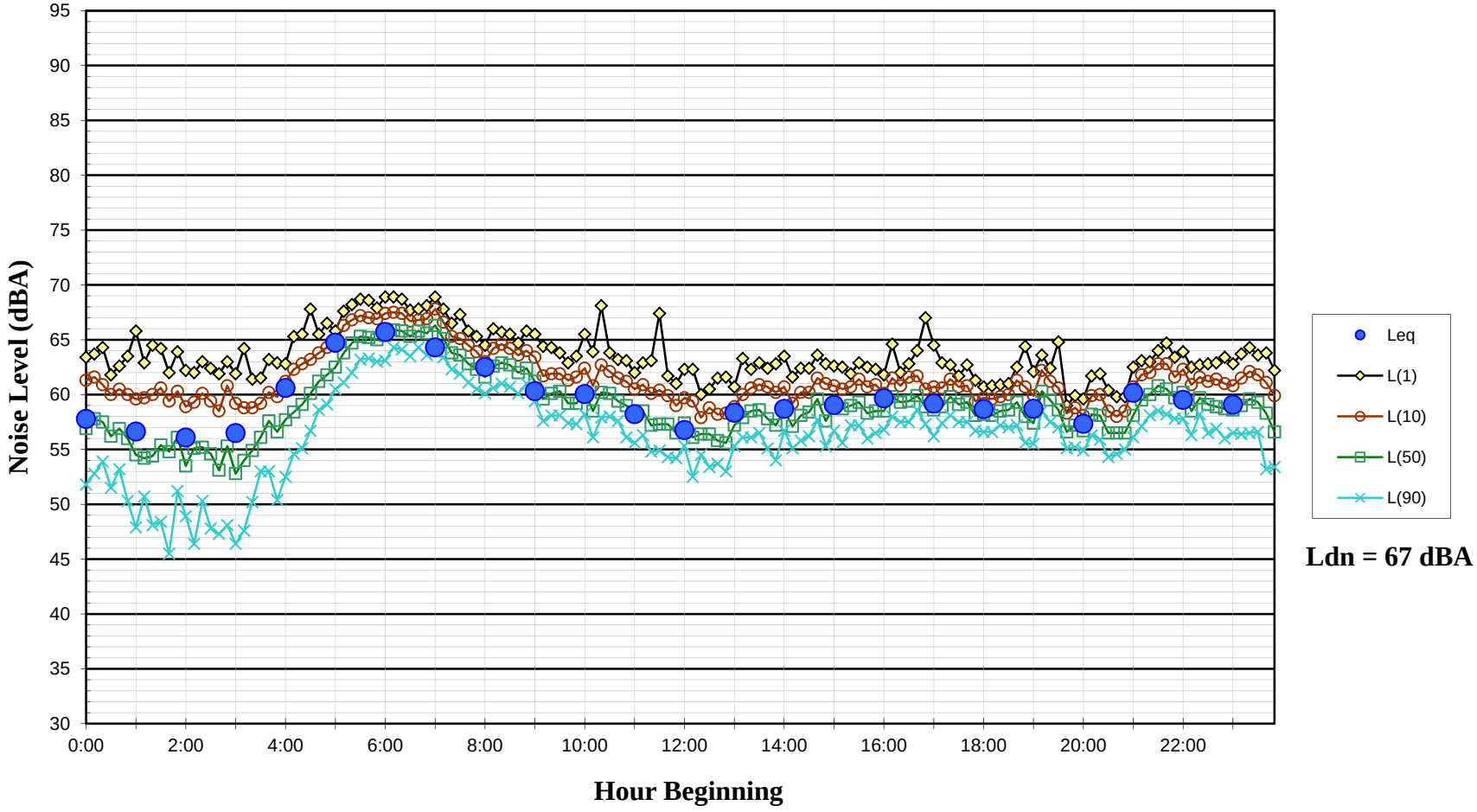


Noise Levels at LT-13
Rear Yard of 251 Crestridge Court, San Jose, CA
~ 340 feet from the Center of US 101
March 7, 2012



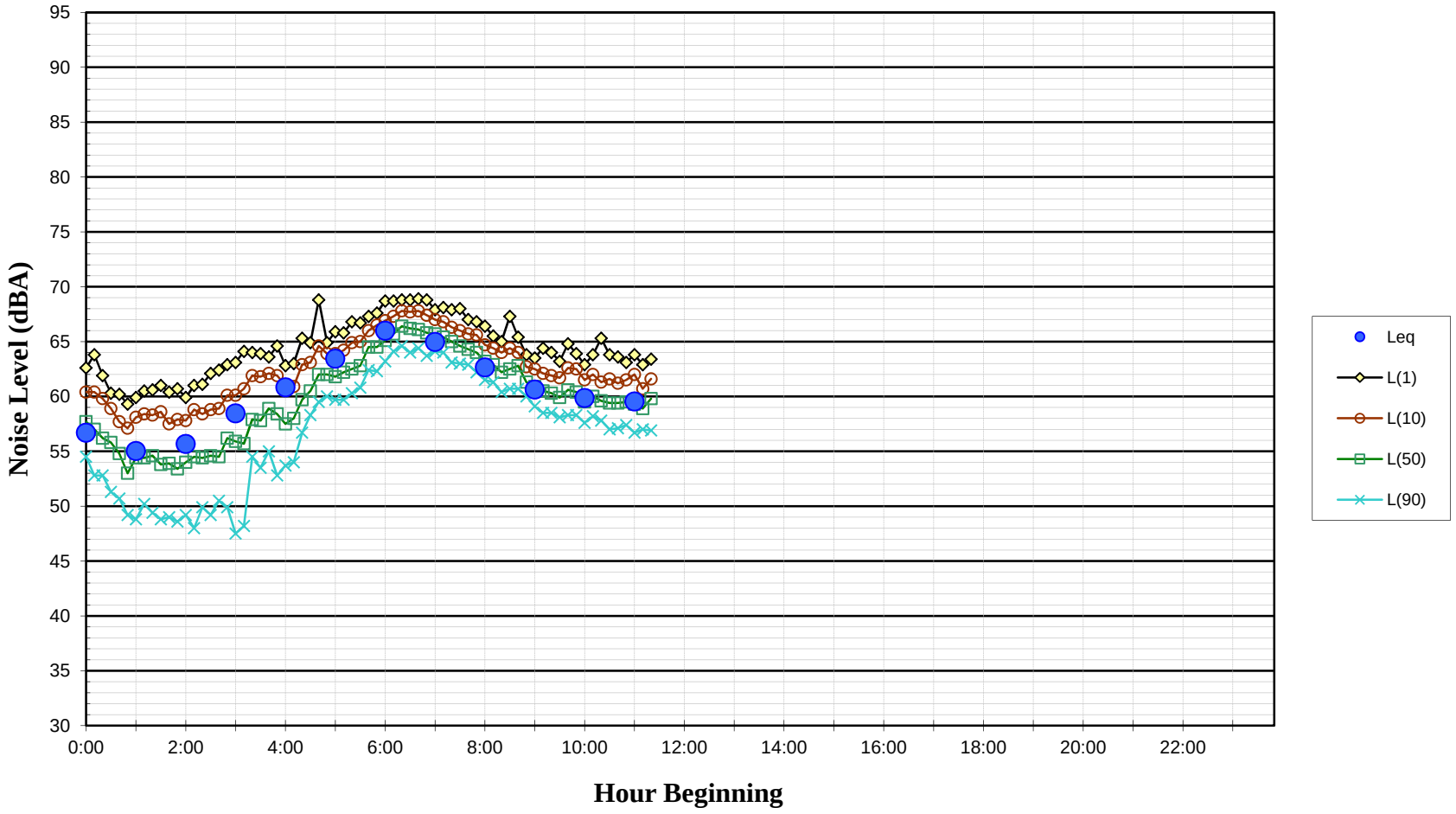
Ldn = 65 dBA

Noise Levels at LT-13
Rear Yard of 251 Crestridge Court, San Jose, CA
~ 340 feet from the Center of US 101
March 8, 2012

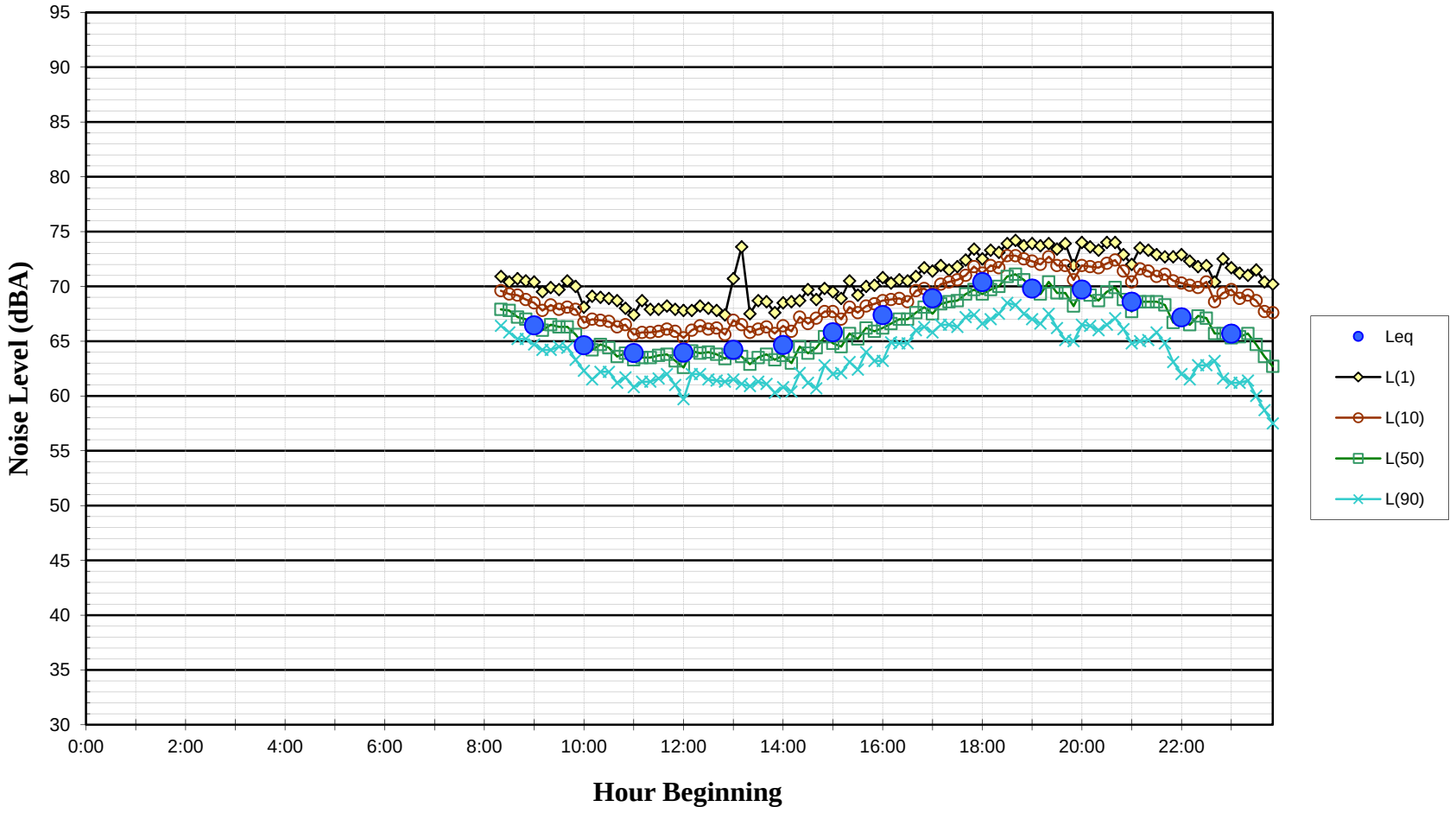


Ldn = 67 dBA

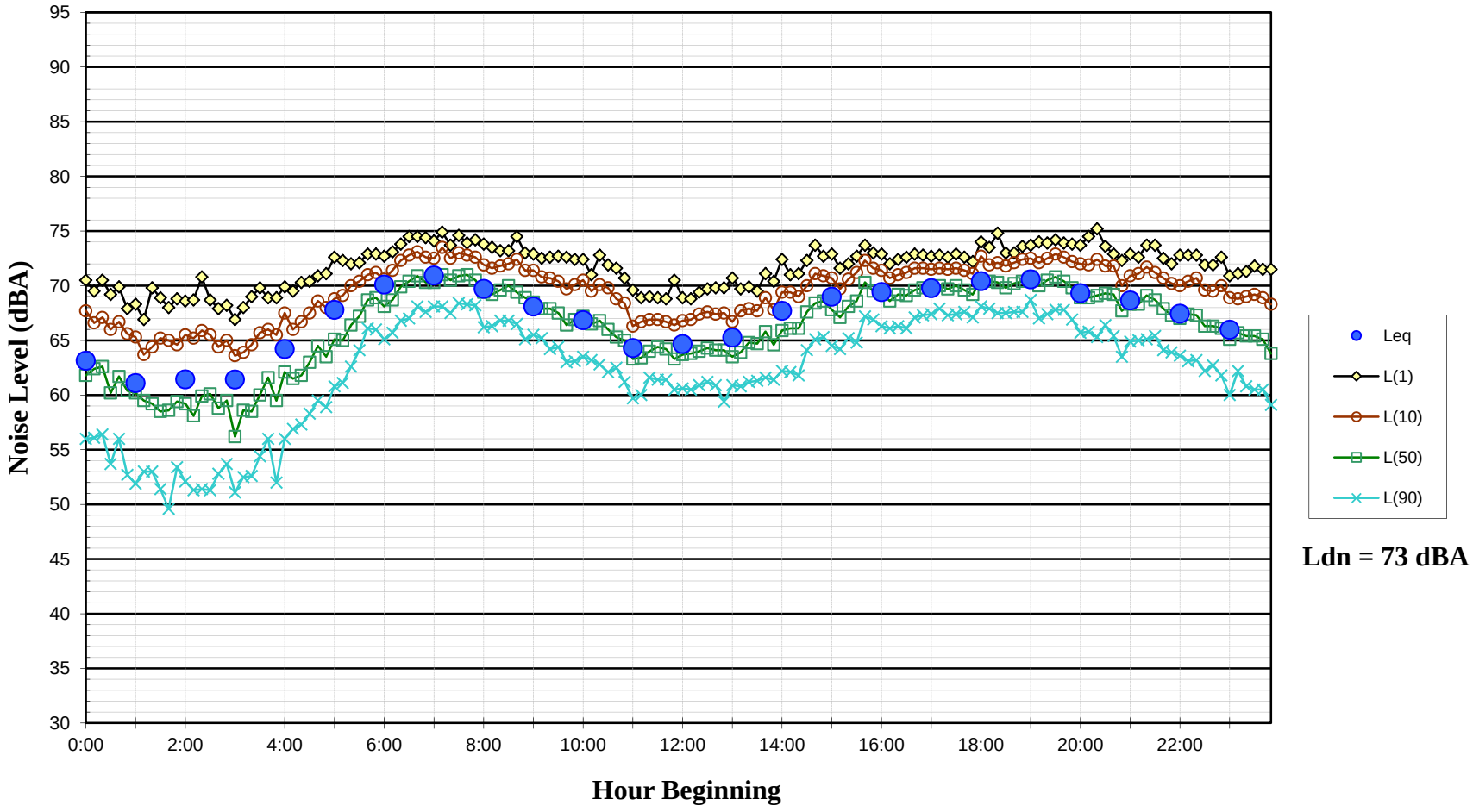
Noise Levels at LT-13
Rear Yard of 251 Crestridge Court, San Jose, CA
~ 340 feet from the Center of US 101
March 9, 2012



Noise Levels at LT-14
Coyote Creek Golf Course, San Jose, CA
~ 235 feet from the Center of US 101
March 7, 2012

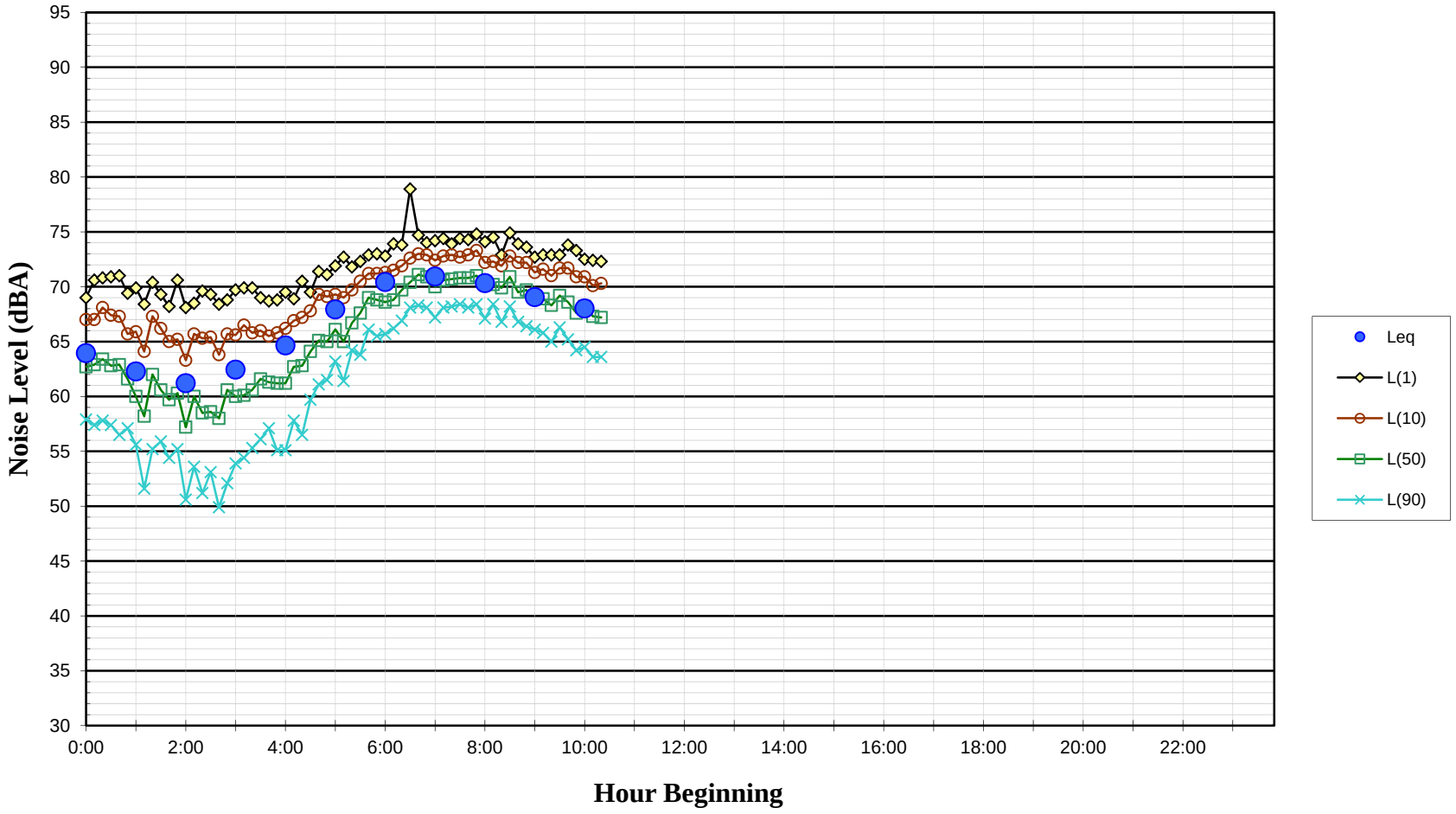


Noise Levels at LT-14
Coyote Creek Golf Course, San Jose, CA
~ 235 feet from the Center of US 101
March 8, 2012



Ldn = 73 dBA

Noise Levels at LT-14
Coyote Creek Golf Course, San Jose, CA
~ 235 feet from the Center of US 101
March 9, 2012



Appendix F
Sound Intensity Data

TIRE/PAVEMENT NOISE SOURCE LEVELS

As discussed in Chapter 5 of the NSR, traffic noise levels for the US 101 Express Lanes Project were predicted using the Federal Highway Administration's Traffic Noise Model (TNM). TNM calculates traffic noise levels based on the hourly traffic volumes, speeds, and vehicle mix, and the geometry of the site, including the positioning of travel lanes, receptors, barriers, terrain, ground type, and buildings. TNM does not account for pavement types and conditions, atypical vehicle noise populations, transparent shielding (such as wood fences with shrinkage gaps), reflections from nearby buildings and structures, or meteorological conditions. For these reasons, noise measurements are conducted and traffic noise model adjustments and calibration factors are developed.

At highway speeds, tire/pavement noise dominates the noise produced by light vehicles and trucks as shown in the REMELs database results[i]. To understand the contribution of the existing pavement types and conditions to the traffic noise levels produced along the US 101 corridor, on-board sound intensity (OBSI) measurements were conducted on May 7, 2012. On-board measurements have been demonstrated to correlate well with wayside pass-by measurements[ii]. Recently, the U.S. DOT Volpe Center has developed an experimental version of TNM to account for different pavements within the model by modifying the ground level source strength of the vehicle types included in the model[iii]. Using these measurements in TNM has been found to improve the correlation between wayside traffic measurements and traffic noise predictions based on TNM average pavement. Analysis using the experimental version of TNM found that wayside levels increased/decreased by about 0.8 dB for every 1 dB increase/decrease in OBSI level from TNM average pavement[vii]. As use of this experimental version of TNM requires specific authorization from the Federal Highway Administration, it could not be applied in this project. However, the OBSI levels were used to interpret the TNM results in calibrating the model relative to the wayside field measurements. The results of the OBSI measurements and use of these data in considering model to measurement agreement are discussed in this appendix.

OBSI Measurements

The OBSI technique was originally applied to quantifying the noise performance of highway pavements under Caltrans research on Quieter Pavements in 2002[iv]. As of 2008, it has been adopted by the American Association of State Highway Transportation Officials as Test Procedure TP76[v] following the findings of the NCHRP Project 1-44 results[vi]. The measurements were taken following this procedure, using sound intensity probes positioned 4-inches from the test tire sidewall, 3-inches above the ground with one probe opposite the leading edge of the tire contact patch and one opposite the trailing edge as shown in Figure 1. Under the TP76 procedure, the sound intensity level is averaged over 5 seconds with a vehicle speed of 60 mph,

equivalent to 440 feet of pavement. Previous work has shown that the differences between OBSI levels measured at 60 mph on different pavement surfaces are applicable to roadways with actual vehicle speeds of 65 mph, such as US 101[iv]. Due to the length of the US 101 Express Lanes Project, OBSI measurements were collected using a survey method, with one measurement taken at many locations along the length of the project instead of repeat measurements taken at a few select locations. Using this method, OBSI levels were captured along the 37 miles of roadway at non-regular intervals for a total of 88 measurements in the southbound and 96 measurements in the northbound directions of travel. Measurements were typically made in the outside lane in both the northbound and southbound directions of travel. The air temperature at the time of the measurements was 88° F. The levels were not corrected for temperature effects.

Figure 1: OBSI measurement fixture mounted on test vehicle

The overall (400 to 5,000 Hz summation) levels for the northbound and southbound directions of travel are shown in Figure 2. OBSI levels ranged from about 98 to 106 dBA over the length of the project. This variation can be attributed to differences in pavement occurring in different segments of the project area and to localized pavement types at specific locations. From Figure 2, most of the pavement levels fall above or below the TNM model's average pavement, which corresponds to an OBSI level of about 102 to 103 dBA at 60 mph[vii]. Depending on which segment is considered, the OBSI levels will be about 2 to 3 dB higher than TNM average pavement or 2 to 3 dB below. At some locations, the range is greater with sections being as much as 3 to 4 dB higher and others as much as 4 to 5 dB lower. As a result, it is expected that at

some locations, the measured traffic noise levels may be correspondingly higher or lower than TNM predicted levels based on average pavement.

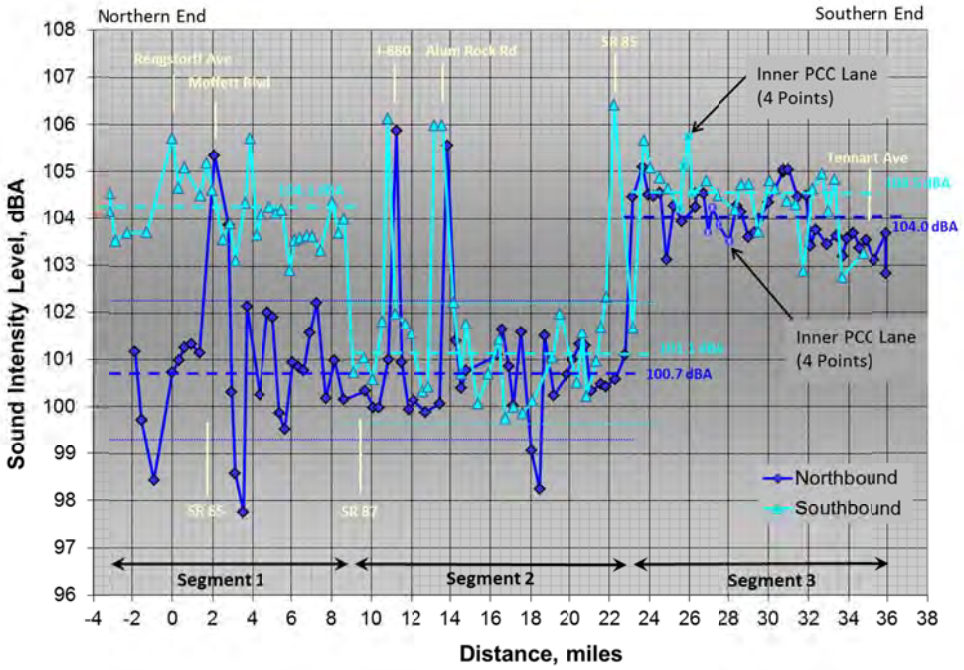


Figure 2: Overall A-weighted sound intensity levels for Highway 101 in the north and southbound directions

Based on the prevalent pavement types, the project was broken into three segments and the OBSI levels were averaged for each segment and direction of travel. Figure 3 shows example of the pavement for each segment. The approximate start points of example OBSI measurements are indicated in red, along with the measured OBSI level. One-third octave band spectra for the northbound and southbound directions are shown in Figures 4 and 5, respectively. Figure 4 presents the results for three pavements in the southbound direction, including the Segment 1 PCC, and the porous and non-porous AC sections from Segment 2. Figure 5 presents the results for the AC and PCC pavements along Segment 3 of northbound US 101.

Figure 3: Example of pavements for Segments 1, 2, and 3, respectively

In Segment 1, located approximately between the northern end of the project and SR 87, the southbound direction pavement is an older Portland cement concrete (PCC) and produces levels averaging about 104 dBA. In the northbound direction, Segments 1 and 2 (located approximately between SR 87 and SR 85) are both newer asphalt concrete pavement (AC) with short sections of the PCC occurring at underpasses and overpasses (see Figure 3). The average level of the AC pavement for these sections is about 101 dBA, excluding four localized high PCC levels and five localized low levels falling above and below the dotted lines shown in Figure 2. The localized high levels correspond to short sections of the PCC at the underpass and overpasses at Moffett Boulevard and Ellis Street, respectively, and to PCC at the underpasses of I-880 (see Figure 3) and Alum Rock Road/East Santa Clara Street.

For the southbound direction in Segment 2, the pavement is similar to the newer AC of the northbound direction with an average of about 101 dBA except at same PCC underpass sections noted in the northbound direction. As indicated in Figure 4, the largest differences between the PCC and AC data for Segments 1 and 2 occur in the frequency bands of 800 Hz and above. As shown by reduced levels in the 1600 to 2500 Hz bands, portions of Segment 2 for both northbound and southbound directions are porous, where as the remainder of the AC pavement is not. The isolated low levels for northbound Segments 1 and 2 are likely due to variation in pavement construction similar to those documented in previous Caltrans Quieter Pavement Research studies[viii]. Comparing one-third octave band spectra for the northbound AC along Segments 1 and 2 to the spectra of the three lowest spectra (not shown), the largest differences are seen in the lower frequency bands from 500 to 1000 Hz. Such lower frequency differences are typically associated with variation in aggregate size for open-graded AC pavements with larger aggregate creating elevated levels in this range[ix].

Although Segment 3 appears to be consistent along the length of the roadway, the pavement composition across the highway is not. As shown in Figure 3, in both the north and southbound directions of travel the two outside lanes are AC while the two inside lanes are PCC. In this case, the AC is older than that of Segment 2, producing higher OBSI levels for this AC pavement. As indicated in Figure 2, four measurements were made in these inside PCC lanes in both directions of travel. This figure shows that the overall levels on the PCC are in the range of those measured on the older AC. The average one-third octave band spectra for these AC and PCC lanes display subtle differences as shown in Figure 5 for the northbound direction. For the Segment 3 pavements, the PCC tends to have slightly higher levels (~ 2 dB) above 800 Hz while below 1000 Hz, the PCC levels are slightly lower.

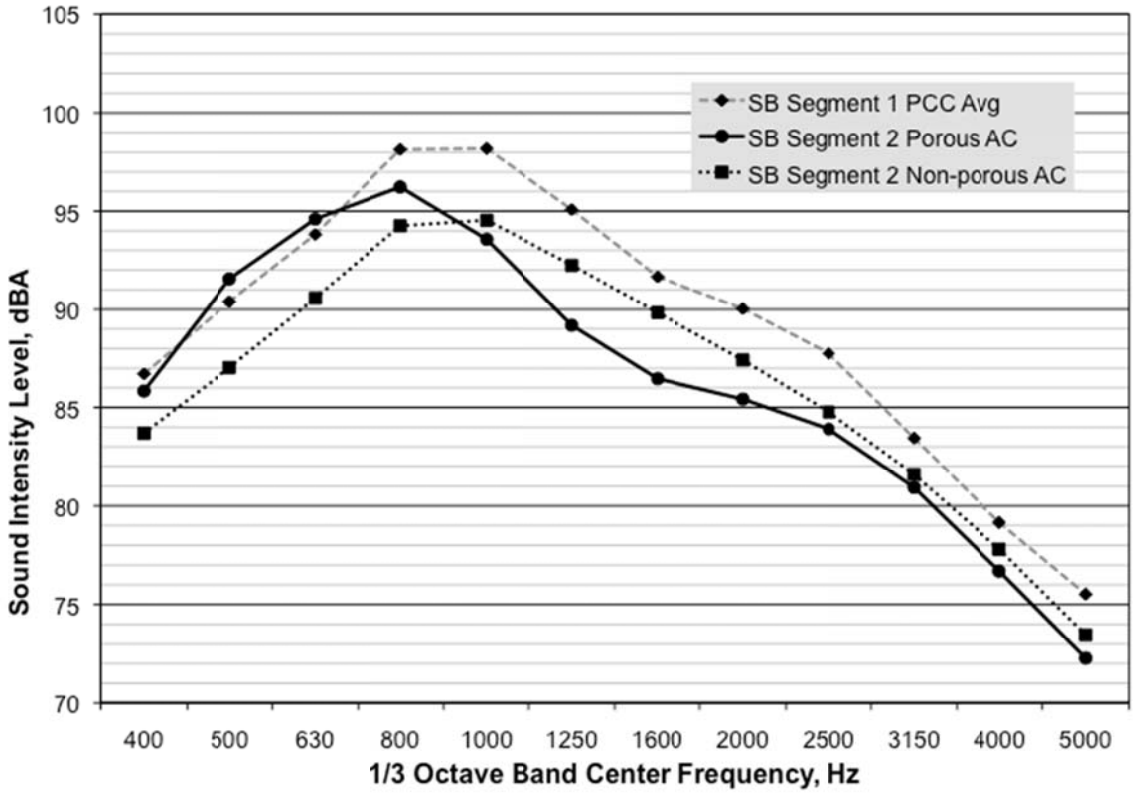


Figure 4: Average one-third octave band levels for PCC, Porous and Non-Porous AC pavements in southbound Segments 1 & 2

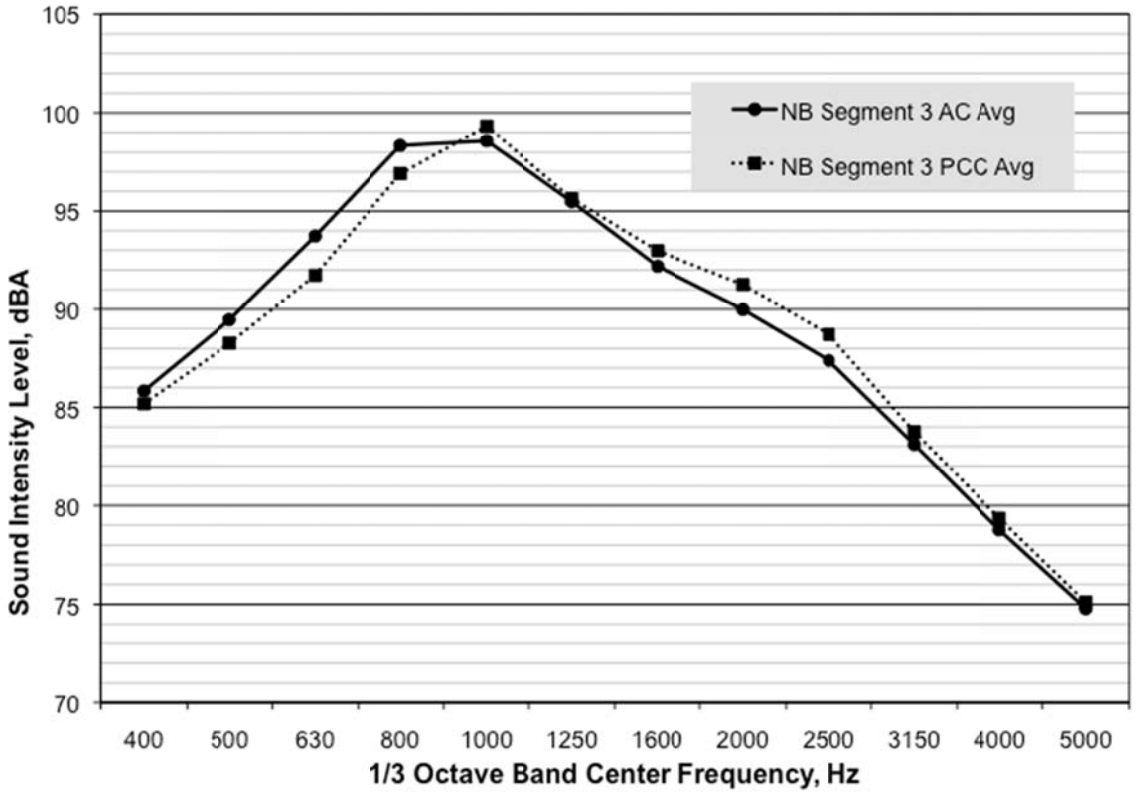


Figure 5: Average one-third octave band levels for PCC and AC pavements in northbound Segment 3

Tire/Pavement Source Levels Relative to TNM/Measurement Comparisons

The tire/pavement noise source levels as measured by OBSI were used to determine if individual differences between TNM traffic predictions using TNM average pavement and the measured wayside levels at each site could be accounted for if pavement were considered. For this assessment, each of the 167 measurement sites were input into TNM following standard practices for developing traffic noise models. As discussed in Chapter 5 of the NSR, travel lanes, receptors, barriers, terrain, and buildings were positioned in the model based on the geometric plans provided by *URS* and by GIS coordinates recorded in the field. Traffic conditions, including volumes, speeds, and vehicle mix, that corresponded to each field noise measurement were input into the model to result in a TNM predicted noise level for each measurement site at the time that the measurement was made. These predicted levels were used to develop K-Factors, as discussed in Chapter 5. In addition, near lane and far lane OBSI levels were associated with each measurement, along with general information about each site such as

whether it is located on an on/off ramp or local roadway, the acoustical shielding, and the consistency of the pavement near the site. Ten of the 167 sites were excluded from the pavement evaluation due to their locations along major freeways other than the roadway of interest, where OBSI levels measured along US 101 are likely not applicable. Sites setback from the roadway by up to 500 feet (152 m), located along local roadways or freeway ramps, shielded by barriers and/or buildings, etc, were left in the data set. OBSI normalization values were then calculated for each measurement site by calculating the difference between the measured OBSI level and the TNM average pavement OBSI level of 102.5 dB and then multiplying this difference by 0.8, as discussed previously. The OBSI normalized levels were then compared to the non-normalized levels.

On average, use of the OBSI normalization values reduced the differences between the measured levels and the TNM predicted levels, from 1.5 dB to 1.3 dB using only the near direction OBSI levels and to 1.2 dB using an average of the near and far lane OBSI levels. Out of 157 data points, 90 (57%) of the sites were improved with the OBSI normalization.

To identify the factors that might impact whether or not the OBSI normalizations improved the data, percentages improved were calculated for the data based on their general site information, as shown in Table 1. As expected, many of the locations that were ‘not improved’ were located in Segment 3, where the inner lanes are PCC and the outer lanes are AC. Throughout most of the project, the pavement on the northbound and southbound lanes differed from each other and there are several pavement changes that occur over the course of the project. These pavement differences are accounted for to some degree with the OBSI adjustments and, as a result, the data is generally improved with the OBSI normalizations. However, since only the outer lane of travel was measured in each direction, it is logical that the OBSI adjustments may not improve the data in areas where different pavement types are present for different lanes along the same section of roadway in the same direction of travel. If the data points located on inconsistent sections of roadway are not included, the OBSI adjustments improve 69% of the data (77 out of 112 data points).

Table 1: Percentages of sites improved based on their general site information

Criteria	No. Improved	Total Number	% Improved
Total	90	157	57%
Model Higher	71	107	66%
Model Lower	19	50	38%
Prediction within 2dB of Measured	34	87	39%
Prediction NOT within 2dB of Meas.	56	70	80%
No Shielding	5	8	63%
Setback	16	38	42%
Adjacent to US 101	48	77	62%
Homogeneous Pavement, Near Lane	77	112	69%
Homogeneous Pave. Both Directions	69	101	69%
Homogeneous Pavement and Predictions NOT within 2dB of Meas.	52	55	95%

Further review of the data indicated that many of the sites where the correlation was 'not improved' had TNM predicted levels that were within 2 dB of the measured levels and only slight adjustments due to the OBSI normalization values. Sites where the difference between the measured and predicted levels are 2 dB or less are not typically adjusted in the traditional assessment method (i.e., K-factors would be 0) to take into account the slight variations that could be caused by meteorological conditions and other variable factors. In these cases, although the correlation was 'not improved', the differences were minimal, indicating that this is scatter in

the data rather than poor correlation. These slight variations are within the range of variability of the model and measured level. Removing the data points where the measured and TNM predicted levels were within 2 dB results in 80% of the data being improved with the OBSI normalization (56 out of 70 data points). This improvement rate increases to 95% (52 out of 55 data points) if the data points where the pavement is not homogeneous are also removed as discussed in the previous paragraph. The remaining three sites that were not improved are all complex sites; one is setback about 175 feet from US 101 and shielded by a barrier as well as several buildings, another is located on an off-ramp and shielded by a barrier, and a third is located more than 500 feet from US 101 on an off-ramp and shielded by a barrier.

As an example, the differences between the measured and predicted levels for sites along Segment 1 are shown in Figure 6, with and without the inclusion of the OBSI normalization values. The results for Segment 2 are similar, with the exception of the porous sections of pavement (Figure 7). All of the Segment 3 sites were eliminated due to the variations between pavement between the inner and outer lanes of travel, as described above.

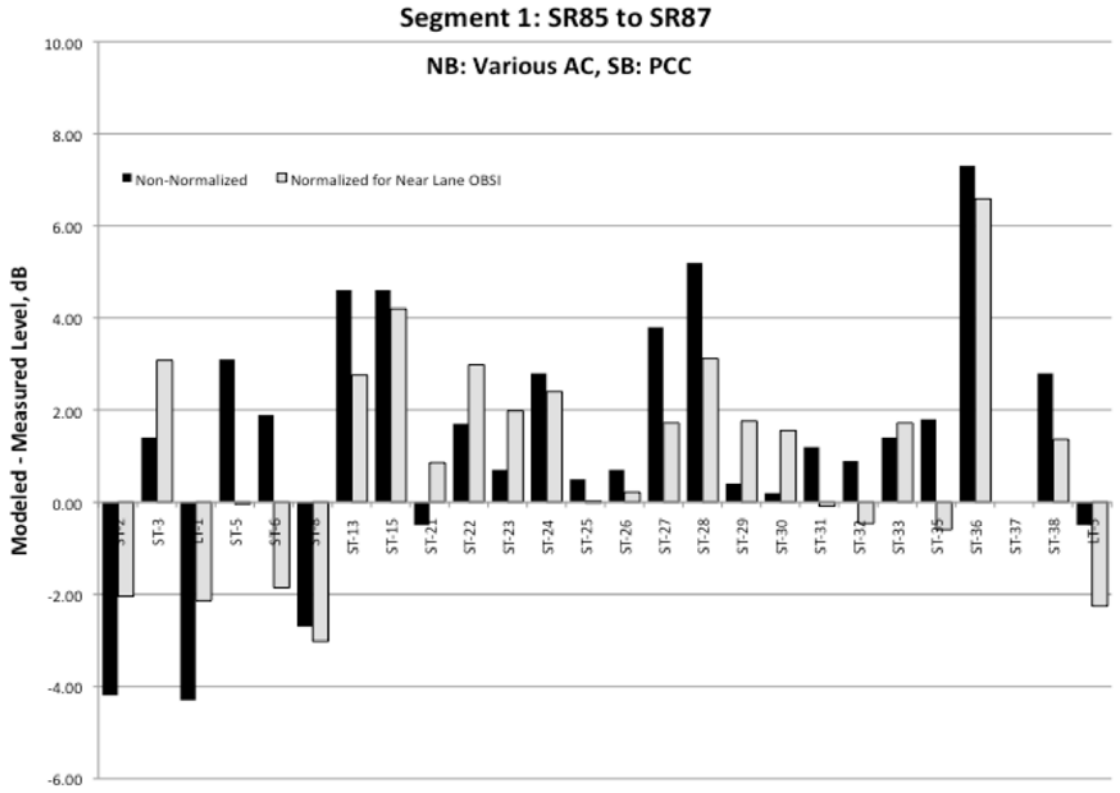


Figure 6: Difference between measured and modeled results for Segment 1 locations, non-normalized and normalized for near lane OBSI levels

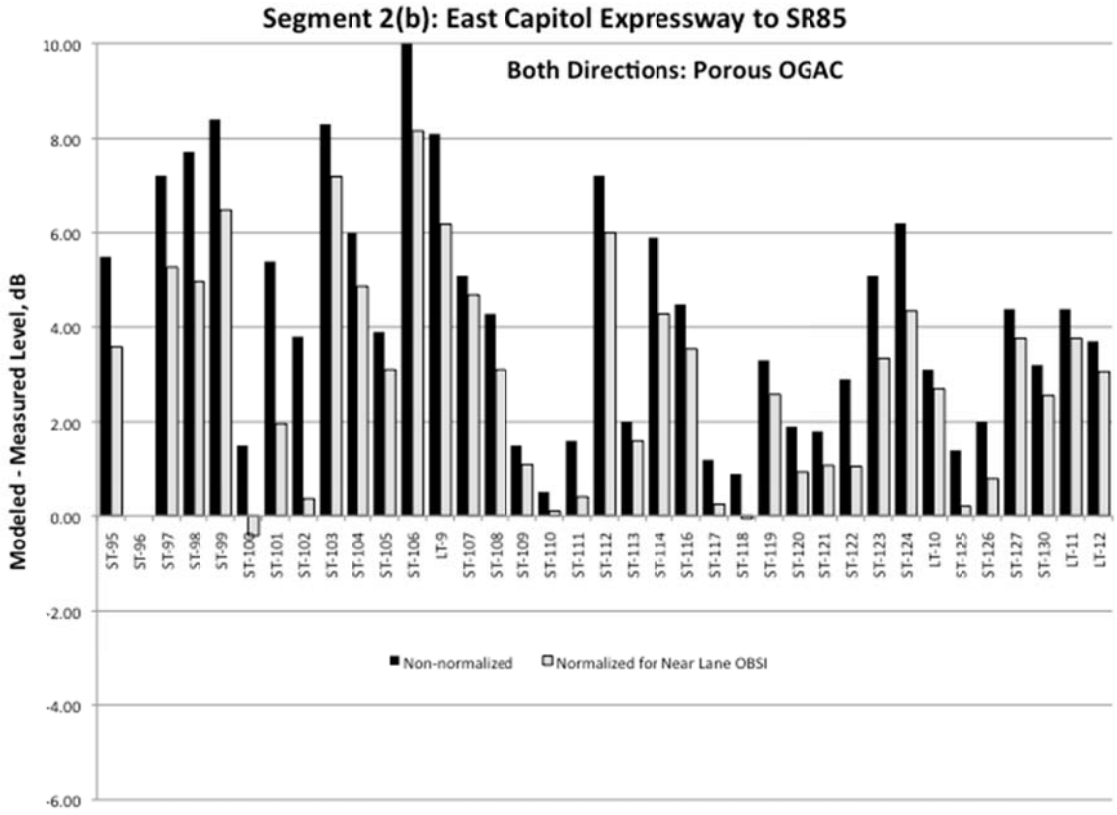


Figure 7: Difference between measured and modeled results for porous sections of Segment 2, non-normalized and normalized for near lane OBSI levels

Porous Pavements

Through review of Figure 7, the differences between the measured and modeled levels for sites along the porous sections of Segment 2 are greater than the differences occurring through the remainder of the project. While the OBSI normalizations do improve the data uniformly throughout this section, the normalizations do not bring the modeled levels within 2 dB of the measured levels, indicating that additional noise reductions are occurring at the wayside. Review of the OBSI spectra (see Figures 4 and 5) indicates that the pavement in both directions along this section is a porous AC. The spectra and differences between measured and modeled levels for OBSI and wayside results for this project are compared in Figure 8 to the results of another porous pavement study[x], located along Interstate 80 in Davis, California. As shown in Figure 8, both pavements have reduced levels in the 1600 to 2500 Hz bands, indicating porosity.

For both pavements, the tire/pavement noise levels were found to be about 1 to 1.5 dB quieter than TNM average pavements. However, the wayside noise levels in both cases were found to be about 4 dB quieter than the TNM average predictions. This indicates that an additional 2.5 dB or so of noise reduction is occurring at the wayside location. Previous research has indicated that this additional attenuation occurs as the noise from the vehicles propagates over sound absorptive, porous pavements[xi]. As OBSI measures only the strength of the tire/pavement noise source, this additional noise reduction as the sound propagates away from the tire is not accounted for in the OBSI measurement. The effects of sound absorptive pavement are also not currently accounted for in TNM. The impact of this feature of porous pavements is even more illuminating when you take into account that the US 101 results shown are an average of all the measurement locations along the porous section of the roadway where actual outdoor activity occurs. This includes sites both adjacent to and setback from the road, most of which are shielded by barriers and/or buildings.

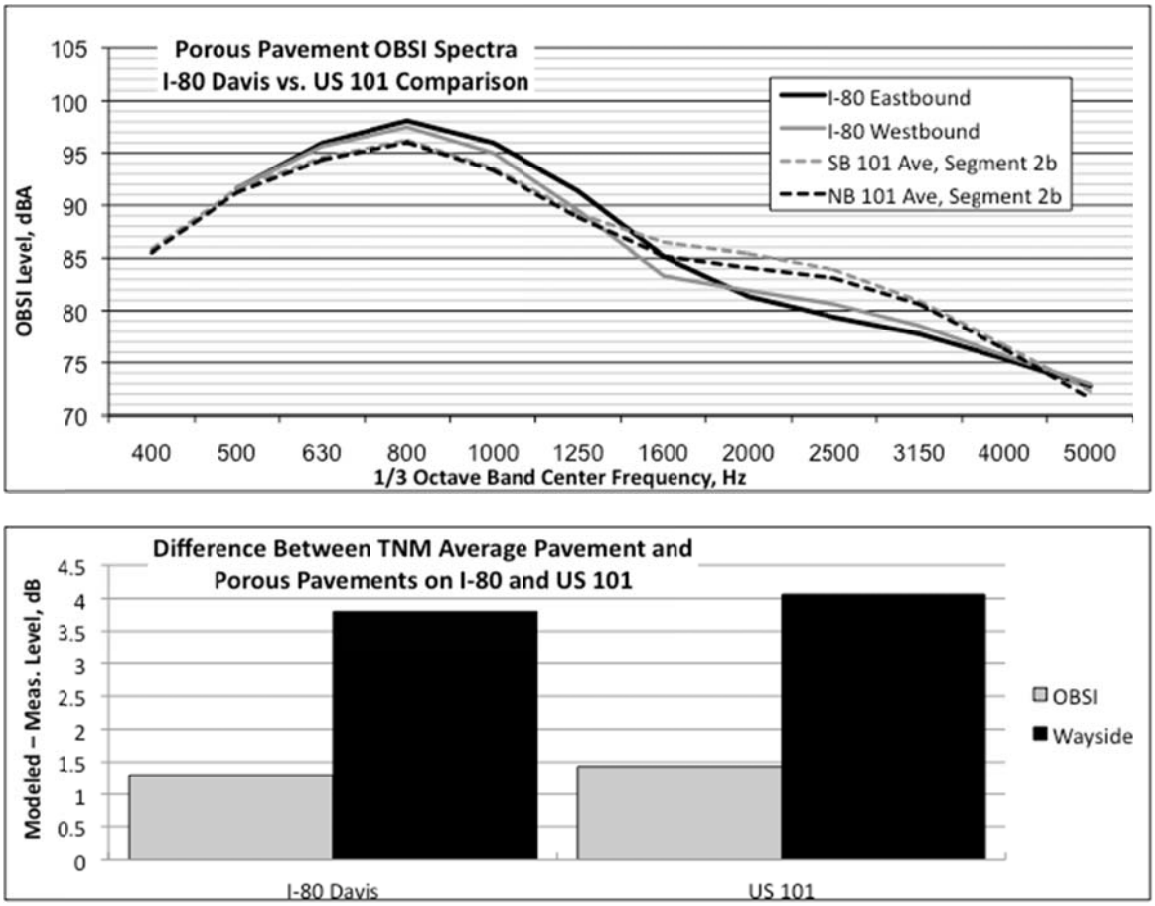


Figure 8: OBSI spectra and difference between measured and modeled results for porous pavements along US 101 and I-80, respectively

Conclusions

Overall, it was found that OBSI results could be used to help explain the contribution of pavement to existing traffic noise levels produced along a roadway project. On-board measurements were demonstrated to correlate well with field measurement sites. Lane by lane measurement of OBSI levels with a moving 5-second average (i.e., so you can get the OBSI level of the pavement centered at the location of the measurement as opposed to wherever the nearest 5 second average occurred) would help to further improve the correlation between field measurements and TNM predictions. The ability to use the U.S. DOT Volpe Center's experimental version of TNM that accounts for different pavements within the model would enable practitioners to take advantage of the additional knowledge gained by the use of OBSI measurement directly within the model.

Another advantage of the use of OBSI adjustments is that practitioners could theoretically account for the pavement types proposed to be installed with the completion of the project. Standard calibration practices account for existing pavement conditions through use of the K-factor. However, the K-factor is also used to account for factors such as transparent shielding, reflections, meteorological conditions, etc, and without additional knowledge it would be impossible to determine just how much of the K-factor to assign to each variable. This means that if one of the variables accounted for in the K-factor changes, such as pavement type, the predicted values would not correctly adjust for this change. With the use of the OBSI adjustments, the adjustment could be changed according to the proposed pavement to give a more realistic result of noise level. If the proposed pavement is not known, the TNM average predictions could be used without the inclusion of the OBSI adjustments.

Note that OBSI measurements can only help to explain the contribution of pavement types and conditions to the traffic noise levels produced along a roadway project. Secondary noise sources such as aircraft overflights, construction, residential noises, or local roadways would lower the correlation between the OBSI levels and wayside measurements.

[iiii] G. Fleming, A. Rapoza, and C. Lee, "Development of National Reference Energy Mean Emission Levels for the FHWA Traffic Noise Model (FHEA TNM), Version 1.0", U.S. Department of Transportation, Report No. DOT-VNTSC-FHWA-96-2, 1996.

[ii] Donavan, P. and Lodico, D., "Measuring Tire-Pavement Noise at the Source", NCHRP Report 630, Transportation Research Board, Washington, D.C., 2009.

[iii] Rochat, J, Hastings, A., and Ferroni, M. "Investigating the Implementation of Pavement Effects Via OBSI Data inn the FHWA Traffic Noise Model® (FHWA TNM)", Proceedings of NOISE-CON 2007, Reno, Nevada, October 2007.

[iv] Donavan, P., and Rymer, B., "Quantification of Tire/Pavement Noise: Application of the Sound Intensity Method", Proceedings of Inter-Noise 2004, Prague, the Czech Republic, August 2004.

[v] Standard Practice for Measurement of Tire/Pavement Noise Using the On-Board Sound Intensity (OBSI) Method", TP 76-11 (Proposed), American Association of State Highway and Transportation Officials, 444 North Capitol Street N.W., Suite 249, May 2009.Washington, D.C. 2001.

[vi] Donavan, P. and Lodico, D., "Measuring Tire-Pavement Noise at the Source", NCHRP Report 630, Transportation Research Board, Washington, D.C., 2009.

[vii] Donavan, Paul R., "Project 10-76: Methodologies for Evaluating Pavement Strategies and Barriers for Noise Mitigation", Preliminary Draft Final Report prepared for NCHRP, Transportation Research Board, Washington, D.C., 2012.

[viii] Donavan, P. and Rymer, B., "Applications of Asphalt Rubber Pavements in American Southwest States", Proceedings of Inter-Noise 2010, Lisbon, Portugal, June 2010.

[ix] U. Sandberg and J. Ejsmont, The Tyre/Road Noise Reference Book, INFORMEX, Ejsmont & Sandberg Handelsbolag, Harg, SE-59040 Kisa, Sweden, 2002, pp. 266-271, 128-139, 272-273, 122.

[x] Lodico, Dana M., and Reyff, James A., "Long-term noise performance of open graded asphalt concrete (OGAC) - Results of 10-year long study", Noise Control Engineering J., Volume 57, Issue 2, pp. 84-93 (March 2009).

[xi] Donavan, P., "The Effects of Porous Pavements on Tire/Pavement Noise Source Levels and Pass-By Measurements", Proceedings of Noise-Con 2011, Portland, Oregon, July 2011.