

Stormwater and Wastewater Best Management Practices

Caltrans regulates stormwater and non-stormwater discharges from State right-of-way through a statewide permit (Caltrans Permit) issued by the State Water Quality Control Board (SWQCB). The Caltrans Permit applies to construction activities as well as all operations of the State Highway System and associated facilities. The permit requires the use Best Management Practices (BMP) to limit the discharge of pollutants to their Maximum Extent Practicable (MEP). This module describes various construction and design BMP and provides guidance for the Geoprofessional on appropriate investigations and reporting standards. The Geoprofessional may be asked for input through all stages of a project.

District Design staff are responsible for the design of stormwater BMP in roadway projects. These BMP are identified based on project needs and input from other functional units such District Stormwater, Hydraulics, and Headquarters Wastewater Design. As part of the Caltrans Permit, District Design staff are required to maximize infiltration unless infiltration is not recommended by Geotechnical Design. Geotechnical Design staff may be asked to provide subsurface information as part of the design.

Much of this module is derived from the Caltrans Stormwater Quality Handbook, Project Planning and Design Guide (PPDG), available at the following web address. (https://design.onramp.dot.ca.gov/downloads/design/files/Final%20PPDG-July%202017%20rev4_29_2019.pdf).

The Water and Wastewater Branch of DES designs wastewater systems for Caltrans facilities. Discharges from these facilities are permitted under the same permit but may have other local requirements as enforced by the local Regional Water Quality Control Board.

Overview of BMP

Two types of BMP are addressed in the PPDG: design-treatment BMP necessary for the long-term operation of the facility and construction BMP necessary during construction operations. Most construction BMP are developed through the Stormwater Pollution Prevention Plan (SWPPP) that details appropriate BMP for construction activities. A third type of BMP are those developed for wastewater treatment. Below are outlined BMP that have been identified as requiring soil or groundwater information and therefore input from Geotechnical Design.

Design Treatment BMP

Design BMP treat stormwater discharges as part of the long-term operation of the State Highway System. Those described below have been identified as requiring some qualitative or quantitative description of the subsurface for their design. The following are

brief descriptions of each, and the relevant geotechnical parameters that should be provided to Design.

- Infiltration areas transmit stormwater directly to the subsurface through overground flow and may include slopes and trenches. Appropriate subsurface parameters include depth to groundwater, soil classification, and infiltration rate.
- Infiltration devices temporarily capture stormwater and then transmit water directly into the subsurface. Infiltration devices may be trenches or basins. Appropriate subsurface parameters include depth to groundwater, soil classification, and infiltration rate.
- Bioretention is the least developed of the BMP. Bioretention uses vegetation and soils to actively remove pollutants from stormwater inflows. These work best near impervious surfaces. Appropriate subsurface parameters include depth to groundwater, soil classification, and infiltration rate.
- Gross Solid Removal Devices remove large pollutants (trash) from stormwater. These are buried in-line structures that may require a minimum bearing capacity of the supporting soil. Appropriate subsurface parameters include soil classification and corrosivity.
- Media Filters (Austin or Delaware Sand Filter) remove pollutants from stormwater by sedimentation and filtering. Two chambers are constructed below ground with the first holding water and the second actively filtering the stormwater. Austin Filters may be earthen or concrete while Delaware Filters are always concrete. Appropriate subsurface parameters include soil classification and corrosivity.
- Detention Basins retain stormwater flows for a period of time and settle pollutants in the stored water column. These pollutants may include trash. Seasonal high groundwater should not be within 5 feet of the subsurface but may be allowed if liners are used. Appropriate subsurface parameters include depth to groundwater, soil classification, and infiltration rate.

Construction BMP

Minimization and treatment of stormwater discharge during construction activities is described in the SWPPP. The SWPPP is typically developed without the input from Geotechnical Design. Construction activities such as drilling for piles may generate groundwater and require subsequent dewatering. This is handled through recommendations made to the District Design staff and not discussed here.

Some construction sites have receiving waters of varying quality or have discharge criteria that are so stringent, normal construction BMP are insufficient. In these cases, the design team may determine that an Area Treatment System is appropriate. This system requires stormwater to be held in a temporary detention facility and treated prior to discharge. These systems can vary in complexity but will require the Geoprofessional to identify the primary soil type to be treated as well as the applicability of the site for a temporary storm water storage basin.

Wastewater BMP

Designs for wastewater requiring Geotechnical Design input include leach fields and treatment BMP for facilities such as rest stops and maintenance stations. The applicable Regional Water Quality Control Board will require soils information as a part of any permit approval. The required soil properties and site conditions are like those of other infiltration BMP including infiltration rate and depth to groundwater. Some facilities may require soil bearing capacities and may involve communication with Structures Design. Other facilities, including wastewater lines under highways, may require trenchless methods of installation. Refer to the appropriate module in the Geotechnical Manual for guidance.

Geotechnical Investigations

Geotechnical parameters required for the design of BMP are permeability of the native soil and depth to groundwater. Other parameters such as soil classification, grain size, and soil strength may be necessary. Perform “Office Work” in accordance with the *Geotechnical Investigations* module to evaluate existing information. Site investigations should be performed if existing data are insufficient.

Preliminary Site Assessment

Verify the following site conditions for each proposed BMP location:

- Invert of stormwater infiltration must be at least 5 to 10 feet above groundwater elevation depending on the system.
- BMP should not be installed on slopes where it could cause slope instability.
- BMP should not be installed on structures or contribute to the increased seismic settlement of structures.

Geotechnical Drilling for Sampling and Groundwater

Drilling may be performed up to at least 10 feet below the deepest proposed infiltration depth at the proposed BMP location to ensure groundwater depth to satisfy applicable criteria. This is specifically for proposed BMP where design inverts may be well below the existing ground surface. Sampling of soil must be performed up to and below the depth of the proposed BMP.

Piezometers may be installed to monitor long term groundwater fluctuations in the absence of sufficient existing groundwater data. Based on the subsurface conditions, it may be prudent to install nested piezometers to capture local or perched groundwater.

Field and Laboratory Testing

Percolation Testing

Percolation Testing is conducted to determine infiltration rate and the Hydrologic Soil Group. The correct percolation testing procedure should be in correlation with the Local Enforcement Agency (LEA) standard. Identify a standard that the LEA approves. If a local percolation testing procedure is not found, use one of the methods described in this module. California Test Method (CTM) 749 and CTM 750 were previously used, however, those standards are no longer maintained by Caltrans and are not recommended to be performed by Caltrans personnel. Use of CTM 749 and 750 requires an exception to policy.

There are many types of percolation tests in LEA guidance. The appropriate type of percolation test is based on the size of the BMP and proposed water quality volume and proposed elevation of infiltration. The following are the percolation tests that may be performed:

- Double-Ring Infiltrometer Test
- Well Permeameter Test
- Boring Percolation Test Procedure
- Excavation Percolation Test Procedure

Refer to the LEA's guidance for specific testing procedures and requirements. Additional guidance on these procedures can be found in the Los Angeles County Department of Health guidance ([Los Angeles \(LA\) County Manual](#))

Laboratory Testing

The soil at the proposed BMP location must be "classified" based on Unified Soil Classification System, which requires laboratory testing of soil samples. If the proposed BMP type has a structure, corrosivity of the soil should be tested.

Parameters Necessary for Specific BMP

Leach field gradation: It may be necessary to work with the Water and Wastewater Branch on gradational specifications for leach field filter media. The Geoprofessional may refer to guidance such as ASTM C33 Standard Specification for Concrete Aggregates.

Media Filter Devices: Filter media will be specified by the designer based on pollutants of concern. Delaware or Austin Sand Filters may require bearing capacity minimums be met by the surrounding native soil. Temporary excavations in unstable soils should be identified and provided to the design team.

For structure foundations, follow the appropriate module to evaluate the foundation design (e.g., Bearing Capacity, Settlement).

Reporting

Reporting for Design and Construction BMP takes place across multiple phases of the project, however specific locations of Design BMP may not be known until late in the design. BMP recommendations are provided to the District as follows:

Report the following in the DPGR:

- Available soil information, such as the “Identification” or “Classification”, infiltration characteristics, and erosion potential
- Depth to groundwater, if available
- Geologic hazards or conditions that may impact the BMP criteria
- Investigation and Laboratory analyses necessary for the design phase

Report the following in the PGDR and GDR:

- Soil Classification
- Soil permeability
- Depth to groundwater including known seasonal fluctuations
- Soil properties for the evaluation of shallow foundations
- Geologic conditions that may impact BMP criteria
- Foundation design recommendations (refer to reporting requirements in the applicable module)

The Geoprofessional must follow appropriate modules/guidelines to do the design calculations (bearing capacity, settlement) of any proposed foundations of BMP elements.