Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING

LOW IMPACT DEVELOPMENT (LID)

FOR:
SEQUOIA COMMERCE CENTER
NORTHEAST CORNER OF W. 190TH ST. AND VAN NESS AVE.
TORRANCE, CA 90504
APNs: 7352-016-001, 7352-016-002 AND 7352-016-003

OWNER:
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13450 MAXELLA AVENUE, SUITE 220
MARINA DEL REY, CA 90292
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CONTACT: NICK ZAHAROV

MARCH 22, 2024

JOB NO. 4221

PREPARED BY:
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1.0 Project Description

The project site is located at the northeast corner of W. 190th Street and Van Ness Avenue in the City of Torrance. The site encompasses approximately 14.02 acres and includes Assessor Parcel Numbers (APNs) 7352-016-001, 7352-016-002, and 7352-016-003 within Los Angeles County (Figure 1 – Vicinity Map).

Proposed improvements include two warehouse buildings: Building 1 with an approximate footprint of 112,700 square feet and Building 2 with an approximate footprint of 147,500 square feet. Both buildings will have loading docks along the east side of the buildings. Vehicle parking will surround the buildings, and landscaping will be located along the street frontage areas and throughout the site.

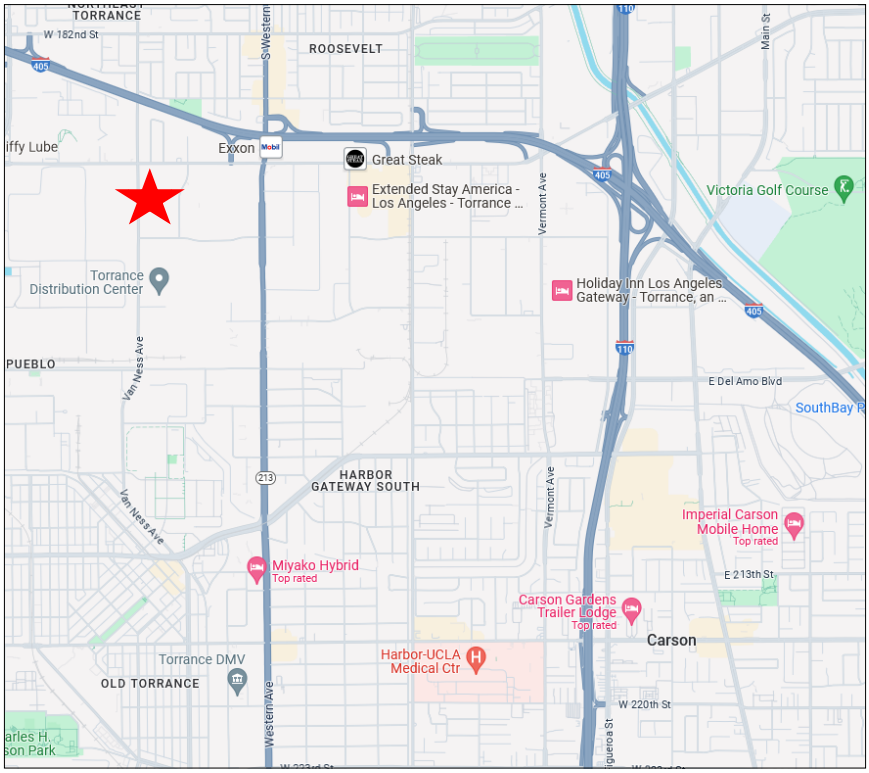

Figure 1 - Vicinity Map (North↑)

The proposed site is a Designated Project identified as a significant redevelopment where 50 percent or more of the impervious surface of a previously developed site is proposed to be altered and the previous development project was not subject to post-construction stormwater quality control measures. Hence, the entire site must meet the requirements of the LID Standards Manual. The project will treat stormwater runoff generated by the project through the use of WetlandMOD biofiltration systems and underground detention systems sized to treat 1.5 times the Stormwater Quality Design volume (SWQDv). The 1.5x SWQDv is achieved by multiplying the 85th percentile rainfall depth by 1.5. Refer to Appendix A for references and calculations.

1.1 Existing Site Description

The project site consists of twelve single-story commercial buildings. Asphalt driveways, vehicle parking areas, and landscaped areas surround these buildings. Most of the site drains westerly onto Van Ness Avenue, with a small northern portion draining to 190th Street.

1.2 Proposed Site Description

Area 1 / Building 1:
Runoff from a portion of the building's rooftop, and the westerly vehicle parking area will drain to two catch basins located within the vehicle parking area. A proposed storm drain (Line "C") will then convey runoff northerly, then easterly towards the loading dock, area and drain southerly into proposed storm drain Line "A" that's located within Area 2. Line "A" will ultimately drain to the southwest corner of the site where it discharges into an existing storm drain system (7'-1"x8'-6" RCB) in Van Ness Avenue.

Runoff from the remainder of the building's rooftop, the northerly, easterly and southerly vehicle parking areas, and the loading dock area will drain to two catch basins in the loading dock area. These catch basins will tie into Line "C" prior to draining into Line "A". Line "A" will ultimately drain to the southwest corner of the site where it discharges into an existing storm drain system (7'-1"x8'-6" RCB) in Van Ness Avenue.

Area 2 / Building 2:
Runoff from a portion of the building's rooftop, and westerly vehicle parking area will drain to several catch basins located in the vehicle parking area. A proposed storm drain (Line "B") will then convey runoff to the underground detention system (STC #2) located in the loading dock area.

Runoff from the remainder of the building's rooftop, the southerly, easterly and northerly vehicle parking areas and the loading dock area will drain to several catch basins in the loading dock. A proposed storm drain (Line "A") will then convey runoff to the southwest corner of the site where it discharges into an existing storm drain system (7'-1"x8'-6" RCB) in Van Ness Avenue.

Treatment of 1.5x the SWQDv:
Prior to discharging offsite, the 1.5x SWQDv will be diverted to underground chambers for detention purposes. From the chambers, the SWQDv will be pumped into the above-grade WetlandMOD biofiltration systems that utilizes the 2012 MS4 Permit's Attachment H soils and plants for treatment. The pumps are designed to pump low flowrates that are equal to or slightly greater than the WetlandMOD's treatment flowrates. These flowrates are intended to drain/treat the 1.5x SWQDv within the allotted 96 hours. Pumped flows exceeding the WetlandMOD's treatment flowrate will overflow into a return pipe and outlet back into the upstream pump's wet well. Since the pump's flowrates are small, stormwater is designed/expected to back-up and fill the detention chambers. Once the chambers are full, it is understood that the 1.5x SWQDv has been achieved and stormwater will again back-up and spill into the overflow pipes within the diversion structures. After the storm event has passed, no additional flows will enter the

chambers and the chambers will slowly deplete as stormwater is being pumped through the WetlandMODs for treatment over 96 hours. Treated flows for WetlandMODs #1 and #2 will drain into Line "A" prior to discharging offsite. See Appendix A for detailed calculations.

Area 3:
Runoff from landscaped areas (including portions of the driveway approaches) along 195th Street, Van Ness Avenue and W. 190th Street will sheet flow offsite without being routed to LID BMPs. The landscaped areas are considered self-treating areas.

1.3 Geological Investigation/Infiltration Feasibility

The soil type, as found in the Los Angeles County Hydrology Manual, is 009 for Montezuma Clay Adobe.

Infiltration Report by Southern California Geotechnical
The infiltration testing consisted of four borings, advanced to a depth of 12 to 15± feet below existing grades. The measured infiltration rates ranged from 0.0 to 0.8 inches per hour.

Geotechnical Investigation by Southern California Geotechnical
Artificial fill soils were encountered beneath the existing pavements at all boring locations, extending to a depth 3 to 6.5± feet below the existing site grades. The artificial fill soils generally consist of medium stiff to very stiff silty clays and sandy clays with varying fine gravel content.

Native alluvial soils were encountered beneath the artificial fill soils at all boring locations, extending to at least the maximum depth explored of 30± feet below the existing site grades. The alluvial soils within the upper 12 to 27± feet generally consist of stiff to very stiff sandy clays and silty clays, with occasional medium stiff sandy clays and silty clays. At greater depths and extending to the maximum depth explored of 30± feet, the alluvium generally consists of medium dense to dense silty sands and sandy silts

Groundwater was not encountered during the drilling of any of the borings. Static groundwater table is at a greater depth than 30± feet below existing site grades.

Based on the results of infiltration testing and the subsurface profile identified in the boring logs, the site is underlain by soils which are not conducive to infiltration. Therefore, infiltration is not recommended for this project. See Appendix F for more details.

2.0 Project Specific Requirements

The proposed site is a Designated Project identified as a significant redevelopment where 50 percent or more of the impervious surface of a previously developed site is proposed to be altered and the previous development project was not subject to post-construction stormwater quality control measures. Hence, the entire site must meet the requirements of the LID Standards Manual.

2.1 Peak Storm Water Runoff Discharge Rates

The peak flow rate discharge from Building #1 and Building #2 will be limited to the allowable condition (11.9 cfs). In accordance with City of Torrance regulations, runoff volume ponding will be allowed only in the easterly loading docks, with a maximum depth of approximately 6 inches above ground. Any remaining peak flow runoff volume will be stored in underground chambers.

The total 50-year peak flow rate discharge will be limited to 3.2 cfs for Building #1 and 4.8 cfs for Building #2. This will require approximately 5,941 cubic feet and 9,345 cubic feet of storage, respectively, with a maximum ponding depth of approximately 0.5 feet above ground at the truck yard.

Building #1 and Building #2 will temporarily store runoff volume with a combination of aboveground storage (4,060 cubic feet for Building #1 and 5,186 cubic feet for Building #2) and underground chambers (3,760 cubic feet for Building #1 and 4,159 cubic feet for Building #2).

To reduce the proposed discharge to the allowable limit, the onsite storm drain pipe sizes will be determined using hydraulic calculations and considering the existing hydraulic grade line downstream. These detailed calculations will be provided during the project's final design phase.

The total 50-year peak flow rate from the project site to the existing 7'1"x8'6" RCB in Van Ness Avenue is approximately 11.9 cfs (3.2 cfs + 4.8 cfs + 2.4 cfs + 1.5 cfs) under the detained condition. This matches the allowable condition, demonstrating that the project site improvements will not negatively impact the existing offsite drainage facilities downstream.

2.2 Source Controls

Source control measures are designed to prevent pollutants from contacting stormwater runoff or prevent discharge of contaminated stormwater runoff to the storm drain system and/or receiving water. This section describes structural-type, source control measures that must be considered for implementation in conjunction with appropriate nonstructural source control measures, such as good housekeeping and employee training, to optimize pollution prevention.

Source control measures should be implemented to the maximum extent practicable to mitigate pollutant mobilization from the project site in stormwater and non-stormwater runoff. A

summary of the source control measures that should be implemented for each type of project is summarized below.

2.2.A Storm Drain Message and Signage (S-1)

All proposed and any existing inlets to remain will be stenciled with prohibitive language and/or graphical icons to prevent dumping. Legibility of the stencils/markers will be maintained on a yearly basis, or as needed.

2.2.B Outdoor Material Storage Area (S-2)

There are no proposed outdoor material storage areas for this project. Any and all materials will be stored indoors.

2.2.C Outdoor Trash Storage/Waste Handling Areas (S-3)

Trash enclosures will be located away from roof drainage. The bin's lid will remain close when not in use and will be walled off to prevent transport by wind and contact with rainfall.

2.2.D Outdoor Loading/Unloading Dock Area (S-4)

The project proposes to construct several aboveground loading docks with dock high doors which will remain closed when not in use. The concrete surface is designed to drain away from the building and minimize run-on to the loading docks. This area will be treated via underground chambers (detention only) and WetlandMOD biofiltration systems. Dock area flows are captured by inlets that utilize drain inserts to filter out pollutants prior to entering the biofiltration systems. Additionally, the proposed buildings will be utilized as a warehouse for finished goods and consequently, items being loaded/unloaded do not have the potential to contribute to stormwater pollution. Please refer to Appendix B for loading dock locations.

2.2.F Outdoor Vehicle/Equipment Repair/Maintenance Area (S-5)

Not applicable

2.2.G Outdoor Vehicle/Equipment Accessory Wash Area (S-6)

Not applicable

2.2.H Fuel & Maintenance Area (S-7)

Not applicable

2.2.I Landscape Irrigation Practices (S-8)

Install irrigation systems that utilize a weather-based smart irrigation controller to minimize water usage and reduce dry weather urban runoff.

2.2.J Building Materials (S-9)

Alternative building materials could not be used in-lieu of traditional materials due to the nature of the project (industrial warehouse).

2.2.K Animal Care and Handling Facilities (S-10)

Not applicable

2.2.L Outdoor Horticulture Areas (S-11)

Not applicable

2.3 Low Impact Development (LID)

2.3.A Infiltration

Refer to section 1.3 Geotechnical Investigation/Infiltration Feasibility.

2.3.B Harvest and Use

This concept was not utilized because it is an industrial facility where the amount of impervious area is much greater than landscape and toilet use. However, stormwater is detained for biofiltration prior to discharging offsite.

2.3.C Biofiltration

Prior to discharging offsite, the 1.5x SWQDv will be diverted to underground chambers for detention purposes. From the chambers, the SWQDv will be pumped into the above-grade WetlandMOD biofiltration systems that utilizes the 2012 MS4 Permit's Attachment H soils and plants for treatment. The pumps are designed to pump low flowrates that are equal to or slightly greater than the WetlandMOD's treatment flowrates. These flowrates are intended to drain/treat the 1.5x SWQDv within the allotted 96 hours. Pumped flows exceeding the WetlandMOD's treatment flowrate will overflow into a return pipe and outlet back into the upstream pump's wet well. Since the pump's flowrates are small, stormwater is designed/expected to back-up and fill the detention chambers. Once the chambers are full, it is understood that the 1.5x SWQDv has been achieved and stormwater will again back-up and spill into the overflow pipes within the diversion structures. After the storm event has passed, no additional flows will enter the chambers and the chambers will slowly deplete as stormwater is being pumped through the

WetlandMODs for treatment over 96 hours. Treated flows for WetlandMODs #1 and #2 will drain into Line "A" prior to discharging offsite. See Appendix A for detailed calculations.

2.4 Hydromodification

The proposed site is tributary to an engineered channel (Dominguez Channel) that is regularly maintained and is not susceptible to hydromodification impacts. In addition, the onsite water quality BMPs will assist in increasing the time of concentration and discharging flows at a control rate.

2.5 Conserve Natural Areas

During the subdivision design and approval process, the site layout must be consistent with the applicable General Plan and Local Area Plan policies and implement the following:

- *Concentrate or cluster development on portions of the site while leaving the remaining land in a natural undisturbed condition;*
- *Limit clearing and grading of native vegetation at the site to the minimum amount needed to build lots, allow access, and provide fire protection;*
- *Maximize trees and other vegetation at the site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants;*
- *Promote natural vegetation by using parking lot islands and other landscaped areas;*
- *Preserve riparian areas and wetlands.*

The property was previously developed with no natural areas to conserve.

2.6 Minimize Storm Water Pollutants of Concern

Stormwater runoff from a site has the potential to contribute oil and grease, suspended solids, metals, gasoline, pesticides, and pathogens to the stormwater conveyance system. The development must be designed so as to minimize, to the maximum extent practicable, the introduction of pollutants of concern that may result in significant impacts, generated from site runoff of directly connected impervious areas (DCIA), to the stormwater conveyance system as approved by the building official. Pollutants of concern, consist of any pollutants that exhibit one or more of the following characteristics: current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water, elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein, or the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna.

In meeting this specific requirement, "minimization of the pollutants of concern" will require the incorporation of a BMP or combination of BMPs best suited to maximize the reduction of pollutant loadings in that runoff to the Maximum Extent Practicable.

Anticipated pollutants generated from the proposed development are:

- Suspended Solids
- Total Phosphorus
- Total Nitrogen
- Total Kjeldahl Nitrogen
- Cadmium, Total
- Chromium, Total
- Copper, Total
- Lead, Total
- Zinc, Total

The receiving waters and their impairments are:

- Dominguez Channel: Benthic Community Effects, Benzo(a)anthracene, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Chlordane (tissue), Chrysene (C1-C4), Copper, DDT (tissue & sediment), Dieldrin (tissue), Indicator Bacteria, Lead , PCBs (Polychlorinated Biphenyls), Phenanthrene, Pyrene and Toxicity.
- Los Angeles Harbor – Consolidated Slip: 2-Methylnaphthalene, Benthic Community Effects, Benzo(a)anthracene, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Cadmium (sediment), Chlordane (tissue & sediment), Chromium, Chrysene (C1-C4), Copper (sediment), DDT (tissue & sediment), Dieldrin, Lead (sediment), Mercury (sediment), PCBs (Polychlorinated Biphenyls) (tissue & sediment), Phenanthrene, Pyrene, Toxaphene (tissue), Toxicity and Zinc (sediment).
- Los Angeles/Long Beach Inner Harbor: Benthic Community Effects, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Chrysene (C1-C4), Copper, DDT (Dichlorodiphenyltrichloroethane), PCBs (Polychlorinated Biphenyls), Toxicity and Zinc.
- Los Angeles/Long Beach Outer Harbor: DDT (Dichlorodiphenyltrichloroethane), PCBs (Polychlorinated Biphenyls) and Toxicity.
- San Pedro Bay Near/Off Shore Zones: Chlordane, PCBs (Polychlorinated Biphenyls), Total DDT and Toxicity.
- Pacific Ocean: None

The pollutants of concern of the project site are:

- Heavy Metals
- Bacteria
- Oxygen Demanding Substances
- Trash

The proposed project will disconnect runoff from impervious areas by means WetlandMOD biofiltration systems and underground detention. Inlets are used to intercept “low flows” towards the biofiltration systems for treatment prior to discharging offsite.

2.7 Protect Slopes and Channels

Project plans must include BMPs consistent with local codes and ordinances and LID to decrease the potential of slopes and/or channels from eroding and impacting stormwater runoff:

- *Convey runoff safely from the tops of slopes and stabilize disturbed slopes.*
- *Utilize natural drainage systems to the maximum extent practicable.*
- *Control or reduce or eliminate flow to natural drainage systems to the maximum extent practicable.*
- *Stabilize permanent channel crossings.*
- *Vegetate slopes with native or drought tolerant vegetation.*
- *Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion, with the approval of all agencies with jurisdiction, e.g., the U.S. Army Corps of Engineers and the California Department of Fish and Game.*

The proposed project site is located on a flat terrain. There are no slopes, natural drainage systems, or channel crossings to protect.

2.8 Provide Proof of Ongoing BMP Maintenance

Improper maintenance is one of the most common reasons why water quality controls will not function as designed or which may cause the system to fail entirely. It is important to consider who will be responsible for maintenance of a permanent BMP, and what equipment is required to perform the maintenance properly. If Structural or Treatment Control BMPs are required or included in project plans, the applicant must provide verification of maintenance provisions through such means as may be appropriate, including, but not limited to legal agreements, covenants, CEQA mitigation requirements and/or Conditional Use Permits.

The verification will include the developer's signed statement, as part of the project application, accepting responsibility for all Structural and Treatment Control BMP maintenance until the time the property is transferred and, where applicable, a signed agreement from the public entity assuming responsibility for Structural or Treatment Control BMP maintenance. The transfer of property to a private or public owner must have conditions requiring the recipient to assume responsibility for maintenance of any Structural or Treatment Control BMP to be included in the sales or lease agreement for that property, and will be the owner's responsibility. The condition of transfer shall include a provision that the property owners conduct maintenance inspection of all Structural or Treatment Control BMPs at least once a year and retain proof of inspection. For residential properties where the Structural or Treatment Control BMPs are located within a common area, which will be maintained by a homeowner's association, language regarding the responsibility for maintenance must be included in the project's conditions, covenants and restrictions (CC&Rs). Printed educational materials will be required to accompany the first deed transfer to highlight the existence of the requirement and to provide information on what stormwater management facilities are present, signs that maintenance is needed, how the

necessary maintenance can be performed, and assistance that the Permittee can provide. The transfer of this information shall also be required with any subsequent sale of the property.

Structural or Treatment Control BMPs located within a public area proposed for transfer will be the responsibility of the developer until accepted for transfer by the appropriate public agency. Structural or Treatment Control BMPs proposed for transfer must meet design standards adopted by the public entity for the BMP installed and should be approved by the appropriate public agency prior to its installation.
The property owner/operator will maintain proof of ongoing maintenance at the site as recorded in the covenant and agreement (see Appendix D).

2.9 Design Standards for Structural or Treatment Controls BMPs

The proposed site is a Designated Project identified as a significant redevelopment where 50 percent or more of the impervious surface of a previously developed site is proposed to be altered and the previous development project was not subject to post-construction stormwater quality control measures. Hence, the entire site must meet the requirements of the LID Standards Manual.

WetlandMOD biofiltration with underground chambers: Prior to discharging offsite, the 1.5x SWQDv will be diverted to underground chambers for detention purposes. From the chambers, the SWQDv will be pumped into the above-grade WetlandMOD biofiltration systems that utilizes the 2012 MS4 Permit's Attachment H soils and plants for treatment. The pumps are designed to pump low flowrates that are equal to or slightly greater than the WetlandMOD's treatment flowrates. These flowrates are intended to drain/treat the 1.5x SWQDv within the allotted 96 hours. Pumped flows exceeding the WetlandMOD's treatment flowrate will overflow into a return pipe and outlet back into the upstream pump's wet well. Since the pump's flowrates are small, stormwater is designed/expected to back-up and fill the detention chambers. Once the chambers are full, it is understood that the 1.5x SWQDv has been achieved and stormwater will again back-up and spill into the overflow pipes within the diversion structures. After the storm event has passed, no additional flows will enter the chambers and the chambers will slowly deplete as stormwater is being pumped through the WetlandMODs for treatment over 96 hours. Treated flows for WetlandMODs #1 and #2 will drain into Line "A" prior to discharging offsite. See Appendix A for detailed calculations.

2.10 Provisions Applicable to Individual Priority Project Categories

2.10.A Parking Lots

2.10.A.1 Properly Design Parking Area

Parking lots contain pollutants such as heavy metals, oil and grease, and polycyclic aromatic hydrocarbons that are deposited on parking lot surfaces by motor-vehicles. These pollutants are directly transported to surface waters. To minimize the offsite transport of pollutants, the following design criteria are required:

- *Reduce impervious land coverage of parking areas.*
- *Infiltrate runoff before it reaches storm drain system.*
- *Treat runoff before it reaches storm drain system.*

The proposed project is designed so that pollutants from the impervious surfaces are disconnected prior to discharging offsite. Runoff from the parking lots is transported through WetlandMOD biofiltration systems and underground detention for treatment.

2.10.A.2 Properly Design to Limit Oil Contamination and Perform Maintenance

Parking lots may accumulate oil, grease, and water insoluble hydrocarbons from vehicle drippings and engine system leaks.

- *Treat to remove oil and petroleum hydrocarbons at parking lots that are heavily used (e.g. fast food outlets, lots with 25 or more parking spaces, sports event parking lots, shopping malls, grocery stores, discount warehouse stores).*
- *Ensure adequate operation and maintenance of treatment systems particularly sludge and oil removal, and system fouling and plugging prevention control.*

The project owner will ensure that grease and oil are contained. The parking lot will be swept on a monthly basis, minimum, and before any rain events. Absorbent materials will be used to collect any spilled oil, and disposed of properly, to ensure they do not contaminate stormwater. Drain inserts will be used at all proposed onsite inlets and collect drainage from impervious areas prior to flowing through the BMP system for treatment. Hydrocarbon booms from the drain inserts are highly effective in the removal of hydrocarbons.

2.11 Waiver

A Permittee may, through adoption of an ordinance or code incorporating the treatment requirements of LID, provide for a waiver from the requirement if impracticability for a specific property can be established. A waiver of impracticability shall be granted only when all other Structural or Treatment Control BMPs have been considered and rejected as infeasible. Recognized situations of impracticability include, (i) extreme limitations of space for treatment on a redevelopment project, (ii) unfavorable or unstable soil conditions at a site to attempt infiltration, and (iii) risk of ground water contamination because a known unconfined aquifer lies beneath the land surface or an existing or potential underground source of drinking water is less than 10 feet from the soil surface. Any other justification for impracticability must be separately petitioned by the Permittee and submitted to the Regional Board for consideration. The Regional Board may consider approval of the waiver justification or may delegate the authority to approve a class of waiver justifications to the Regional Board Executive Officer. The supplementary waiver justification becomes recognized and effective only after approval by the Regional Board or the Regional Board Executive Officer. A waiver granted by a Permittee to any development or redevelopment project may be revoked by the Regional Board Executive Officer for cause and with proper notice upon petition.

The proposed project does not require a waiver of impracticability from any LID conditions.

2.12 Mitigation Funding

The Permittees may propose a management framework, for endorsement by the Regional Board Executive Officer, to support regional or sub-regional solutions to storm water pollution, where any of the following situations occur:

- *A waiver for impracticability is granted;*
- *Legislative funds become available;*
- *Off-site mitigation is required because of loss of environmental habitat; or*
- *An approved watershed management plan or a regional storm water mitigation plan exists that incorporates an equivalent or improved strategy for storm water mitigation.*

No management framework for mitigation funding is necessary for the proposed project.

Funding will be the responsibility of the owner:

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MARINA DEL REY, CA 90292
PHONE: (XXX) XXX-XXXX
CONTACT: NICK ZAHAROV

2.13 Limitation on Use of Infiltration BMPs

Three factors significantly influence the potential for storm water to contaminate ground water. They are (i) pollutant mobility, (ii) pollutant abundance in storm water, (iii) and soluble fraction of pollutant. The risk of contamination of groundwater may be reduced by pretreatment of storm water. A discussion of limitations and guidance for infiltration practices is contained in, Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration, Report No. EPA/600/R-94/051, USEPA (1994).

In addition, the distance of the groundwater table from the infiltration BMP may also be a factor determining the risk of contamination. A water table distance separation of ten feet depth in California presumptively poses negligible risk for storm water not associated with industrial activity or high vehicular traffic.

Infiltration BMPs are not recommended for areas of industrial activity or areas subject to high vehicular traffic (25,000 or greater average daily traffic (ADT) on main roadway or 15,000 or more ADT on any intersecting roadway) unless appropriate pretreatment is provided to ensure groundwater is protected and the infiltration BMP is not rendered ineffective by overload.

See Section 1.3 of this LID report for details.

2.14 Alternative Certification for Storm Water Treatment Mitigation

In lieu of conducting detailed BMP review to verify Structural or Treatment Control BMPs adequacy, a Permittee may elect to accept a signed certification from a Civil Engineer or a Licensed Architect registered in the State of California, that the plan meets the criteria established herein. The Permittee is encouraged to verify that certifying person(s) have been trained on BMP design for water quality, not more than two years prior to the signature date. Training conducted by an organization with storm water BMP design expertise (e.g., a University, American Society of Civil Engineers, American Society of Landscape Architects, American Public Works Association, or the California Water Environment Association) may be considered qualifying.

A California licensed civil engineer has provided a detailed BMP review of this report.

2.15 Resources and Reference

California Storm Water Best Management Practices Handbooks for Construction Activity (2009), Municipal (2003), and Industrial/Commercial (2003).

APPENDIX A

Stormwater Quality Design Calculations

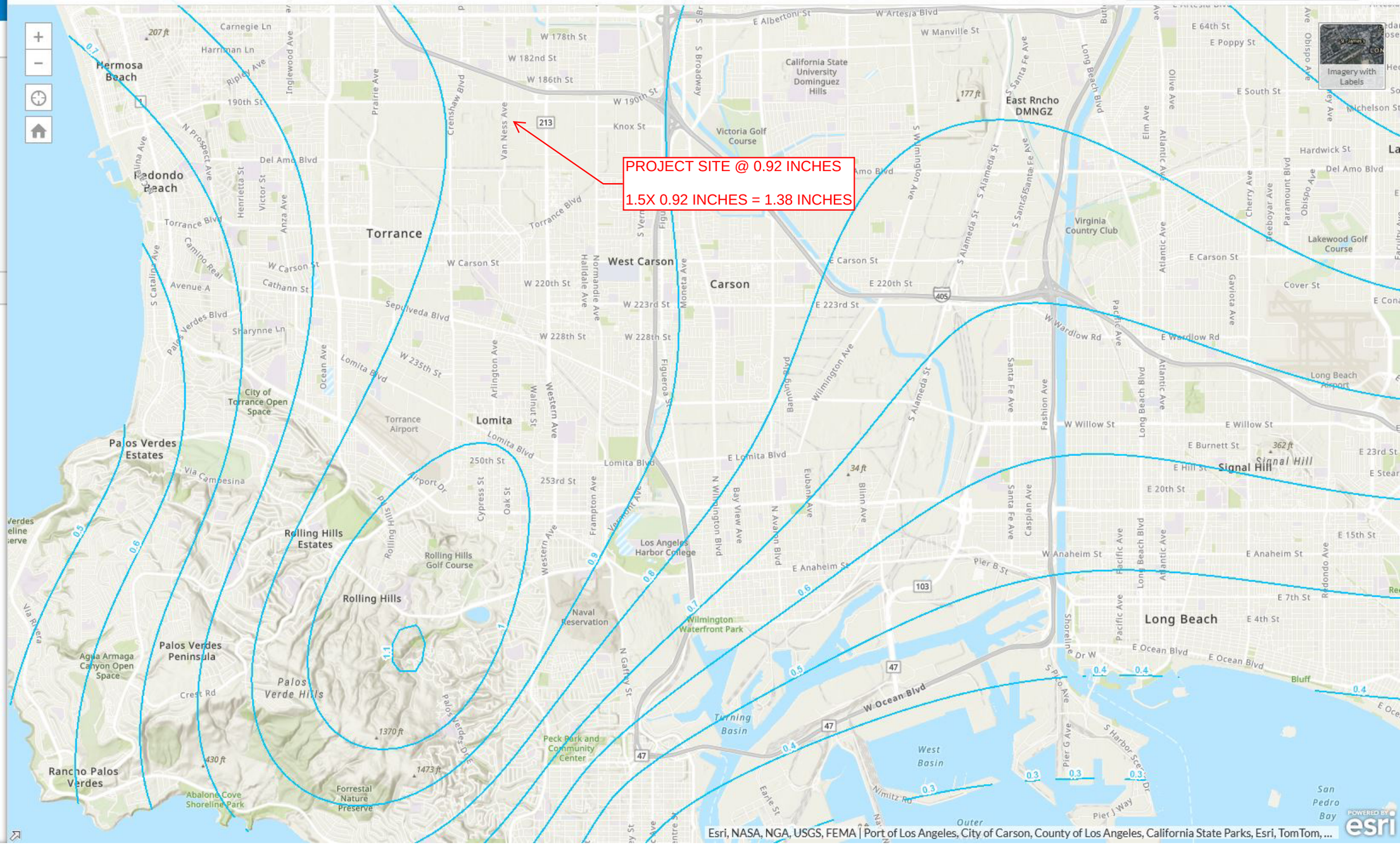
About | Legend | Layers

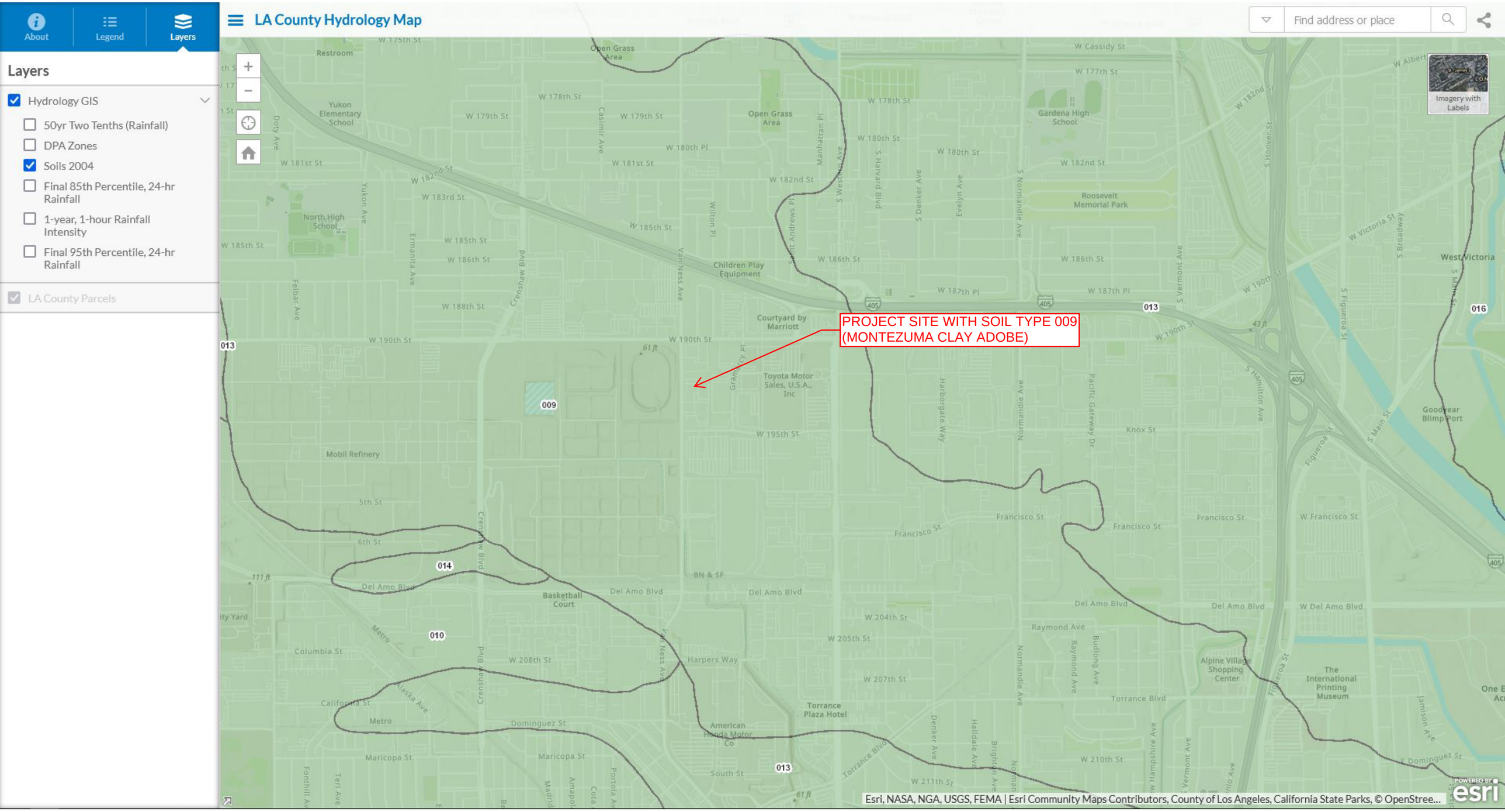
Layers

- [x] Hydrology GIS
  - [ ] 50yr Two Tenths (Rainfall)
  - [ ] DPA Zones
  - [ ] Soils 2004
  - [x] Final 85th Percentile, 24-hr Rainfall
  - [ ] 1-year, 1-hour Rainfall Intensity
  - [ ] Final 95th Percentile, 24-hr Rainfall
- [x] LA County Parcels

LA County Hydrology Map

Find address or place

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DPA Zones
Soils 2004
Final 85th Percentile, 24-hr Rainfall
1-year, 1-hour Rainfall Intensity
Final 95th Percentile, 24-hr Rainfall
LA County Parcels
PROJECT SITE WITH SOIL TYPE 009
(MONTEZUMA CLAY ADOBE)
Imagery with Labels
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, County of Los Angeles, California State Parks, © OpenStree...

Peak Flow Hydrologic Analysis

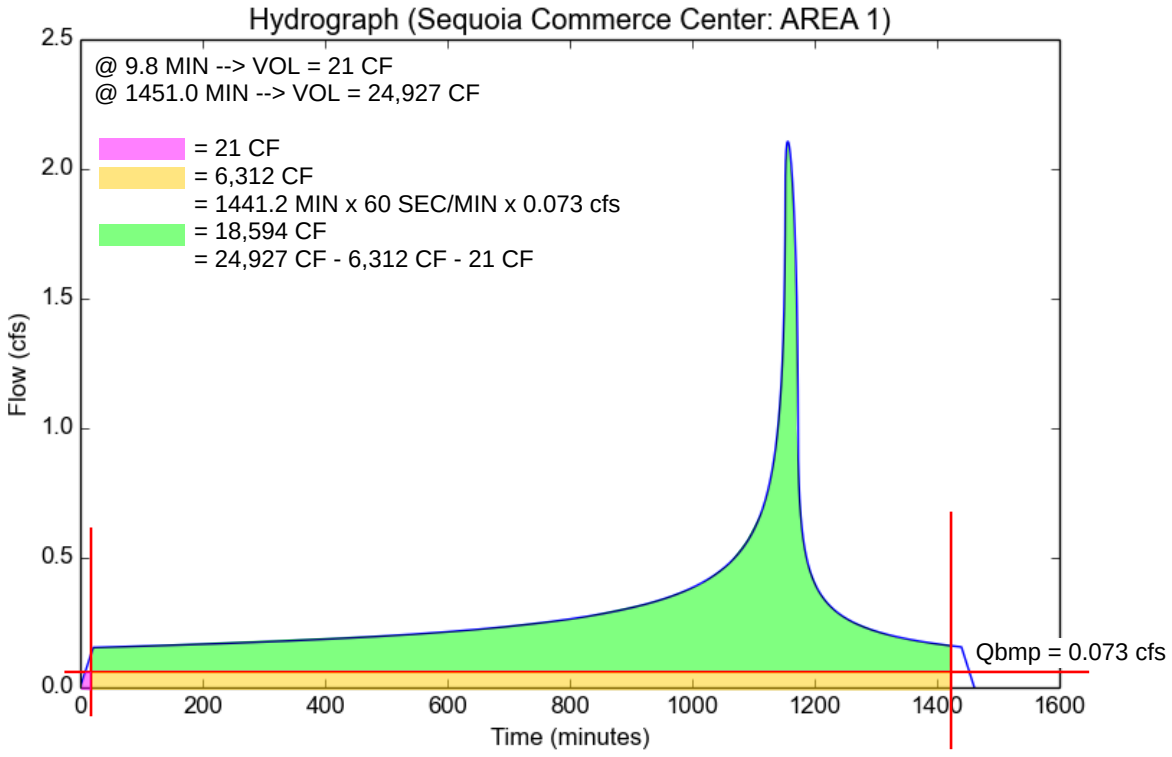
File location: O:/4200-4299/4221/SUSMP/2024-03-XX 1st Submittal/Appendices/Appendix A - SWQDv (PRINT IN COLOR)/HYDROCALC/Sequoia Comm
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Sequoia Commerce Center
Subarea ID	AREA 1
Area (ac)	5.58
Flow Path Length (ft)	563.0
Flow Path Slope (vft/hft)	0.008
85th Percentile Rainfall Depth (in)	1.38
Percent Impervious	1.0
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.38
Peak Intensity (in/hr)	0.4194
Undeveloped Runoff Coefficient (Cu)	0.2004
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	2.1064
Burned Peak Flow Rate (cfs)	2.1064
24-Hr Clear Runoff Volume (ac-ft)	0.5728
24-Hr Clear Runoff Volume (cu-ft)	24949.4355



Inputs: Sequoia Commerce Center

Subarea ID	Area (ac)	Flow Path L	Flow Path S	85th Percer	Percent Imp	Soil Type	Design Stor	Fire Factor
AREA 1	5.58	563	0.008	1.38	1	9	85th percer	0

Outputs: Sequoia Commerce Center

Area (ac)	Modeled (8	Time of Cor	Clear Peak	24-Hr Clear	Burned Pea	Peak Intens	Undevelope	Developed
AREA 1	1.38	21	2.106356	0.57276	2.106356	0.419426	0.200434	0.9

Hydrograph: Sequoia Commerce Center - AREA 1

Time (min)	Incrementa	Incrementa	Intensity (ir	Undevelope	Developed	Clear Peak	Incrementa	Cumulative
0	0	0	0	0	0	0	0	0
0.2	7.36E-05	0.000102	0	0	0	0.001464	0.008783	0.008783
0.4	0.000147	0.000203	0	0	0	0.002928	0.02635	0.035133
0.6	0.000221	0.000305	0	0	0	0.004392	0.043916	0.079049
0.8	0.000294	0.000406	0	0	0	0.005856	0.061483	0.140532
1	0.000368	0.000508	0	0	0	0.007319	0.079049	0.219581
1.2	0.000442	0.00061	0	0	0	0.008783	0.096616	0.316197
1.4	0.000515	0.000711	0	0	0	0.010247	0.114182	0.43038
1.6	0.000589	0.000813	0	0	0	0.011711	0.131749	0.562128
1.8	0.000663	0.000915	0	0	0	0.013175	0.149315	0.711444
2	0.000736	0.001016	0	0	0	0.014639	0.166882	0.878326
2.2	0.00081	0.001118	0	0	0	0.016103	0.184448	1.062774
2.4	0.000884	0.00122	0	0	0	0.017567	0.202015	1.264789
2.6	0.000957	0.001321	0	0	0	0.01903	0.219581	1.48437
2.8	0.001031	0.001423	0	0	0	0.020494	0.237148	1.721518
3	0.001105	0.001525	0	0	0	0.021958	0.254714	1.976233
3.2	0.001179	0.001626	0	0	0	0.023422	0.272281	2.248514
3.4	0.001252	0.001728	0	0	0	0.024886	0.289847	2.538361
3.6	0.001326	0.00183	0	0	0	0.02635	0.307414	2.845775
3.8	0.0014	0.001932	0	0	0	0.027814	0.324981	3.170756
4	0.001473	0.002033	0	0	0	0.029278	0.342547	3.513303
4.2	0.001547	0.002135	0	0	0	0.030741	0.360114	3.873416
4.4	0.001621	0.002237	0	0	0	0.032205	0.37768	4.251096
4.6	0.001695	0.002339	0	0	0	0.033669	0.395247	4.646343
4.8	0.001768	0.00244	0	0	0	0.035133	0.412813	5.059156
5	0.001842	0.002542	0	0	0	0.036597	0.43038	5.489536
5.2	0.001916	0.002644	0	0	0	0.038061	0.447946	5.937482
5.4	0.00199	0.002746	0	0	0	0.039525	0.465513	6.402994
5.6	0.002063	0.002848	0	0	0	0.040989	0.483079	6.886073
5.8	0.002137	0.002949	0	0	0	0.042452	0.500646	7.386719
6	0.002211	0.003051	0	0	0	0.043916	0.518212	7.904931
6.2	0.002285	0.003153	0	0	0	0.04538	0.535779	8.44071

6.4	0.002359	0.003255	0	0	0	0.046844	0.553345	8.994055
6.6	0.002432	0.003357	0	0	0	0.048308	0.570912	9.564967
6.8	0.002506	0.003459	0	0	0	0.049772	0.588478	10.15345
7	0.00258	0.003561	0	0	0	0.051236	0.606045	10.75949
7.2	0.002654	0.003662	0	0	0	0.0527	0.623611	11.3831
7.4	0.002728	0.003764	0	0	0	0.054163	0.641178	12.02428
7.6	0.002802	0.003866	0	0	0	0.055627	0.658744	12.68302
7.8	0.002875	0.003968	0	0	0	0.057091	0.676311	13.35933
8	0.002949	0.00407	0	0	0	0.058555	0.693877	14.05321
8.2	0.003023	0.004172	0	0	0	0.060019	0.711444	14.76466
8.4	0.003097	0.004274	0	0	0	0.061483	0.72901	15.49367
8.6	0.003171	0.004376	0	0	0	0.062947	0.746577	16.24024
8.8	0.003245	0.004478	0	0	0	0.064411	0.764143	17.00439
9	0.003319	0.00458	0	0	0	0.065874	0.78171	17.7861
9.2	0.003392	0.004682	0	0	0	0.067338	0.799276	18.58537
9.4	0.003466	0.004784	0	0	0	0.068802	0.816843	19.40221
9.6	0.00354	0.004886	0	0	0	0.070266	0.834409	20.23662
9.8	0.003614	0.004988	0	0	0	0.07173	0.851976	21.0886
10	0.003688	0.00509	0	0	0	0.073194	0.869542	21.95814
10.2	0.003762	0.005192	0	0	0	0.074658	0.887109	22.84525
10.4	0.003836	0.005294	0	0	0	0.076122	0.904675	23.74993
10.6	0.00391	0.005396	0	0	0	0.077585	0.922242	24.67217
10.8	0.003984	0.005498	0	0	0	0.079049	0.939808	25.61198
11	0.004058	0.0056	0	0	0	0.080513	0.957375	26.56935
11.2	0.004132	0.005702	0	0	0	0.081977	0.974942	27.54429
11.4	0.004206	0.005804	0	0	0	0.083441	0.992508	28.5368
11.6	0.00428	0.005906	0	0	0	0.084905	1.010075	29.54688
11.8	0.004354	0.006008	0	0	0	0.086369	1.027641	30.57452
12	0.004428	0.00611	0	0	0	0.087833	1.045208	31.61973
12.2	0.004502	0.006212	0	0	0	0.089296	1.062774	32.6825
12.4	0.004575	0.006314	0	0	0	0.09076	1.080341	33.76284
12.6	0.004649	0.006416	0	0	0	0.092224	1.097907	34.86075
12.8	0.004723	0.006518	0	0	0	0.093688	1.115474	35.97622
13	0.004797	0.006621	0	0	0	0.095152	1.13304	37.10926
13.2	0.004871	0.006723	0	0	0	0.096616	1.150607	38.25987
13.4	0.004946	0.006825	0	0	0	0.09808	1.168173	39.42804
13.6	0.00502	0.006927	0	0	0	0.099544	1.18574	40.61378
13.8	0.005094	0.007029	0	0	0	0.101007	1.203306	41.81709
14	0.005168	0.007131	0	0	0	0.102471	1.220873	43.03796
14.2	0.005242	0.007233	0	0	0	0.103935	1.238439	44.2764
14.4	0.005316	0.007336	0	0	0	0.105399	1.256006	45.5324
14.6	0.00539	0.007438	0	0	0	0.106863	1.273572	46.80598
14.8	0.005464	0.00754	0	0	0	0.108327	1.291139	48.09712
15	0.005538	0.007642	0	0	0	0.109791	1.308705	49.40582

1449.6	1	1.38	0.016701	0.1	0.9	0.08387	1.015355	24920.84
1449.8	1	1.38	0.016405	0.1	0.9	0.082385	0.997529	24921.84
1450	1	1.38	0.016109	0.1	0.9	0.0809	0.979709	24922.82
1450.2	1	1.38	0.015814	0.1	0.9	0.079416	0.961895	24923.78
1450.4	1	1.38	0.015518	0.1	0.9	0.077932	0.944087	24924.73
1450.6	1	1.38	0.015223	0.1	0.9	0.076449	0.926285	24925.65
1450.8	1	1.38	0.014928	0.1	0.9	0.074966	0.908489	24926.56
1451	1	1.38	0.014632	0.1	0.9	0.073484	0.890699	24927.45
1451.2	1	1.38	0.014337	0.1	0.9	0.072002	0.872915	24928.32
1451.4	1	1.38	0.014042	0.1	0.9	0.070521	0.855137	24929.18
1451.6	1	1.38	0.013748	0.1	0.9	0.06904	0.837365	24930.02
1451.8	1	1.38	0.013453	0.1	0.9	0.06756	0.8196	24930.84
1452	1	1.38	0.013158	0.1	0.9	0.06608	0.80184	24931.64
1452.2	1	1.38	0.012864	0.1	0.9	0.064601	0.784086	24932.42
1452.4	1	1.38	0.012569	0.1	0.9	0.063122	0.766338	24933.19
1452.6	1	1.38	0.012275	0.1	0.9	0.061644	0.748596	24933.94
1452.8	1	1.38	0.011981	0.1	0.9	0.060166	0.73086	24934.67
1453	1	1.38	0.011686	0.1	0.9	0.058689	0.71313	24935.38
1453.2	1	1.38	0.011392	0.1	0.9	0.057212	0.695406	24936.08
1453.4	1	1.38	0.011098	0.1	0.9	0.055736	0.677688	24936.75
1453.6	1	1.38	0.010804	0.1	0.9	0.05426	0.659976	24937.41
1453.8	1	1.38	0.010511	0.1	0.9	0.052785	0.64227	24938.06
1454	1	1.38	0.010217	0.1	0.9	0.05131	0.624569	24938.68
1454.2	1	1.38	0.009923	0.1	0.9	0.049836	0.606875	24939.29
1454.4	1	1.38	0.00963	0.1	0.9	0.048362	0.589187	24939.88
1454.6	1	1.38	0.009337	0.1	0.9	0.046889	0.571504	24940.45
1454.8	1	1.38	0.009043	0.1	0.9	0.045416	0.553827	24941
1455	1	1.38	0.00875	0.1	0.9	0.043944	0.536157	24941.54
1455.2	1	1.38	0.008457	0.1	0.9	0.042472	0.518492	24942.06
1455.4	1	1.38	0.008164	0.1	0.9	0.041	0.500833	24942.56
1455.6	1	1.38	0.007871	0.1	0.9	0.03953	0.48318	24943.04
1455.8	1	1.38	0.007578	0.1	0.9	0.038059	0.465533	24943.51
1456	1	1.38	0.007286	0.1	0.9	0.036589	0.447891	24943.95
1456.2	1	1.38	0.006993	0.1	0.9	0.03512	0.430256	24944.38
1456.4	1	1.38	0.006701	0.1	0.9	0.033651	0.412626	24944.8
1456.6	1	1.38	0.006408	0.1	0.9	0.032183	0.395002	24945.19
1456.8	1	1.38	0.006116	0.1	0.9	0.030715	0.377384	24945.57
1457	1	1.38	0.005824	0.1	0.9	0.029247	0.359772	24945.93
1457.2	1	1.38	0.005532	0.1	0.9	0.02778	0.342166	24946.27
1457.4	1	1.38	0.00524	0.1	0.9	0.026314	0.324566	24946.6
1457.6	1	1.38	0.004948	0.1	0.9	0.024848	0.306971	24946.9
1457.8	1	1.38	0.004656	0.1	0.9	0.023382	0.289382	24947.19
1458	1	1.38	0.004364	0.1	0.9	0.021917	0.271799	24947.46
1458.2	1	1.38	0.004073	0.1	0.9	0.020453	0.254222	24947.72

1458.4	1	1.38	0.003781	0.1	0.9	0.018989	0.236651	24947.96
1458.6	1	1.38	0.00349	0.1	0.9	0.017525	0.219085	24948.17
1458.8	1	1.38	0.003198	0.1	0.9	0.016062	0.201525	24948.38
1459	1	1.38	0.002907	0.1	0.9	0.0146	0.183971	24948.56
1459.2	1	1.38	0.002616	0.1	0.9	0.013138	0.166423	24948.73
1459.4	1	1.38	0.002325	0.1	0.9	0.011676	0.14888	24948.88
1459.6	1	1.38	0.002034	0.1	0.9	0.010215	0.131344	24949.01
1459.8	1	1.38	0.001743	0.1	0.9	0.008754	0.113812	24949.12
1460	1	1.38	0.001452	0.1	0.9	0.007294	0.096287	24949.22
1460.2	1	1.38	0.001162	0.1	0.9	0.005834	0.078768	24949.3
1460.4	1	1.38	0.000871	0.1	0.9	0.004375	0.061254	24949.36
1460.6	1	1.38	0.000581	0.1	0.9	0.002916	0.043746	24949.4
1460.8	1	1.38	0.00029	0.1	0.9	0.001458	0.026244	24949.43
1461	1	1.38	0	0.1	0.9	0	0.008747	24949.44

1461 min x 60 (sec/min) x 0.073 cfs = 6,399 cf biofiltered

WetlandMOD - 24" Media Thickness, Volume Based

Project ID:	795261-020
Project Name:	Sequoia Commerce Center (Area 1)
City, State, ZIP:	Torrance, CA
Date:	14-Mar

Blue = User Input
Gray = Formula
Green = Proceed
Red = Redo

WetlandMOD Size	**WM-11-23-V**

	User Input Data		
LA County 24"; Bay Area 18"	Media Thickness (in)	24	
Volume By EOR	Treatment Volume (CF)	24950	
Drain Down Time in hours	Drain Down Time (hrs)	96	
LA 5-12in/hr; Bay Area 5-12in/hr	Infiltration Rate (in/hr)	12	
Add Row(s) to change footprint	Number of Row(s)	2	For half row, use 0.5
RIM/FG to Outlet pipe	WM Vault Depth (ft)	5.0	Single Max depth 7ft, Double Max depth 5ft
Includes 1" grout above pipe	Overflow/Return Pipe (in)	6	Includes 1" spacing above return pipe
	Overflow/Return below Top Slab (ft)	-1.42	
If using pump upstream	Operating head (ft)	3.58	Standard operating head = RIM - 9.5"

	Treatment Data	
Treatment volume x 448.8 =	Treatment Flow (gpm)	32.40
in/hr / 100 =	Media Loading Rate (gpm/sf)	0.12
Treatment flow / Loading rate =	Requried Media Surface Area (sf)	270.00

	Cage, HGL Height	
Provding 3" Multch on top	Cage Height (ft)	4.75
Reduced by 4" from FS	HGL Height (ft)	3.58
Length of cage in each row	Cage Length/ Row (ft)	19.0

	Final Checks	
Based on HGL head build up	Provided Media Surface Area (sf)	272.33
Unit discharge rate	Discharge Rate (cfs)	0.073
Orifice Diameter in inches	Orifice Diameter per Row (in)	0.85

Provided >= Required surface area, unit dimensions in good standing.

	Unit Dimensions		
Length of Media row + Baffle wall	Length Media chamber (ft)	19.0	
Pre-treatment + Filtration chm.	Total Length of Unit (ft)	23.0	4"/6" baffle wall part of Pre-treatment chamber
Total width of unit	Width of Unit (ft)	11.0	

Media, Gravel Volume	
WM Media Volume (cy)	26.74
Gravel Layer Volume (cy)	5.57

Feel free to fax or email proposed sizing calculations to BioClean, for assistance with sizing, compliance, and design.
Phone: 760.433.7640 |Fax: 760.433.3176
Email: Info@modularwetlands.com

BioClean
A QUIKRETE COMPANY

Project: **Sequoia Commerce Center (Area 1)**

Chamber Model -	MC-3500	
Units -	**Imperial**	Click Here for Metric
Number of Chambers -	100	
Number of End Caps -	10	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	36	in

StormTech Detention • Retention • Water Quality
A division of ADS

☐ Include Perimeter Stone in Calculations

Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Single End Cap (cubic feet)	Incremental Chambers (cubic feet)	Incremental End Cap (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch, EC and Stone (cubic feet)	Cumulative System (cubic feet)	Elevation (feet)	
93	0.00	0.00	0.00	0.00	176.81	176.81	23129.95	7.75	4,412 CF
92	0.00	0.00	0.00	0.00	176.81	176.81	22953.13	7.67	additional for
91	0.00	0.00	0.00	0.00	176.81	176.81	22776.32	7.58	50 year detention
90	0.00	0.00	0.00	0.00	176.81	176.81	22599.51	7.50	
89	0.00	0.00	0.00	0.00	176.81	176.81	22422.70	7.42	
88	0.00	0.00	0.00	0.00	176.81	176.81	22245.89	7.33	
87	0.00	0.00	0.00	0.00	176.81	176.81	22069.08	7.25	
86	0.00	0.00	0.00	0.00	176.81	176.81	21892.27	7.17	
85	0.00	0.00	0.00	0.00	176.81	176.81	21715.46	7.08	
84	0.00	0.00	0.00	0.00	176.81	176.81	21538.65	7.00	
83	0.00	0.00	0.00	0.00	176.81	176.81	21361.84	6.92	
82	0.00	0.00	0.00	0.00	176.81	176.81	21185.03	6.83	
81	0.06	0.00	5.81	0.00	174.49	180.30	21008.22	6.75	
80	0.19	0.02	19.41	0.24	168.95	188.60	20827.92	6.67	
79	0.29	0.04	29.40	0.38	164.90	194.67	20639.32	6.58	
78	0.40	0.05	40.36	0.52	160.46	201.34	20444.65	6.50	
77	0.69	0.07	68.72	0.68	149.05	218.45	20243.31	6.42	
76	1.03	0.09	102.83	0.88	135.33	239.04	20024.86	6.33	
75	1.25	0.11	124.95	1.07	126.40	252.43	19785.83	6.25	
74	1.42	0.13	142.22	1.26	119.42	262.90	19533.40	6.17	
73	1.57	0.14	157.31	1.44	113.31	272.07	19270.50	6.08	
72	1.71	0.16	170.72	1.63	107.87	280.22	18998.43	6.00	
71	**1.83**	**0.18**	**182.85**	**1.82**	**102.94**	**287.61**	**18718.22**	**5.92**	> 18,594 CF
70	1.94	0.20	193.78	2.01	98.50	294.28	18430.61	5.83	WQ volume met
69	2.04	0.22	204.08	2.18	94.30	300.57	18136.33	5.75	
68	2.13	0.23	213.47	2.35	90.48	306.30	17835.76	5.67	
67	2.22	0.25	222.42	2.51	86.84	311.77	17529.46	5.58	
66	2.31	0.27	230.68	2.66	83.48	316.81	17217.69	5.50	
65	2.38	0.28	238.48	2.80	80.30	321.58	16900.88	5.42	
64	2.46	0.29	245.91	2.94	77.27	326.12	16579.30	5.33	
63	2.53	0.31	252.82	3.08	74.45	330.35	16253.18	5.25	
62	2.59	0.32	259.37	3.21	71.78	334.36	15922.83	5.17	
61	2.66	0.33	265.61	3.34	69.23	338.18	15588.47	5.08	
60	2.72	0.35	271.51	3.47	66.82	341.80	15250.29	5.00	
59	2.77	0.36	277.13	3.60	64.52	345.25	14908.49	4.92	
58	2.82	0.37	282.47	3.72	62.34	348.52	14563.24	4.83	
57	2.88	0.38	287.55	3.84	60.25	351.64	14214.72	4.75	
56	2.92	0.40	292.41	3.96	58.26	354.64	13863.08	4.67	
55	2.97	0.41	296.99	4.08	56.38	357.45	13508.44	4.58	
54	3.01	0.42	301.25	4.19	54.64	360.07	13150.99	4.50	
53	3.05	0.43	305.33	4.30	52.96	362.58	12790.92	4.42	
52	3.09	0.44	309.43	4.40	51.28	365.11	12428.34	4.33	
51	3.13	0.45	313.06	4.51	49.78	367.35	12063.23	4.25	
50	3.17	0.46	316.57	4.61	48.34	369.52	11695.88	4.17	
49	3.20	0.47	319.95	4.71	46.95	371.60	11326.36	4.08	
48	3.23	0.48	323.11	4.80	45.65	373.56	10954.76	4.00	
47	3.26	0.49	326.14	4.89	44.40	375.43	10581.21	3.92	
46	3.29	0.50	329.03	4.98	43.21	377.21	10205.77	3.83	
45	3.32	0.51	331.80	5.06	42.07	378.93	9828.56	3.75	
44	3.34	0.51	334.41	5.14	40.99	380.54	9449.63	3.67	
43	3.37	0.52	336.86	5.22	39.98	382.06	9069.09	3.58	
42	3.39	0.53	339.25	5.30	38.99	383.54	8687.03	3.50	
41	3.41	0.54	341.45	5.37	38.08	384.90	8303.49	3.42	
40	3.44	0.54	343.70	5.43	37.16	386.29	7918.59	3.33	
39	3.46	0.55	345.77	5.49	36.30	387.57	7532.30	3.25	
38	3.48	0.56	347.87	5.55	35.44	388.86	7144.73	3.17	
37	3.51	0.59	350.51	5.95	34.23	390.69	6755.86	3.08	
36	0.00	0.00	0.00	0.00	176.81	176.81	6365.18	3.00	
35	0.00	0.00	0.00	0.00	176.81	176.81	6188.37	2.92	
34	0.00	0.00	0.00	0.00	176.81	176.81	6011.56	2.83	
33	0.00	0.00	0.00	0.00	176.81	176.81	5834.75	2.75	
32	0.00	0.00	0.00	0.00	176.81	176.81	5657.94	2.67	
31	0.00	0.00	0.00	0.00	176.81	176.81	5481.13	2.58	
30	0.00	0.00	0.00	0.00	176.81	176.81	5304.32	2.50	
29	0.00	0.00	0.00	0.00	176.81	176.81	5127.51	2.42	
28	0.00	0.00	0.00	0.00	176.81	176.81	4950.69	2.33	

Peak Flow Hydrologic Analysis

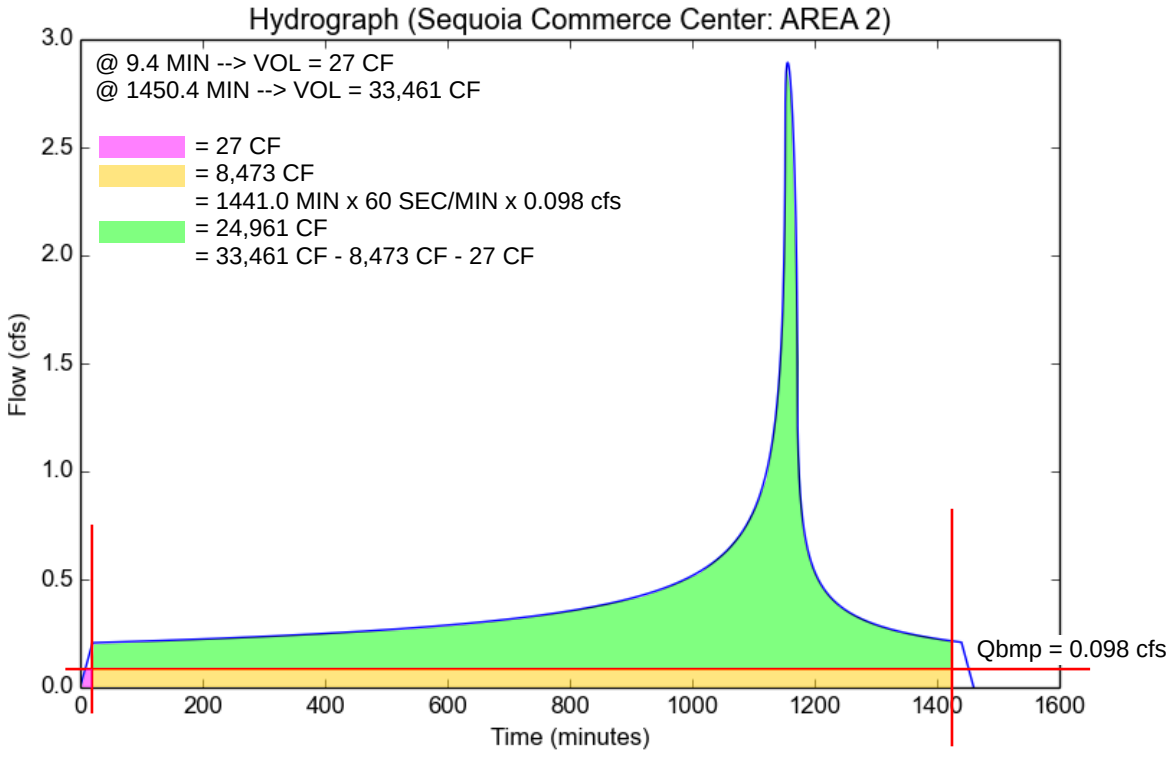
File location: O:/4200-4299/4221/SUSMP/2024-03-XX 1st Submittal/Appendices/Appendix A - SWQDv (PRINT IN COLOR)/HYDROCALC/Sequoia Comm
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Sequoia Commerce Center
Subarea ID	AREA 2
Area (ac)	7.49
Flow Path Length (ft)	522.0
Flow Path Slope (vft/hft)	0.008
85th Percentile Rainfall Depth (in)	1.38
Percent Impervious	1.0
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.38
Peak Intensity (in/hr)	0.4292
Undeveloped Runoff Coefficient (Cu)	0.2086
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	2.8929
Burned Peak Flow Rate (cfs)	2.8929
24-Hr Clear Runoff Volume (ac-ft)	0.7688
24-Hr Clear Runoff Volume (cu-ft)	33489.4578



Inputs: Sequoia Commerce Center

Subarea ID	Area (ac)	Flow Path L	Flow Path S	85th Percer	Percent Imp	Soil Type	Design Stor	Fire Factor
AREA 2	7.49	522	0.008	1.38	1	9	85th percer	0

Outputs: Sequoia Commerce Center

Area (ac)	Modeled (8	Time of Cor	Clear Peak	24-Hr Clear	Burned Pea	Peak Intens	Undevelope	Developed
AREA 2	1.38	20	2.892933	0.768812	2.892933	0.429155	0.208616	0.9

Hydrograph: Sequoia Commerce Center - AREA 2

Time (min)	Incrementa	Incrementa	Intensity (ir	Undevelope	Developed	Clear Peak	Incrementa	Cumulative
0	0	0	0	0	0	0	0	0
0.2	7.36E-05	0.000102	0	0	0	0.002063	0.012377	0.012377
0.4	0.000147	0.000203	0	0	0	0.004126	0.03713	0.049507
0.6	0.000221	0.000305	0	0	0	0.006188	0.061883	0.11139
0.8	0.000294	0.000406	0	0	0	0.008251	0.086636	0.198026
1	0.000368	0.000508	0	0	0	0.010314	0.11139	0.309416
1.2	0.000442	0.00061	0	0	0	0.012377	0.136143	0.445559
1.4	0.000515	0.000711	0	0	0	0.014439	0.160896	0.606455
1.6	0.000589	0.000813	0	0	0	0.016502	0.18565	0.792105
1.8	0.000663	0.000915	0	0	0	0.018565	0.210403	1.002508
2	0.000736	0.001016	0	0	0	0.020628	0.235156	1.237664
2.2	0.00081	0.001118	0	0	0	0.022691	0.259909	1.497573
2.4	0.000884	0.00122	0	0	0	0.024753	0.284663	1.782236
2.6	0.000957	0.001321	0	0	0	0.026816	0.309416	2.091652
2.8	0.001031	0.001423	0	0	0	0.028879	0.334169	2.425821
3	0.001105	0.001525	0	0	0	0.030942	0.358923	2.784744
3.2	0.001179	0.001626	0	0	0	0.033004	0.383676	3.16842
3.4	0.001252	0.001728	0	0	0	0.035067	0.408429	3.576849
3.6	0.001326	0.00183	0	0	0	0.03713	0.433182	4.010031
3.8	0.0014	0.001932	0	0	0	0.039193	0.457936	4.467967
4	0.001473	0.002033	0	0	0	0.041255	0.482689	4.950656
4.2	0.001547	0.002135	0	0	0	0.043318	0.507442	5.458098
4.4	0.001621	0.002237	0	0	0	0.045381	0.532195	5.990293
4.6	0.001695	0.002339	0	0	0	0.047444	0.556949	6.547242
4.8	0.001768	0.00244	0	0	0	0.049507	0.581702	7.128944
5	0.001842	0.002542	0	0	0	0.051569	0.606455	7.735399
5.2	0.001916	0.002644	0	0	0	0.053632	0.631209	8.366608
5.4	0.00199	0.002746	0	0	0	0.055695	0.655962	9.02257
5.6	0.002063	0.002848	0	0	0	0.057758	0.680715	9.703285
5.8	0.002137	0.002949	0	0	0	0.05982	0.705468	10.40875
6	0.002211	0.003051	0	0	0	0.061883	0.730222	11.13898
6.2	0.002285	0.003153	0	0	0	0.063946	0.754975	11.89395

6.4	0.002359	0.003255	0	0	0	0.066009	0.779728	12.67368
6.6	0.002432	0.003357	0	0	0	0.068072	0.804482	13.47816
6.8	0.002506	0.003459	0	0	0	0.070134	0.829235	14.30739
7	0.00258	0.003561	0	0	0	0.072197	0.853988	15.16138
7.2	0.002654	0.003662	0	0	0	0.07426	0.878741	16.04012
7.4	0.002728	0.003764	0	0	0	0.076323	0.903495	16.94362
7.6	0.002802	0.003866	0	0	0	0.078385	0.928248	17.87187
7.8	0.002875	0.003968	0	0	0	0.080448	0.953001	18.82487
8	0.002949	0.00407	0	0	0	0.082511	0.977754	19.80262
8.2	0.003023	0.004172	0	0	0	0.084574	1.002508	20.80513
8.4	0.003097	0.004274	0	0	0	0.086636	1.027261	21.83239
8.6	0.003171	0.004376	0	0	0	0.088699	1.052014	22.88441
8.8	0.003245	0.004478	0	0	0	0.090762	1.076768	23.96117
9	0.003319	0.00458	0	0	0	0.092825	1.101521	25.06269
9.2	0.003392	0.004682	0	0	0	0.094888	1.126274	26.18897
9.4	0.003466	0.004784	0	0	0	0.09695	1.151027	27.34
9.6	0.00354	0.004886	0	0	0	0.099013	1.175781	28.51578
9.8	0.003614	0.004988	0	0	0	0.101076	1.200534	29.71631
10	0.003688	0.00509	0	0	0	0.103139	1.225287	30.9416
10.2	0.003762	0.005192	0	0	0	0.105201	1.250041	32.19164
10.4	0.003836	0.005294	0	0	0	0.107264	1.274794	33.46643
10.6	0.00391	0.005396	0	0	0	0.109327	1.299547	34.76598
10.8	0.003984	0.005498	0	0	0	0.11139	1.3243	36.09028
11	0.004058	0.0056	0	0	0	0.113453	1.349054	37.43933
11.2	0.004132	0.005702	0	0	0	0.115515	1.373807	38.81314
11.4	0.004206	0.005804	0	0	0	0.117578	1.39856	40.2117
11.6	0.00428	0.005906	0	0	0	0.119641	1.423313	41.63501
11.8	0.004354	0.006008	0	0	0	0.121704	1.448067	43.08308
12	0.004428	0.00611	0	0	0	0.123766	1.47282	44.5559
12.2	0.004502	0.006212	0	0	0	0.125829	1.497573	46.05347
12.4	0.004575	0.006314	0	0	0	0.127892	1.522327	47.5758
12.6	0.004649	0.006416	0	0	0	0.129955	1.54708	49.12288
12.8	0.004723	0.006518	0	0	0	0.132017	1.571833	50.69471
13	0.004797	0.006621	0	0	0	0.13408	1.596586	52.2913
13.2	0.004871	0.006723	0	0	0	0.136143	1.62134	53.91264
13.4	0.004946	0.006825	0	0	0	0.138206	1.646093	55.55873
13.6	0.00502	0.006927	0	0	0	0.140269	1.670846	57.22958
13.8	0.005094	0.007029	0	0	0	0.142331	1.6956	58.92518
14	0.005168	0.007131	0	0	0	0.144394	1.720353	60.64553
14.2	0.005242	0.007233	0	0	0	0.146457	1.745106	62.39064
14.4	0.005316	0.007336	0	0	0	0.14852	1.769859	64.1605
14.6	0.00539	0.007438	0	0	0	0.150582	1.794613	65.95511
14.8	0.005464	0.00754	0	0	0	0.152645	1.819366	67.77448
15	0.005538	0.007642	0	0	0	0.154708	1.844119	69.61859

1449.6	1	1.38	0.015984	0.1	0.9	0.107748	1.305514	33455.94
1449.8	1	1.38	0.015674	0.1	0.9	0.105658	1.280432	33457.22
1450	1	1.38	0.015364	0.1	0.9	0.103569	1.255359	33458.47
1450.2	1	1.38	0.015054	0.1	0.9	0.10148	1.230294	33459.7
1450.4	1	1.38	0.014744	0.1	0.9	0.099393	1.205238	33460.91
1450.6	1	1.38	0.014435	0.1	0.9	0.097306	1.18019	33462.09
1450.8	1	1.38	0.014125	0.1	0.9	0.095219	1.155151	33463.24
1451	1	1.38	0.013816	0.1	0.9	0.093134	1.13012	33464.37
1451.2	1	1.38	0.013507	0.1	0.9	0.091049	1.105097	33465.48
1451.4	1	1.38	0.013198	0.1	0.9	0.088965	1.080083	33466.56
1451.6	1	1.38	0.012889	0.1	0.9	0.086881	1.055078	33467.61
1451.8	1	1.38	0.01258	0.1	0.9	0.084799	1.030081	33468.64
1452	1	1.38	0.012271	0.1	0.9	0.082717	1.005092	33469.65
1452.2	1	1.38	0.011962	0.1	0.9	0.080635	0.980111	33470.63
1452.4	1	1.38	0.011653	0.1	0.9	0.078555	0.955139	33471.58
1452.6	1	1.38	0.011345	0.1	0.9	0.076475	0.930176	33472.51
1452.8	1	1.38	0.011036	0.1	0.9	0.074395	0.90522	33473.42
1453	1	1.38	0.010728	0.1	0.9	0.072317	0.880273	33474.3
1453.2	1	1.38	0.01042	0.1	0.9	0.070239	0.855335	33475.16
1453.4	1	1.38	0.010112	0.1	0.9	0.068162	0.830405	33475.99
1453.6	1	1.38	0.009803	0.1	0.9	0.066085	0.805483	33476.79
1453.8	1	1.38	0.009496	0.1	0.9	0.06401	0.780569	33477.57
1454	1	1.38	0.009188	0.1	0.9	0.061934	0.755664	33478.33
1454.2	1	1.38	0.00888	0.1	0.9	0.05986	0.730767	33479.06
1454.4	1	1.38	0.008572	0.1	0.9	0.057786	0.705878	33479.76
1454.6	1	1.38	0.008265	0.1	0.9	0.055713	0.680998	33480.45
1454.8	1	1.38	0.007957	0.1	0.9	0.053641	0.656126	33481.1
1455	1	1.38	0.00765	0.1	0.9	0.051569	0.631262	33481.73
1455.2	1	1.38	0.007343	0.1	0.9	0.049498	0.606406	33482.34
1455.4	1	1.38	0.007036	0.1	0.9	0.047428	0.581559	33482.92
1455.6	1	1.38	0.006729	0.1	0.9	0.045359	0.55672	33483.48
1455.8	1	1.38	0.006422	0.1	0.9	0.04329	0.531889	33484.01
1456	1	1.38	0.006115	0.1	0.9	0.041221	0.507066	33484.52
1456.2	1	1.38	0.005808	0.1	0.9	0.039154	0.482252	33485
1456.4	1	1.38	0.005502	0.1	0.9	0.037087	0.457446	33485.46
1456.6	1	1.38	0.005195	0.1	0.9	0.035021	0.432648	33485.89
1456.8	1	1.38	0.004889	0.1	0.9	0.032955	0.407858	33486.3
1457	1	1.38	0.004582	0.1	0.9	0.030891	0.383076	33486.68
1457.2	1	1.38	0.004276	0.1	0.9	0.028827	0.358303	33487.04
1457.4	1	1.38	0.00397	0.1	0.9	0.026763	0.333537	33487.37
1457.6	1	1.38	0.003664	0.1	0.9	0.0247	0.30878	33487.68
1457.8	1	1.38	0.003358	0.1	0.9	0.022638	0.284031	33487.96
1458	1	1.38	0.003052	0.1	0.9	0.020577	0.25929	33488.22
1458.2	1	1.38	0.002747	0.1	0.9	0.018516	0.234558	33488.46

1458.4	1	1.38	0.002441	0.1	0.9	0.016456	0.209833	33488.67
1458.6	1	1.38	0.002136	0.1	0.9	0.014397	0.185117	33488.85
1458.8	1	1.38	0.00183	0.1	0.9	0.012338	0.160408	33489.01
1459	1	1.38	0.001525	0.1	0.9	0.01028	0.135708	33489.15
1459.2	1	1.38	0.00122	0.1	0.9	0.008223	0.111016	33489.26
1459.4	1	1.38	0.000915	0.1	0.9	0.006166	0.086332	33489.35
1459.6	1	1.38	0.00061	0.1	0.9	0.00411	0.061656	33489.41
1459.8	1	1.38	0.000305	0.1	0.9	0.002055	0.036988	33489.45
1460	1	1.38	0	0.1	0.9	0	0.012328	33489.46

1460 min x 60 (sec/min) x 0.098 cfs = 8,585 cf biofiltered

WetlandMOD - 24" Media Thickness, Volume Based

Project ID:	795261-020
Project Name:	Sequoia Commerce Center (Area 2)
City, State, ZIP:	Torrance, CA
Date:	14-Mar

Blue = User Input
Gray = Formula
Green = Proceed
Red = Redo

WetlandMOD Size	**WM-17-21-V**

	User Input Data		
LA County 24"; Bay Area 18"	Media Thickness (in)	24	
Volume By EOR	Treatment Volume (CF)	33490	
Drain Down Time in hours	Drain Down Time (hrs)	96	
LA 5-12in/hr; Bay Area 5-12in/hr	Infiltration Rate (in/hr)	12	
Add Row(s) to change footprint	Number of Row(s)	3	For half row, use 0.5
RIM/FG to Outlet pipe	WM Vault Depth (ft)	5.0	Single Max depth 7ft, Double Max depth 5ft
Includes 1" grout above pipe	Overflow/Return Pipe (in)	6	Includes 1" spacing above return pipe
	Overflow/Return below Top Slab (ft)	-1.42	
If using pump upstream	Operating head (ft)	3.58	Standard operating head = RIM - 9.5"

	Treatment Data	
Treatment volume x 448.8 =	Treatment Flow (gpm)	43.49
in/hr / 100 =	Media Loading Rate (gpm/sf)	0.12
Treatment flow / Loading rate =	Requried Media Surface Area (sf)	362.42

	Cage, HGL Height	
Provding 3" Multch on top	Cage Height (ft)	4.75
Reduced by 4" from FS	HGL Height (ft)	3.58
Length of cage in each row	Cage Length/ Row (ft)	17.0

	Final Checks	
Based on HGL head build up	Provided Media Surface Area (sf)	365.50
Unit discharge rate	Discharge Rate (cfs)	0.098
Orifice Diameter in inches	Orifice Diameter per Row (in)	0.81

Provided >= Required surface area, unit dimensions in good standing.

	Unit Dimensions		
Length of Media row + Baffle wall	Length Media chamber (ft)	17.0	
Pre-treatment + Filtration chm.	Total Length of Unit (ft)	21.0	4"/6" baffle wall part of Pre-treatment chamber
Total width of unit	Width of Unit (ft)	17.0	

Media, Gravel Volume	
WM Media Volume (cy)	35.89
Gravel Layer Volume (cy)	8.22

Feel free to fax or email proposed sizing calculations to BioClean, for assistance with sizing, compliance, and design.
Phone: 760.433.7640 |Fax: 760.433.3176
Email: Info@modularwetlands.com

BioClean
A QUIKRETE COMPANY

Project: **Sequoia Commerce Center (Area 2)**

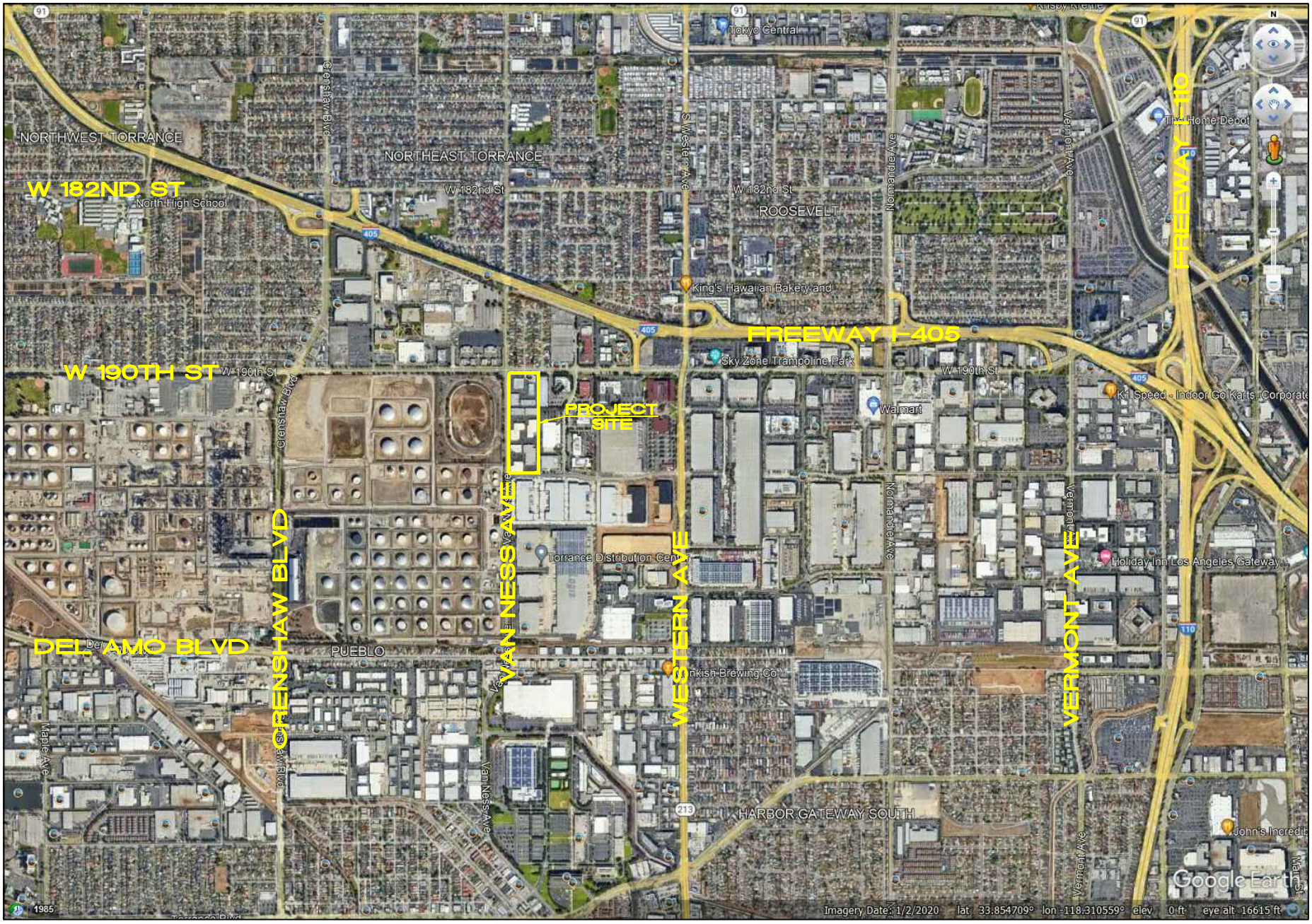
Chamber Model -	MC-3500	
Units -	**Imperial**	Click Here for Metric
Number of Chambers -	161	
Number of End Caps -	10	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	9	in

☐ Include Perimeter Stone in Calculations

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Single End Cap *(cubic feet)*	Incremental Chambers *(cubic feet)*	Incremental End Cap *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch, EC and Stone *(cubic feet)*	Cumulative System (cubic feet)	Elevation (feet)	
66	0.00	0.00	0.00	0.00	281.24	281.24	29272.51	5.50	4,272 CF
65	0.00	0.00	0.00	0.00	281.24	281.24	28991.27	5.42	additional for
64	0.00	0.00	0.00	0.00	281.24	281.24	28710.03	5.33	50 year detention
63	0.00	0.00	0.00	0.00	281.24	281.24	28428.79	5.25	
62	0.00	0.00	0.00	0.00	281.24	281.24	28147.55	5.17	
61	0.00	0.00	0.00	0.00	281.24	281.24	27866.31	5.08	
60	0.00	0.00	0.00	0.00	281.24	281.24	27585.07	5.00	
59	0.00	0.00	0.00	0.00	281.24	281.24	27303.83	4.92	
58	0.00	0.00	0.00	0.00	281.24	281.24	27022.59	4.83	
57	0.00	0.00	0.00	0.00	281.24	281.24	26741.35	4.75	
56	0.00	0.00	0.00	0.00	281.24	281.24	26460.11	4.67	
55	0.00	0.00	0.00	0.00	281.24	281.24	26178.87	4.58	
54	0.06	0.00	9.35	0.00	277.50	286.85	25897.63	4.50	
53	0.19	0.02	31.25	0.24	268.64	300.13	25610.77	4.42	
52	0.29	0.04	47.33	0.38	262.16	309.86	25310.64	4.33	
51	0.40	0.05	64.99	0.52	255.04	320.54	25000.78	4.25	> 24,961 CF
50	0.69	0.07	110.64	0.68	236.72	348.03	24680.24	4.17	WQ volume met
49	1.03	0.09	165.56	0.88	214.67	381.10	24332.21	4.08	
48	1.25	0.11	201.17	1.07	200.34	402.59	23951.10	4.00	
47	1.42	0.13	228.98	1.26	189.14	419.39	23548.52	3.92	
46	1.57	0.14	253.27	1.44	179.35	434.07	23129.13	3.83	
45	1.71	0.16	274.85	1.63	170.65	447.13	22695.06	3.75	
44	1.83	0.18	294.39	1.82	162.76	458.96	22247.93	3.67	
43	1.94	0.20	311.98	2.01	155.65	469.63	21788.97	3.58	
42	2.04	0.22	328.57	2.18	148.94	479.69	21319.33	3.50	
41	2.13	0.23	343.68	2.35	142.83	488.86	20839.64	3.42	
40	2.22	0.25	358.10	2.51	137.00	497.60	20350.78	3.33	
39	2.31	0.27	371.39	2.66	131.62	505.67	19853.18	3.25	
38	2.38	0.28	383.95	2.80	126.54	513.29	19347.51	3.17	
37	2.46	0.29	395.91	2.94	121.70	520.55	18834.22	3.08	
36	2.53	0.31	407.04	3.08	117.19	527.31	18313.66	3.00	
35	2.59	0.32	417.59	3.21	112.92	533.72	17786.35	2.92	
34	2.66	0.33	427.63	3.34	108.85	539.82	17252.63	2.83	
33	2.72	0.35	437.13	3.47	105.00	545.60	16712.81	2.75	
32	2.77	0.36	446.18	3.60	101.33	551.11	16167.21	2.67	
31	2.82	0.37	454.77	3.72	97.84	556.34	15616.10	2.58	
30	2.88	0.38	462.95	3.84	94.52	561.32	15059.76	2.50	
29	2.92	0.40	470.79	3.96	91.34	566.09	14498.45	2.42	
28	2.97	0.41	478.15	4.08	88.35	570.58	13932.36	2.33	
27	3.01	0.42	485.00	4.19	85.56	574.76	13361.78	2.25	
26	3.05	0.43	491.57	4.30	82.89	578.76	12787.03	2.17	
25	3.09	0.44	498.18	4.40	80.21	582.79	12208.26	2.08	
24	3.13	0.45	504.02	4.51	77.83	586.36	11625.47	2.00	
23	3.17	0.46	509.67	4.61	75.53	589.81	11039.12	1.92	
22	3.20	0.47	515.11	4.71	73.31	593.13	10449.31	1.83	
21	3.23	0.48	520.21	4.80	71.24	596.25	9856.18	1.75	
20	3.26	0.49	525.09	4.89	69.25	599.23	9259.93	1.67	
19	3.29	0.50	529.73	4.98	67.36	602.07	8660.70	1.58	
18	3.32	0.51	534.19	5.06	65.54	604.79	8058.63	1.50	
17	3.34	0.51	538.40	5.14	63.82	607.37	7453.84	1.42	
16	3.37	0.52	542.35	5.22	62.21	609.78	6846.47	1.33	
15	3.39	0.53	546.19	5.30	60.65	612.13	6236.69	1.25	
14	3.41	0.54	549.74	5.37	59.20	614.30	5624.55	1.17	
13	3.44	0.54	553.36	5.43	57.72	616.52	5010.25	1.08	
12	3.46	0.55	556.69	5.49	56.37	618.55	4393.73	1.00	
11	3.48	0.56	560.07	5.55	54.99	620.61	3775.18	0.92	
10	3.51	0.59	564.32	5.95	53.13	623.40	3154.57	0.83	
9	0.00	0.00	0.00	0.00	281.24	281.24	2531.17	0.75	
8	0.00	0.00	0.00	0.00	281.24	281.24	2249.92	0.67	
7	0.00	0.00	0.00	0.00	281.24	281.24	1968.68	0.58	
6	0.00	0.00	0.00	0.00	281.24	281.24	1687.44	0.50	
5	0.00	0.00	0.00	0.00	281.24	281.24	1406.20	0.42	
4	0.00	0.00	0.00	0.00	281.24	281.24	1124.96	0.33	
3	0.00	0.00	0.00	0.00	281.24	281.24	843.72	0.25	
2	0.00	0.00	0.00	0.00	281.24	281.24	562.48	0.17	
1	0.00	0.00	0.00	0.00	281.24	281.24	281.24	0.08	

APPENDIX B

LID Site Plan



Last Update: 3/7/24
O:\4200-4299\4221\4221VICMAP.dwg

"VICINITY MAP"
FOR

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

NORTHEAST CORNER OF W. 190TH ST. AND VAN NESS AVE.
TORRANCE, CA

LEGEND

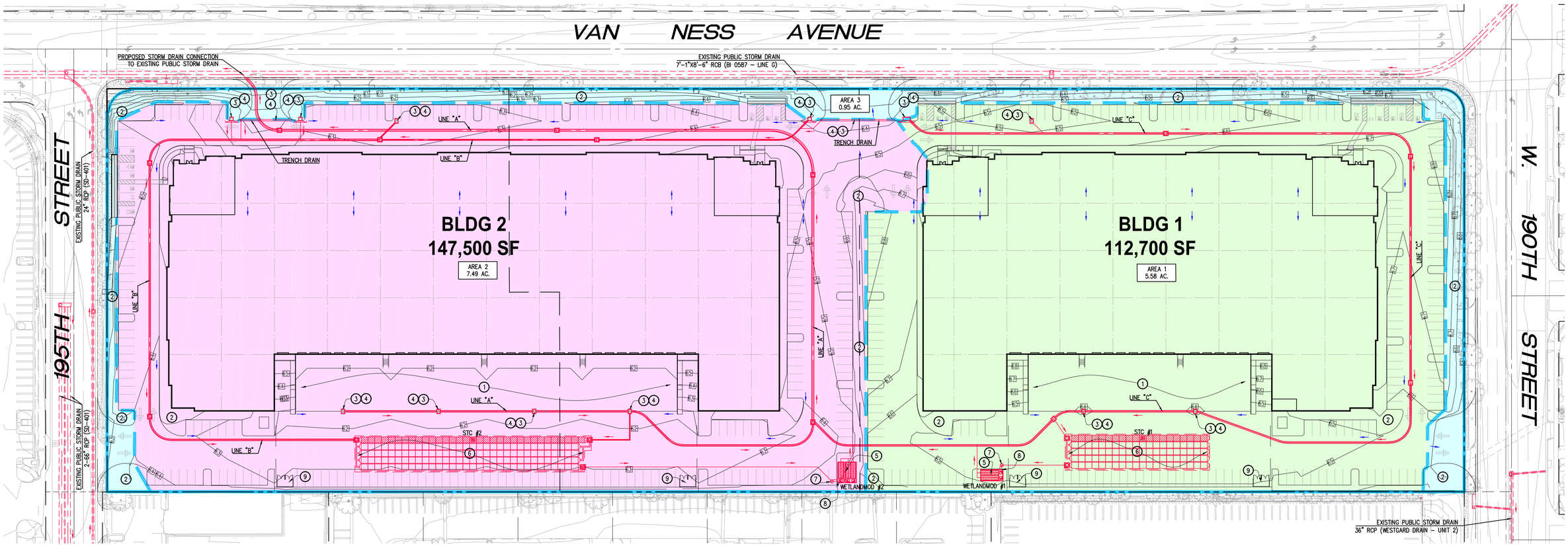
1. LOADING/UNLOADING DOCKS
2. LANDSCAPE
3. DRAIN INSERT(S)
4. CATCH BASIN STENCIL "NO DUMPING-THIS DRAINS TO OCEAN"
5. BIOCLEAN – WETLANDMOD SYSTEM
6. MC-3500 STORMTECH CHAMBERS WITH IMPERMEABLE LINER
7. SUMP PUMP
8. PUMP DISCHARGE LOCATION
9. TRASH ENCLOSURE

RD ROOF DRAIN
BOUNDARY
DRAINAGE AREAS
SURFACE FLOW LINE
SD FLOW LINE
SUBAREAS TRIBUTARY TO WETLANDMOD UNIT #1
SUBAREAS TRIBUTARY TO WETLANDMOD UNIT #2
SUBAREAS NOT ACCOUNTED FOR IN BMPS

NO DUMPING
DRAINS TO OCEAN

SAMPLE STENCIL TO BE USED NEAR GRATE AND CURB OPENING INLETS

VICINITY MAP
N.T.S.



Last Update: 3/22/24
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0 25 50 100 150
SCALE: 1"=50'

CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

LID SITE MAP

SEQUOIA COMMERCE CENTER
NORTHEAST CORNER OF W. 190TH ST. AND VAN NESS AVE.

4221/ 1 OF 3 SHEETS

PREPARED FOR:
IPERS SEQUOIA COMMERCE CENTER INC
13450 MAXELLA AVENUE, SUITE 220
MARINA DEL REY, CA 90292
PHONE: (XXX) XXX-XXXX

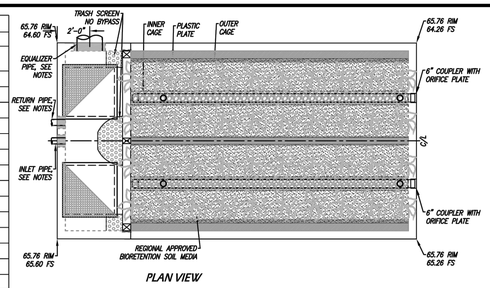
PREPARED BY:
Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

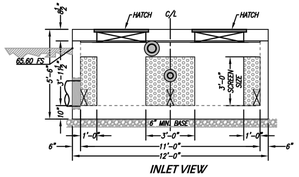
Approved by _____ Date _____
Public Works Director _____ R.C.E. _____

Sheet 1 of 3 Sheets

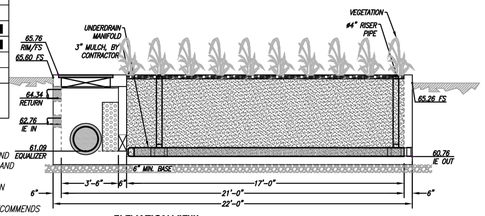
SITE SPECIFIC DATA			
PROJECT ID		795261-010	
PROJECT NAME		SEQUOIA COMMERCE CENTER (TEI 4221)	
PROJECT LOCATION		TORRANCE, CA	
STRUCTURE ID		WM #2A	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
22500 OF 33490		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) - IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE	62.76	PVC	2"
RETURN PIPE	64.34	PVC	6"
OVERFLOW PIPE	61.09	PVC	18"
OUTLET PIPE	60.76	PVC-SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	65.76	65.76	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	(2) 36"X36"	N/A	N
LA COUNTY MEDIA MIX VOLUME (CY)			25.08
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			5.25 SQ. FT.
ORIFICE DIAMETER (IN)			ø0.81"
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.			



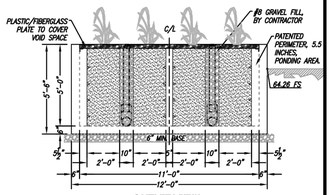
PLAN VIEW



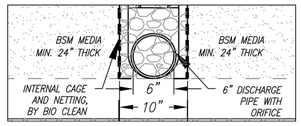
INLET VIEW



ELEVATION VIEW



OUTLET VIEW



INTERNAL CAGE DETAILS

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)		24
TREATMENT VOLUME (CF)		22500
TARGETED DRAINDOWN DURATION (HR)		96
WETLANDMEDIA INFILTRATION RATE (IN/HR)	OR	12
WETLANDMEDIA LOADING RATE (GPM/SF)		0.12
DISCHARGE RATE (CFS)		0.065
REQUIRED TOTAL MEDIA SURFACE AREA (SF)		243.49
PROVIDED TOTAL MEDIA SURFACE AREA (SF)		121.84
NUMBER OF ROW(S)		2

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURER'S STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

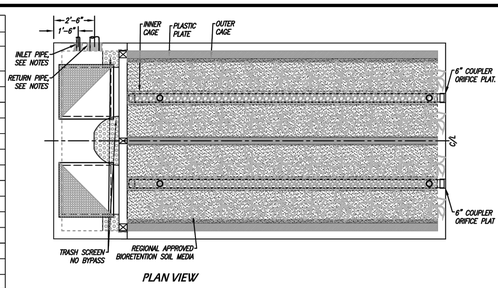
GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

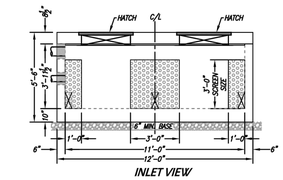
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

WetlandMOD-11'-21'-5'-0"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

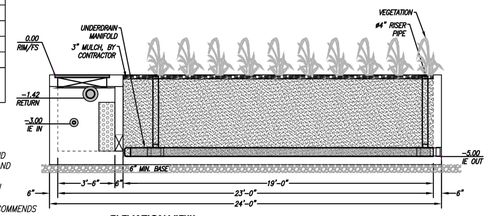
SITE SPECIFIC DATA			
PROJECT ID		795261-020	
PROJECT NAME		SEQUOIA COMMERCE CENTER (TEI 4221)	
PROJECT LOCATION		TORRANCE, CA	
STRUCTURE ID		WM #1	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
24950		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) - IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE	-3.00	PVC	2"
RETURN PIPE	-1.42	PVC	6"
OUTLET PIPE	-5.00	PVC-SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	0.00	0.00	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	(2) 36"X36"	N/A	N/A
LA COUNTY MEDIA MIX VOLUME (CY)			28.03
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			5.86
ORIFICE DIAMETER (IN)			ø0.85"
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.			



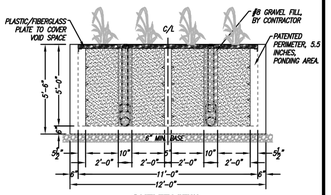
PLAN VIEW



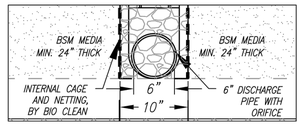
INLET VIEW



ELEVATION VIEW



OUTLET VIEW



INTERNAL CAGE DETAILS

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)		24
TREATMENT VOLUME (CF)		24950
TARGETED DRAINDOWN DURATION (HR)		96
WETLANDMEDIA INFILTRATION RATE (IN/HR)	OR	12
WETLANDMEDIA LOADING RATE (GPM/SF)		0.12
DISCHARGE RATE (CFS)		0.072
REQUIRED TOTAL MEDIA SURFACE AREA (SF)		270.00
PROVIDED TOTAL MEDIA SURFACE AREA (SF)		136.17
NUMBER OF ROW(S)		2

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
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4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

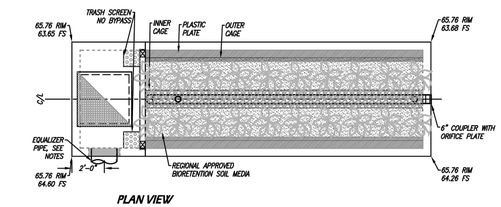
GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

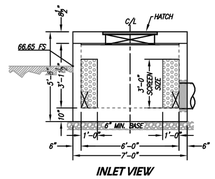
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

WetlandMOD-11'-23'-5'-0"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

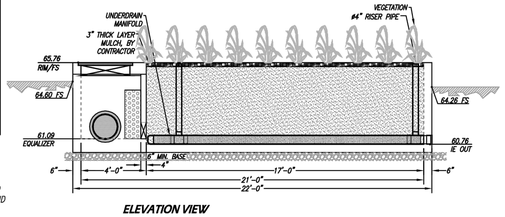
SITE SPECIFIC DATA			
PROJECT ID		795261-015	
PROJECT NAME		SEQUOIA COMMERCE CENTER (TEI 4221)	
PROJECT LOCATION		TORRANCE, CA	
STRUCTURE ID		WM #2B	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
11000 OF 33490		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) - IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
OVERFLOW PIPE	61.09	PVC	18"
RETURN PIPE	N/A	N/A	N/A
OUTLET PIPE	60.76	PVC-SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	65.76	65.76	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	36" X 36"	N/A	N/A
LA COUNTY MEDIA MIX VOLUME (CY)			12.54
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			3.40
ORIFICE DIAMETER (IN)			ø0.81"
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.			



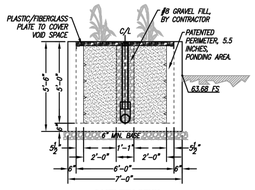
PLAN VIEW



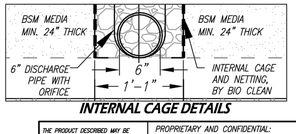
INLET VIEW



ELEVATION VIEW



OUTLET VIEW



INTERNAL CAGE DETAILS

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)		24
TREATMENT VOLUME (CF)		11000
TARGETED DRAINDOWN DURATION (HR)		96
WETLANDMEDIA INFILTRATION RATE (IN/HR)	OR	12
WETLANDMEDIA LOADING RATE (GPM/SF)		0.12
DISCHARGE RATE (CFS)		0.033
REQUIRED TOTAL MEDIA SURFACE AREA (SF)		119.04
PROVIDED TOTAL MEDIA SURFACE AREA (SF)		121.83
NUMBER OF ROW(S)		1

INSTALLATION NOTES

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4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

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WetlandMOD-6'-21'-5'-0"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Last Update: 3/22/24
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CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

LID SITE MAP

SEQUOIA COMMERCE CENTER
NORTHEAST CORNER OF W. 190TH ST. AND VAN NESS AVE.

PREPARED FOR:
IPERS SEQUOIA COMMERCE CENTER INC
13450 MAXELLA AVENUE, SUITE 220
MARINA DEL REY, CA 90292
PHONE: (XXX) XXX-XXXX

PREPARED BY:
Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director _____ R.C.E. _____

Sheet 2 of 3 Sheets

4221/ 2 OF 3 SHEETS

BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

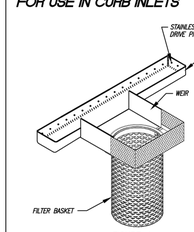

FIGURE 1:
DETAIL OF PARTS

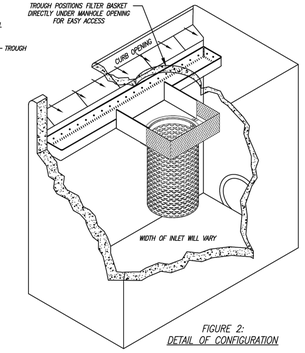

FIGURE 2:
DETAIL OF CONFIGURATION

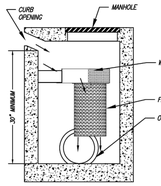

FIGURE 4:
DETAIL OF PROFILE

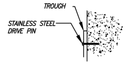

FIGURE 3:
DETAIL OF MOUNTING

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS	MEETS FULL CAPTURE REQUIREMENTS
TREATMENT FLOW RATE: 2.85 cfs	MODEL #: BIO-CURB-FULL
WARRANTY: 1 YEAR MANUFACTURER'S	PROJECT:
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 388 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176	REVISIONS: DATE: REVISIONS: DATE:
DATE: 10/12/2017 SCALE: NTS	REVISIONS: DATE:
DRAFTER: M.C.P. UNITS = INCHES	REVISIONS: DATE:

NOTES:

1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100lb STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0.
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

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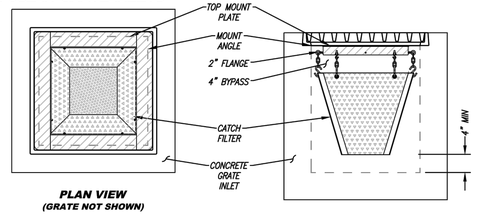
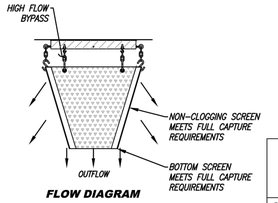
BIO CLEAN FULL CAPTURE FILTER

FOR USE IN GRATE INLETS



PLAN VIEW
(GRATE NOT SHOWN)

ELEVATION VIEW



FLOW DIAGRAM

INSTALLATION NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL.
2. OPTIONAL HYDROCARBON BOOM SHALL BE 2" DIAMETER.
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS.
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON .37ft OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.

NOT TO SCALE

MODEL #	TREATMENT FLOW RATE (CFS.)	BYPASS FLOW (CFS.)	SOLIDS STORAGE CAPACITY (CF.)
BIO-GRATE-FULL 12-12-12	1.04	1.24	0.15
BIO-GRATE-FULL 18-18-12	1.78	2.79	0.33
BIO-GRATE-FULL 24-24-12	2.70	4.96	0.59
BIO-GRATE-FULL 24-40-12	3.70	6.35	0.88
BIO-GRATE-FULL 24-24-24	7.31	4.96	1.22
BIO-GRATE-FULL 24-40-24	9.53	6.35	1.82
BIO-GRATE-FULL 36-36-24	11.93	7.74	2.73

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

GRATE INLET FILTER
FULL CAPTURE
STANDARD DETAIL

StormTech® MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
90" x 77" x 45"
2286 mm x 1956 mm x 1143 mm

Chamber Storage
109.9 ft³ (3.11 m³)

Min. Installed Storage*
175.0 ft³ (4.96 m³)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 6" (150 mm) of stone between chambers/ end caps and 40% stone porosity.

Nominal End Cap Specifications
(not to scale)

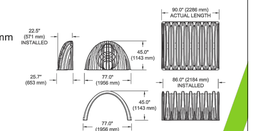
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1803 mm x 1145 mm

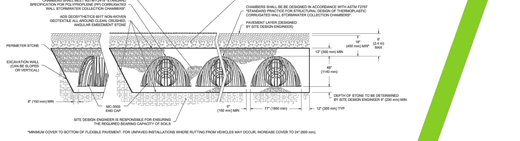
End Cap Storage
14.9 ft³ (0.42 m³)

Min. Installed Storage*
45.1 ft³ (1.28 m³)

Weight
49 lbs (22.2 kg)

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone perimeter, 6" (150 mm) of stone between chambers/ end caps and 40% stone porosity.





ADS StormTech

Working on a project?
Visit us at adspipe.com/stormtech and utilize the Design Tool

ADS StormTech

adspipe.com
800-821-6710

StormTech MC-3500 Specifications

Storage Volume Per Chamber

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9 in (230 mm)	12 in (300 mm)	15 in (375 mm)	18 in (450 mm)
Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth			
	9 in	12 in	15 in	18 in
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
Metric Kilograms (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

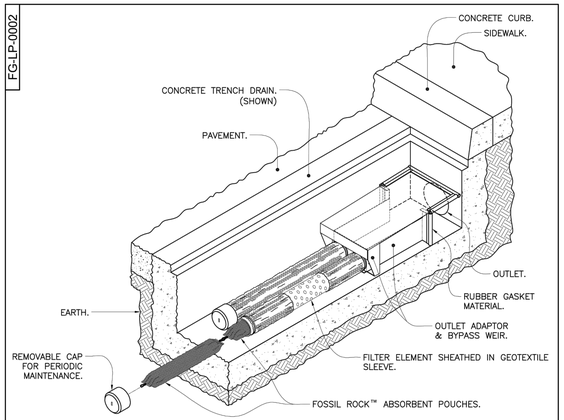
Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	9 in (230 mm)	12 in (300 mm)	15 in (375mm)	18 in (450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.3)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

FG-LP-0002



NOTES:

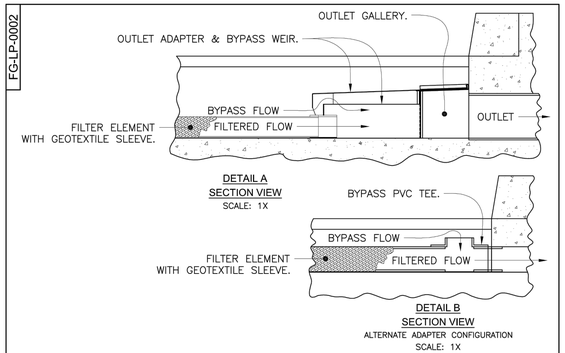
1. Filter insert shall have a high flow bypass feature.
2. Filter outlet adapter shall be constructed from stainless steel Type 304. Alternate outlet adaptor for shallow installations shall be PVC SCH-40. See detail B, sheet 2 of 2.
3. Filter medium shall be *Fossil Rock* ™, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.
5. For alternate outlet adapter configurations used for extremely shallow trench drains contact Oldcastle Stormwater Solutions for engineering assistance.
6. Filter element should be a minimum of one half the length of trench. Confirm flow rate upon order.

FloGard®
Catch Basin Insert Filter
Trench Drain Style

Oldcastle® Stormwater Solutions
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	SHEET
FG-LP-0002	H	ECO-0142 JPR 7/13/16	JPR 2/21/07	SHEET 1 OF 2

FG-LP-0002



SPECIFIER CHART

MODEL	FILTER TYPE	TRENCH WIDTH "ID" (CLEAR OPENING)	MINIMUM TRENCH DEPTH (FROM BOTTOM OF GRATE)	SOLIDS STORAGE CAPACITY CUBIC FEET **	FILTERED FLOW CUBIC FEET / SECOND **	TOTAL BYPASS CAPACITY CUBIC FEET /SECOND
FG-TDOF3	PIPE *	3.0	6.5	0.1	0.5	0.1
FG-TDOF4	PIPE *	4.0	6.5	0.2	0.5	0.1
FG-TDOF6	PIPE	6.0	6.5	0.4	0.5	0.2
FG-TDOF8	PIPE	8.0	6.5	0.7	0.5	0.3
FG-TDOF10	PIPE	10.0	6.5	0.9	0.5	0.5
FG-TDOF12	PIPE	12.0	6.5	0.9	1.0	0.6
FG-TDOF18	PIPE	18.0	6.5	1.3	1.5	1.1
FG-TDOF24	PIPE	24.0	6.5	1.8	2.0	1.5
FG-TDOA6	PANEL	6.0	4.5	0.4	0.2	0.2
FG-TDOA8	PANEL	8.0	4.5	0.7	0.2	0.3
FG-TDOA10	PANEL	10.0	4.5	0.8	0.3	0.5
FG-TDOA12	PANEL	12.0	4.5	1.0	0.4	0.6
FG-TDOA18	PANEL	18.0	4.5	1.4	0.8	1.1
FG-TDOA24	PANEL	24.0	4.5	1.8	1.1	1.5

* ALTERNATE ADAPTER CONFIGURATION. SEE DETAIL B.
**CAPACITY PER 5-FT. SEGMENT USED.

FloGard®
Catch Basin Insert Filter
Trench Drain Style

Oldcastle® Stormwater Solutions
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	SHEET
FG-LP-0002	H	ECO-0142 JPR 7/13/16	JPR 2/21/07	SHEET 2 OF 2

Last Update: 3/22/24
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CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

LID SITE MAP

SEQUOIA COMMERCE CENTER
NORTHEAST CORNER OF W. 190TH ST. AND VAN NESS AVE.

4221/ 3 OF 3 SHEETS

PREPARED FOR:
IPERS SEQUOIA COMMERCE CENTER INC
13450 MAXELLA AVENUE, SUITE 220
MARINA DEL REY, CA 90292
PHONE: (XXX) XXX-XXXX

PREPARED BY:
Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by _____ Approved by _____ Date _____
Date _____
Checked by _____
Date _____
Designed by _____
Date _____
Checked by _____
Date _____

Public Works Director _____ R.C.E. _____

Sheet 3 of 3 Sheets

APPENDIX C

BMP Operation and Maintenance

BMP Operation and Maintenance			
BMP	**Operation/Maintenance**	**Inspection Frequency**	**Responsibility**
Storm Drain Stencil and Signage	➢ Visually inspect for legibility and replace/repaint as necessary.	Annually	Owner
Parking Lot Sweeping	➢ At a minimum, sweep on a monthly basis.	Monthly (minimum)	Owner
Drain Inserts	➢ Visually inspect for defects and illegal dumping. Notify proper authorities if illegal dumping has occurred. ➢ Using an industrial vacuum, the collected materials shall be removed from the filter basket and disposed of properly. ➢ Inspect biosorb hydrocarbon boom and replace as necessary.	Semi-annually (October 1st and February 1st) through maintenance service contract with the vendor or equally qualified contractor.	Owner
Underground Chambers	➢ The isolator row shall be inspected semi-annually (October 1st and February 1st) and maintained once sediment depth is greater than 3-inches. The isolator row shall be inspected and maintained by a qualified technician and he/she will properly dispose of all wastes. A manhole is installed in order to inspect and maintain the isolator row. It is installed per OSHA codes to ensure operator and inspector safety.	Semi-annually (October 1st and February 1st) through maintenance service contract with the vendor or equally qualified contractor.	Owner
WetlandMOD System	➢ All work to be done by the supplier or by a supplier approved contractor. ➢ Clean separation (sediment) chamber. The chamber is located directly under the manhole. ➢ Replace media in pre-filtration cartridges. Media life depends on the loading conditions and can easily be replaced and disposed of without any equipment. The BioMediaGREEN filter can be ordered from the manufacturer. ➢ Replace drain down filter media. Replacement of media takes approximately 5 minutes and is performed without any equipment. ➢ Replace wetland media. The life of the media can be up to 20 years. Remove spent media with shovel or vacuum truck and replace with new media. Media can be ordered from the manufacturer. ➢ See manufacturer's maintenance requirements for additional information.	Semi-annually (October 1st and February 1st) through maintenance service contract with the vendor or equally qualified contractor.	Owner

BMP Operation and Maintenance			
BMP	**Operation/Maintenance**	**Inspection Frequency**	**Responsibility**
Maintenance Log	➢ Keep a log of all inspection and maintenance performed on the above mentioned BMPs for at least 5 years. Keep this log on-site.	Ongoing	Owner

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

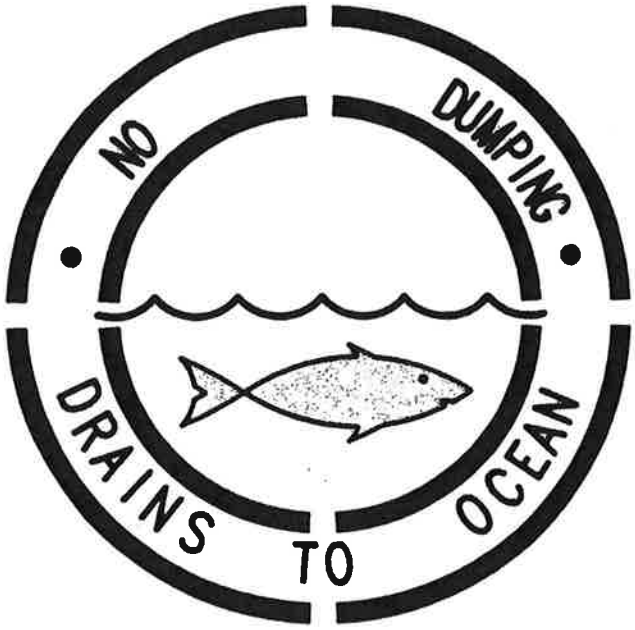
Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



SAMPLE STENCIL TO BE USED NEAR
GRATE AND CURB OPENING INLETS
SYMBOL TO BE 24" IN DIAMETER

Thienes Engineering
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

SAMPLE CATCH BASIN STENCIL
PER BMP SD-13

CONTECH®
ENGINEERED SOLUTIONS

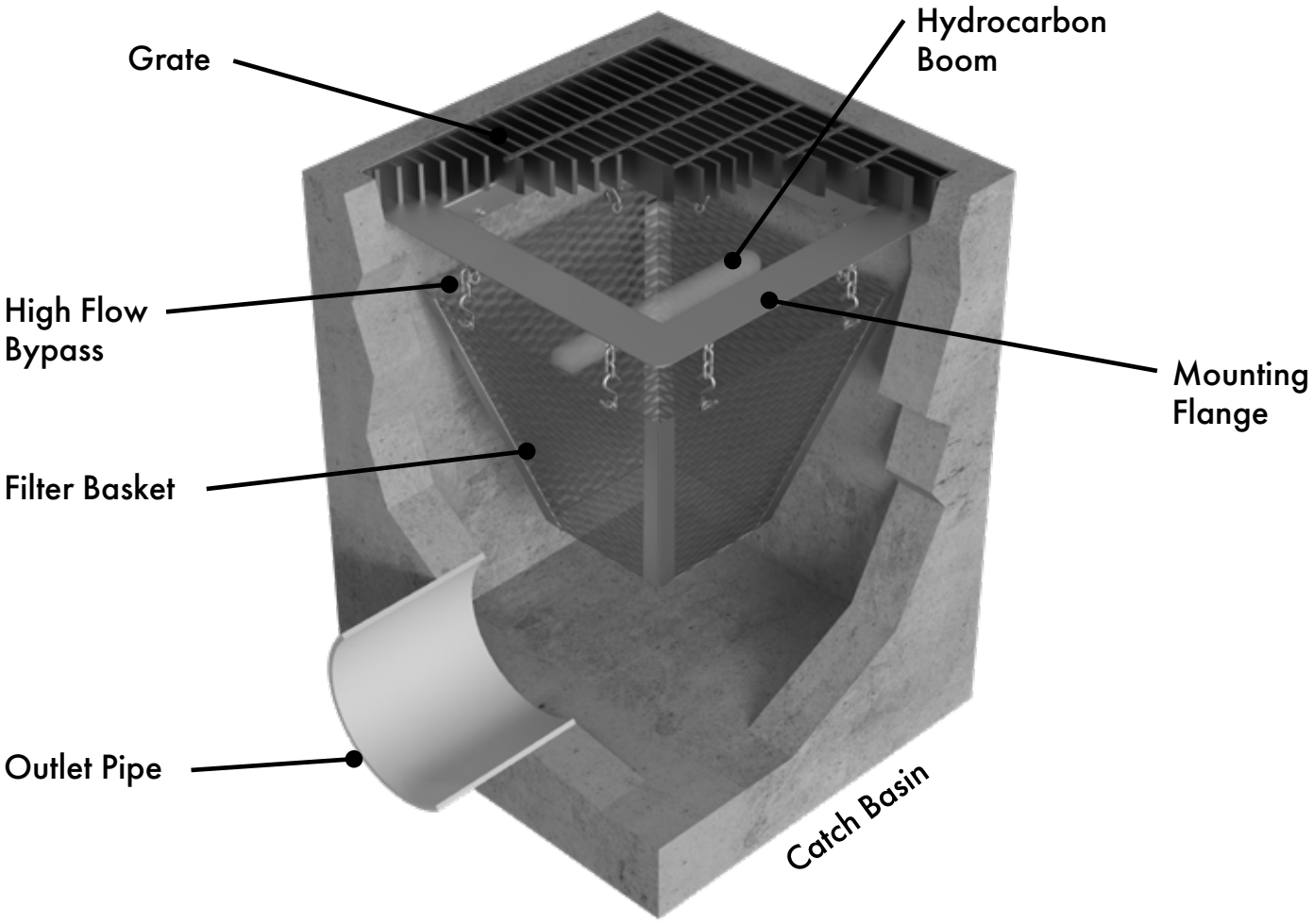
Bio Clean® Grate Inlet Filter
Operation & Maintenance Manual

Bio Clean®

Operation & Maintenance

Contech's Bio Clean® Grate Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, Kraken® membrane filter, and fabric filter variations. This manual covers maintenance procedures of the trash full capture and fabric filter configurations. A supplemental manual is available for the Kraken variation. The trash full capture filter is made of 100% stainless steel, while the fabric filter is made of a woven monofilament geotextile fabric. Both filters are available at various sizes and depths allowing them to fit in any grated catch basin inlet. The filters heavy duty construction allows for cleaning with any vacuum truck. The filter can also easily be cleaned by hand.

As with all stormwater BMPs, inspection and maintenance on the Grate Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance, a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.



System Diagram

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Grate Inlet Filter:

- Contech Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.

Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Grate Inlet Filter are quick and easy. As mentioned above, the first year should be seen as the maintenance interval establishment phase. During the first year, more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Grate Inlet Filter can be inspected though visual observation. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open grated inlet. Once the grate has been safely removed, the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the filter with the grate removed.
- Look for any out of the ordinary obstructions on the grate or in the filter and its bypass. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the filter basket and its bypass.
- Excessive accumulation of trash, foliage and sediment in the filter basket. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Basket Model	Height[1] (inches)	Top Width (inches)	Top Length (inches)	Bottom Width (inches)	Bottom Length (inches)	50% Storage Capacity (CF)	100% Storage Capacity (CF)
BIO-GRATE-FULL/ FABRIC-12-12-12	6.00	10.00	10.00	8.31	8.31	0.15	0.30
BIO-GRATE-FULL/ FABRIC-18-18-12	6.00	15.00	15.00	12.50	12.50	0.33	0.66
BIO-GRATE-FULL/ FABRIC-24-24-12	6.00	20.00	20.00	16.69	16.69	0.59	1.18
BIO-GRATE-FULL/ FABRIC-24-24-24	18.00	20.00	20.00	10.00	10.00	1.22	2.44
BIO-GRATE-FULL/ FABRIC-24-40-12	6.00	20.00	30.00	16.69	25.00	0.88	1.76
BIO-GRATE-FULL/ FABRIC-24-40-24	18.00	20.00	30.00	10.00	15.00	1.82	3.64
BIO-GRATE-FULL/ FABRIC-36-36-24	18.00	30.00	30.00	15.00	15.00	2.73	5.46
BIO-GRATE-FULL/ FABRIC-24-40-24	18.00	20.00	30.00	10.00	15.00	1.82	3.64
BIO-GRATE-FULL/ FABRIC-36-36-24	18.00	30.00	30.00	15.00	15.00	2.73	5.46

[1] Refers to basket height, total system height is equal to basket height plus 6 inches for bypass.

Maintenance Equipment

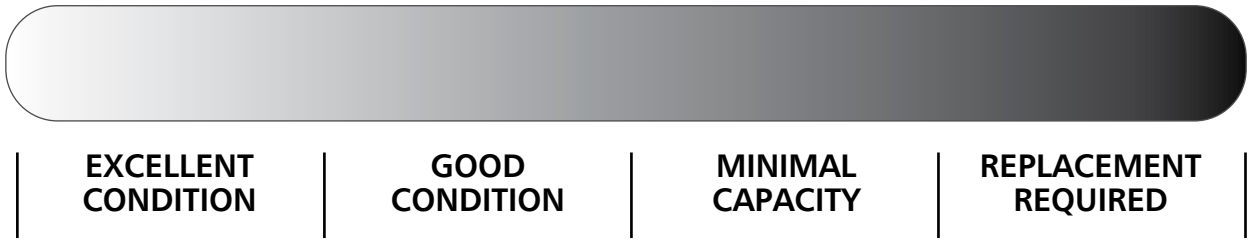
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can easily be cleaned by hand:

- Contech Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to remove the grate.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Grate Inlet Filter can be performed utilizing a vacuum truck. Once all safety measures have been set up, cleaning of the Grate Inlet Filter can proceed as followed:

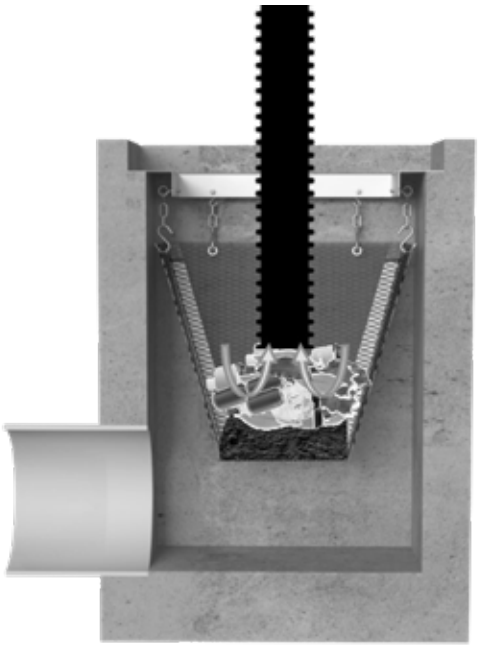
- Remove grate (traffic control and safety measures to be completed prior)
- Using an extension on a vacuum truck, position the hose over the opened catch basin. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying off any debris stuck on the side or bottom of the filter basket. Power wash off the filter basket sides and bottom.
- Next, remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required, install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- The following is a replacement indication color chart for the hydrocarbon booms:



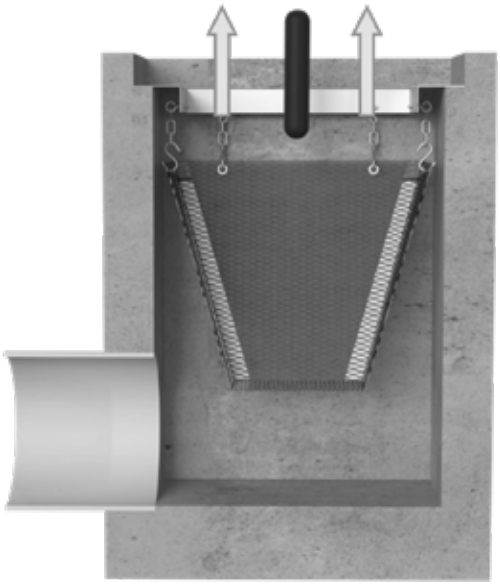
- The last step is to replace the grate and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

Maintenance Sequence

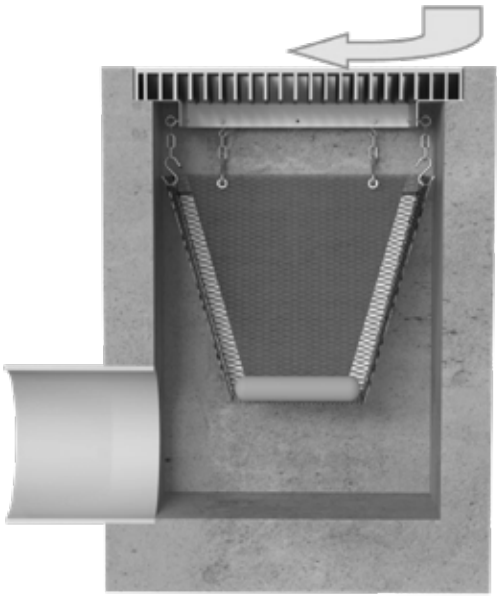
1. Remove grate and set up vacuum truck to clean the filter basket.



2. Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off screens.



3. Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the information in the chart above. If replacement is required, install and fasten on a new hydrocarbon boom.



4. Close up and replace the grate and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.

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Inspection and Maintenance Report
Catch Basin Only

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspector Name _____ Date ____ / ____ / _____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							
Comments:								

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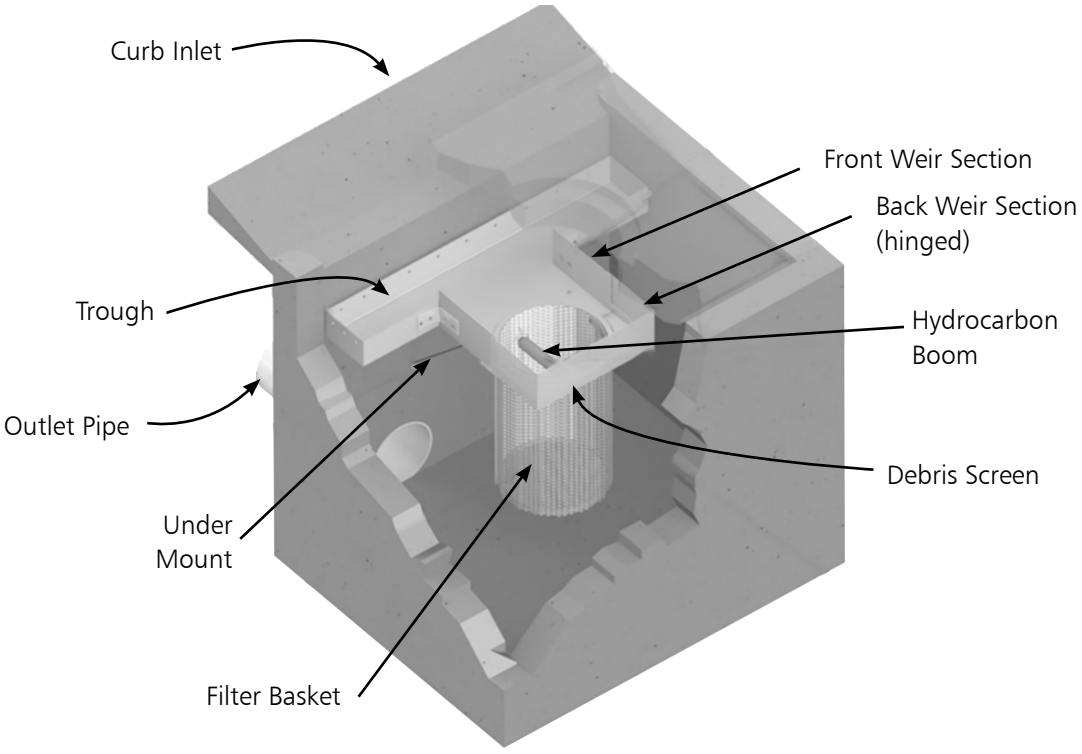
Bio Clean® Curb Inlet Filter
Operation & Maintenance Manual

Bio Clean®

Operation & Maintenance

Contech's Bio Clean® Curb Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture,filter fabric, and Kraken membrane filter variations. This manual covers maintenance procedures of the trash full capture and filter fabric configurations. A supplemental manual is available for the Kraken variations. The innovative trough & weir system is mounted along the curb face and directs incoming stormwater toward the filter basket which is positioned "directly" under the manhole access opening regardless of its location in the catch basin. This innovative design allows the filter to be cleaned from finish surface without access into the catch basin, therefore drastically reducing maintenance time and eliminating confined space entry. The filter has a lifting handle allowing for the filter to be removed easily through the manhole. The weir also folds up to allow for unimpeded access into the basin for routine maintenance or pipe jetting.

As with all stormwater BMPs, inspection and maintenance on the Curb Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.



Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Curb Inlet Filter:

- Contech Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.

Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Curb Inlet Filter are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Curb Inlet Filter can be inspected though visual observation without entry into the catch basin. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once the manhole has been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the catch basin through the manhole. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the catch basin.
- Look for any out of the ordinary obstructions in the catch basin, trough, weir, filter basket, basin floor our outlet pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the filter basket and its bypass.
- Excessive accumulation of trash, foliage and sediment in the filter basket. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Basket Model	Filter Basket Diameter (inches)	Filter Basket Height (inches)	50% Storage Capacity (CF)	100% Storage Capacity (CF)
BC-CURB-24	16	24	1.77	3.53
BC-CURB-12	16	12	0.88	1.77

Maintenance Equipment

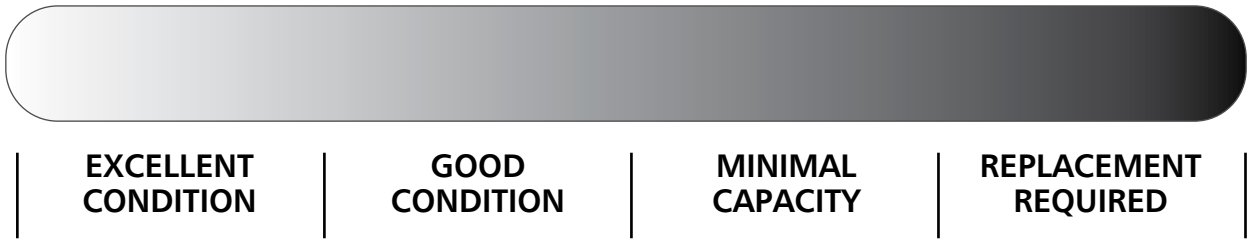
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter though it can easily cleaned by hand:

- Contech Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

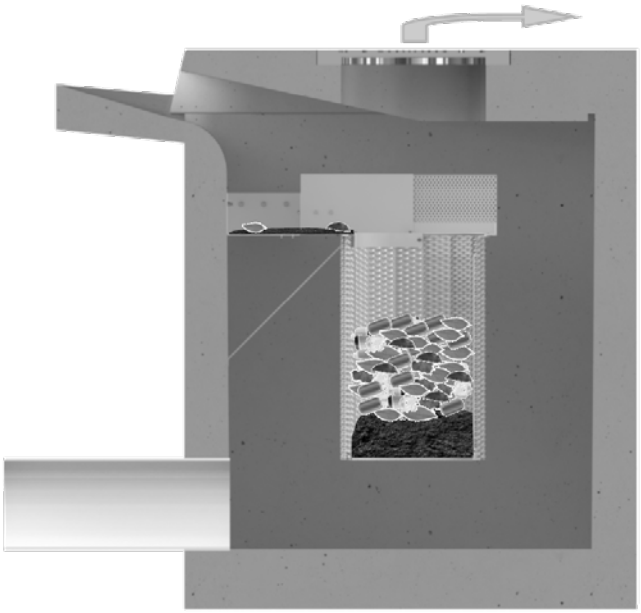
It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Curb Inlet Filter can be performed from finish surface without entry into catch basin utilizing a vacuum truck. Some unique and custom configurations may create conditions which would require entry for some or all of the maintenance procedures. Once all safety measures have been set up cleaning of the Curb Inlet Filter can proceed as followed:

- Remove all manhole cover or access hatches (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened manhole or hatch opening. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. If the filter basket is full, trash, sediment, and debris will accumulate inside the trough and weir sections of the system. Once the filter basket is clean power wash the weir and trough pushing these debris into the filter basket (leave the hose in the filter basket during this process so entering debris will be sucked out). Power wash off the trough, weir, debris screen, and filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:

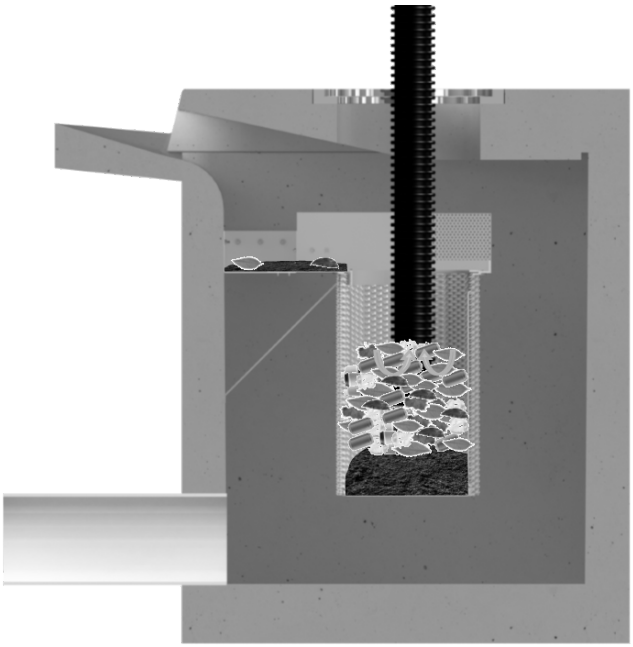


- The last step is to close up and replace the manhole or hatch and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

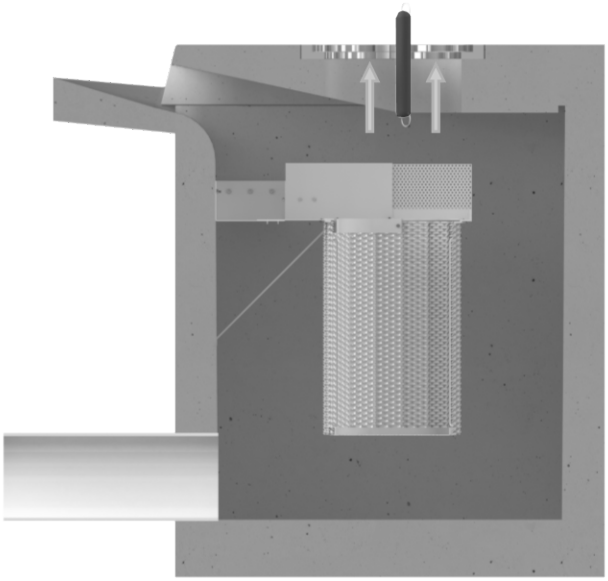
Maintenance Sequence



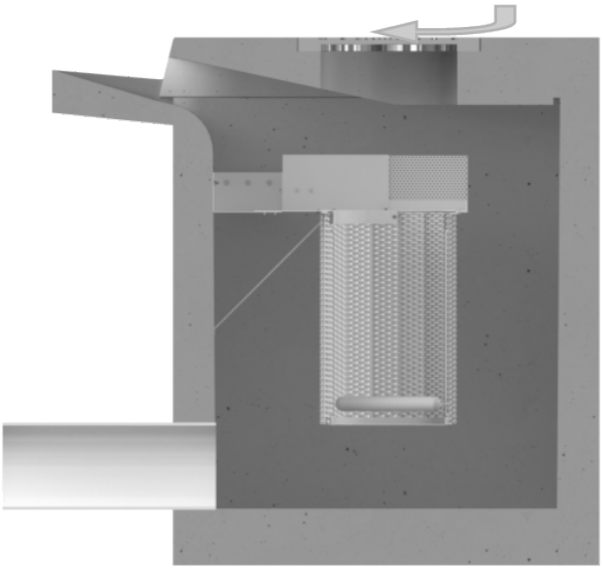
1. *Remove manhole cover and set up vacuum truck to clean the filter basket. Ensure all traffic control and safety measures are in place.*



2. *Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off the weir and trough and vacuum out any remaining debris.*



3. *Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.*



4. *Close up and replace the manhole or hatch and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.*

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Inspection and Maintenance Report
Catch Basin Only

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspector Name _____ Date ____ / ____ / _____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
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3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							
Comments:								

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Curb Inlet Filter Operation & Maintenance Manual 10/22

Bio Clean

A Forterra Company

WetlandMod® Separator

A Stormwater Biofiltration Solution

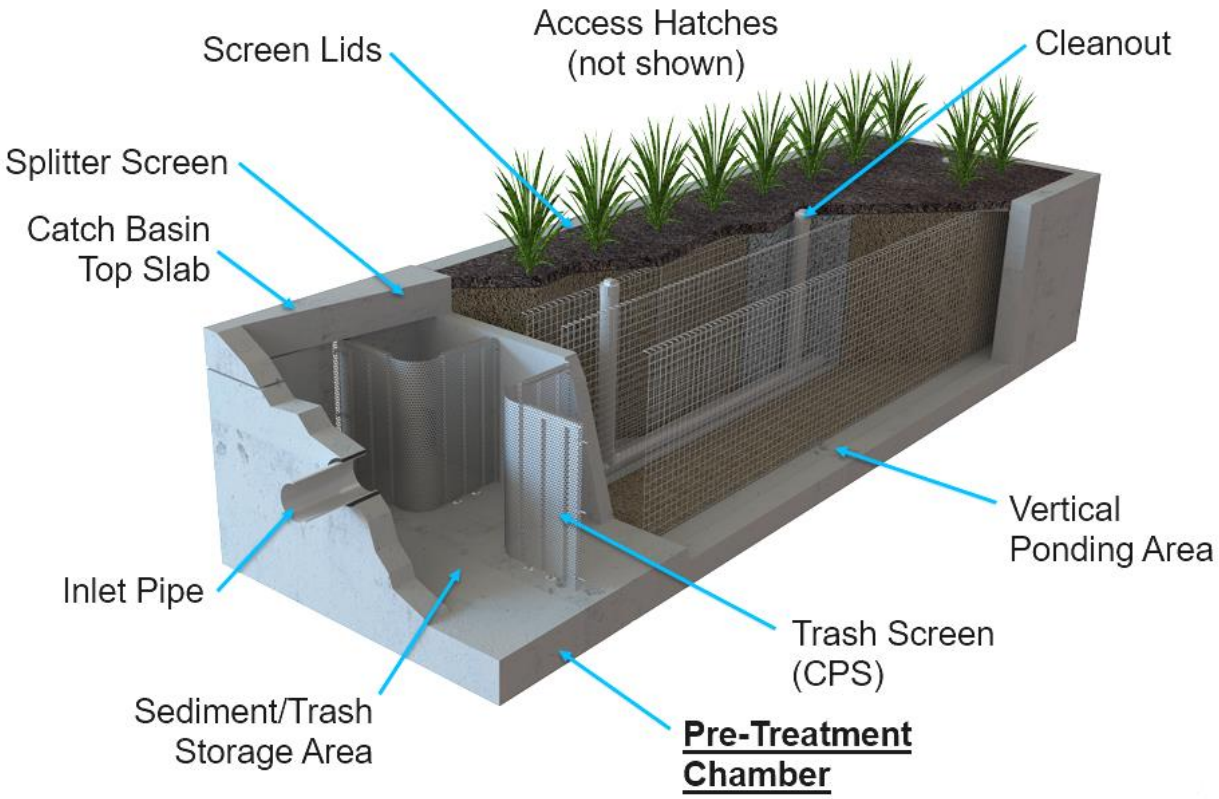
OPERATION & MAINTENANCE MANUAL

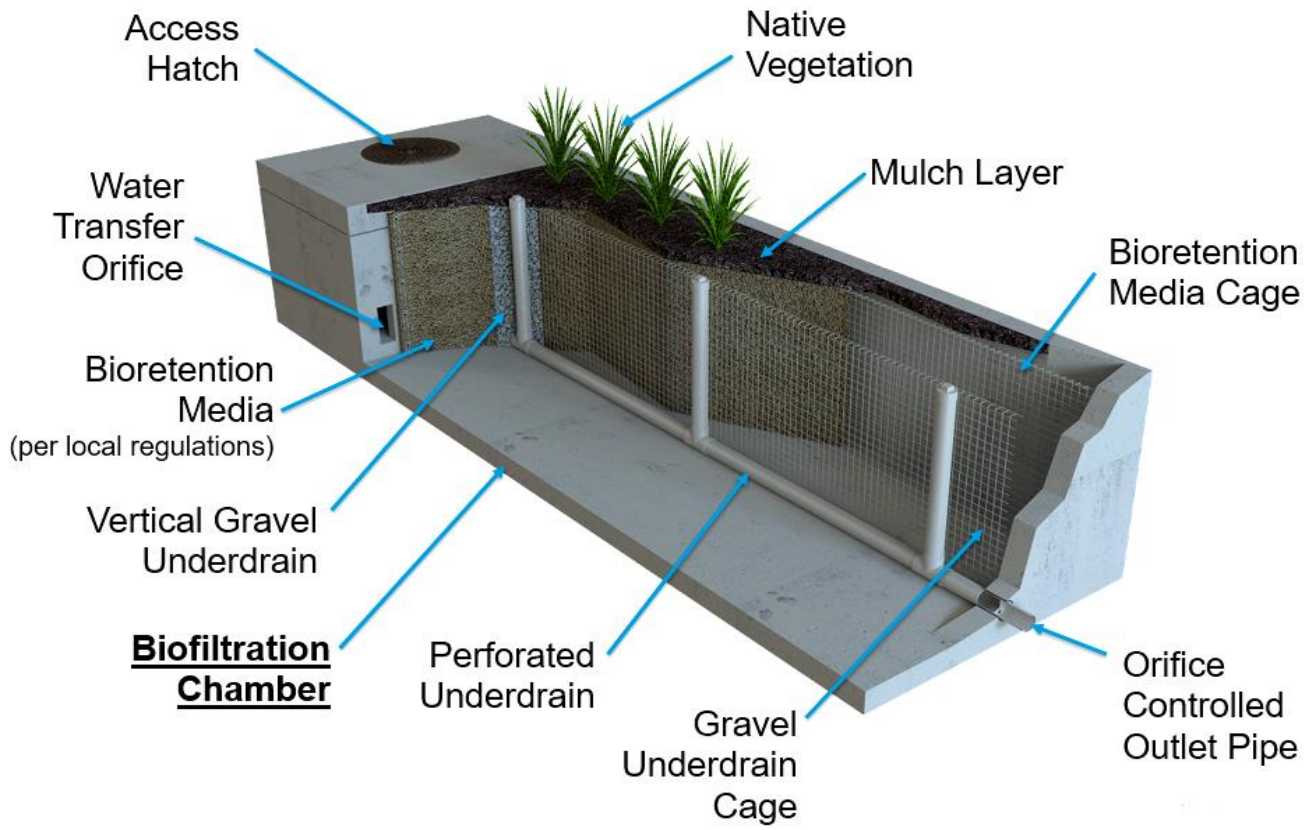
Inspection Guidelines for WetlandMod

Inspection Summary

- Inspect Pre-Treatment Chamber – average inspection interval is 6 to 12 months.
  - (5-*minute average inspection time*).
- Inspect Biofiltration Chamber – average inspection interval is 6 to 12 months.
  - (1*0-minute average inspection time*).
- NOTE: Pollutant loading varies greatly from site to site and no two sites are the same. Therefore, the first year requires inspection monthly during the wet season and every other month during the dry season in order to observe and record the amount of pollutant loading the system is receiving.

System Diagram





Inspection Overview

As with all stormwater BMPs inspection and maintenance on the WetlandMod is necessary. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific loading conditions. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance a BMP will exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

Inspection Equipment:

Following is a list of equipment to allow for simple and effective inspection of the WetlandMod:

- WetlandMod Inspection Form
- Flashlight
- Manhole hook or appropriate tools to remove access hatches and covers (if applicable)
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure.
- Protective clothing and eye protection.

- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the WetlandMod are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The WetlandMod can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access. Once the top tray is removed the following apply:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the pre-treatment chamber and biofiltration chamber once the access hatch is removed. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system and all of its chambers.
- Look for any out of the ordinary obstructions in the inflow pipe, around the trash screen (CPS), on the surface of the media, or in the drain down riser. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, debris and sediment accumulated in the chamber. Utilizing a tape measure or measuring stick estimate the amount of trash, debris and sediment on the floor of each chamber. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the system or its inlet or outlet.

- Excessive accumulation of floatables more than 12” in depth in the pre-treatment chamber.
- Excessive accumulation of sediment of more than 6” in depth in the biofiltration chamber.
- Excessive build up on the vertical surface of the biofiltration media.
- Overgrown vegetation.
- Storage area around media cage has standing water 72 hours after a storm event.

Inspection Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Media.

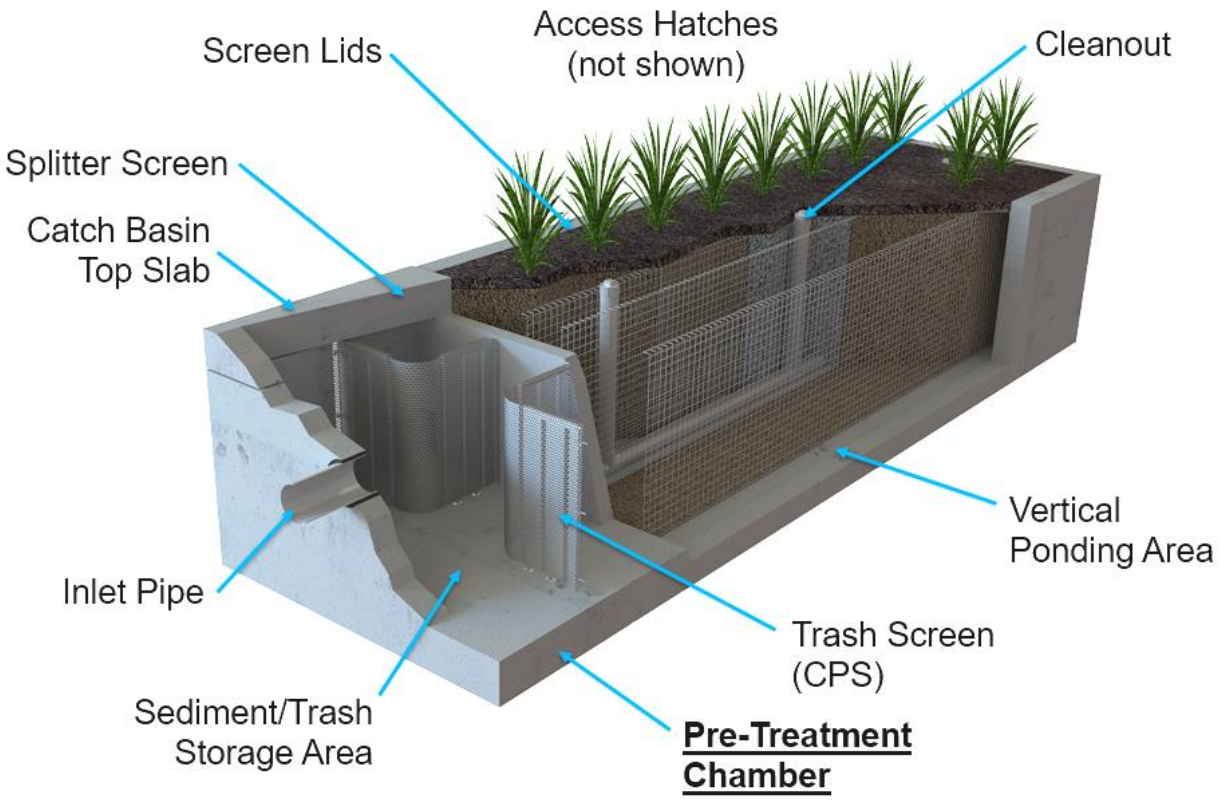
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

Maintenance Guidelines for WetlandMod

Maintenance Summary

- Remove Sediment and Trash from Pre-Treatment Chamber – average maintenance interval is 6 to 12 months.
  - (*15 minute average service time*).
- Removed Sediment and Pressure Wash Biofiltration Media Surface – average maintenance interval 12 to 24 months.
  - (*15-60 minutes depending on size of system).*
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Overview

The time has come to maintain your WetlandMod. To ensure successful and efficient maintenance on the system we recommend the following. The WetlandMod can be maintained by removing the access hatches. The mulch over the top tray should be removed prior to removing the top hatch over the biofiltration chamber. All necessary pre-maintenance steps must be carried out before maintenance occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once traffic control has been set up per local and state regulations and access covers have been safely opened the maintenance process can begin. It should be noted that no maintenance activities require confined space entry but if entry is done all confined space requirements must be strictly followed before entry into the system. In addition the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and cleaning equipment.
- Ensure traffic control is set up and properly positioned.
- Prepare a pre-checks (OSHA, safety, confined space entry) are performed.

Maintenance Equipment

Following is a list of equipment required for maintenance of the WetlandMod:

- WetlandMod Maintenance Form
- Manhole hook or appropriate tools to access hatches and covers (if applicable)
- Protective clothing, flashlight and eye protection.
- Vacuum assisted truck with pressure washer.
- Replacement pre-filter wraps (order from manufacturer).

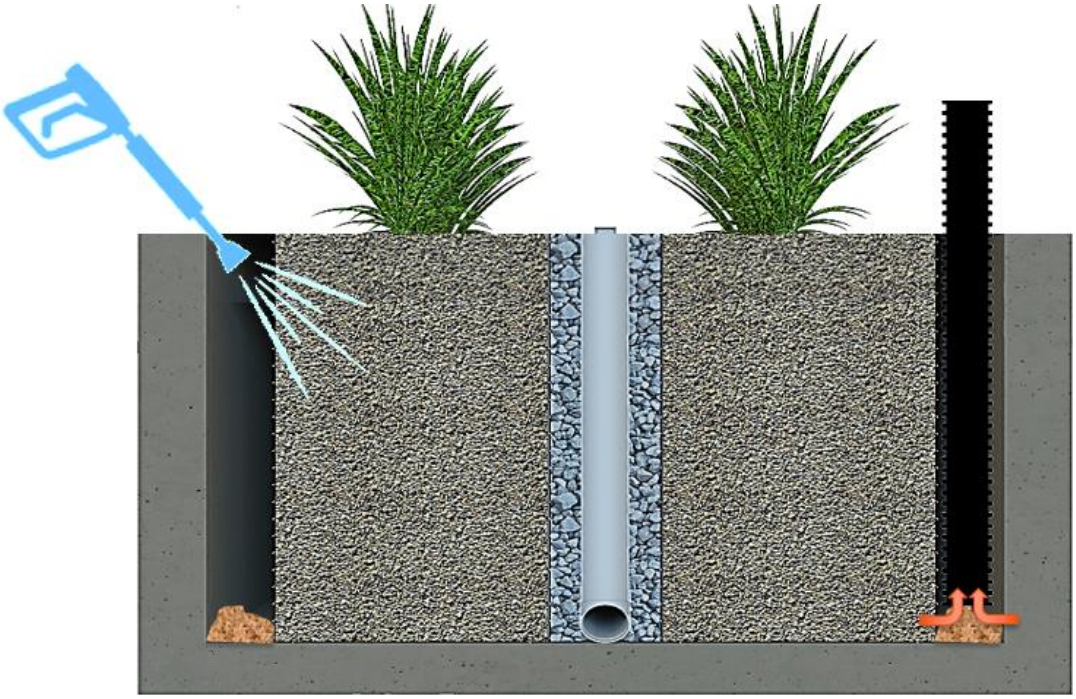
Maintenance Steps

1. Pre-Treatment Chamber (first chamber that contains trash screens)

   A. Remove access hatch and position vacuum truck accordingly.
   B. With a pressure washer spray down pollutants accumulated on trash screens.
   C. Vacuum out all accumulated pollutants including trash, debris and sediments. Be sure to vacuum the floor, screens, and walls along with outlet side of screens.

2. Biofiltration Chamber (vegetated chamber)

   A. Remove the mulch along each side of the unit. Rake away from side walls. Remove top covers to gain access to void areas.
   B. Pressure wash off the vertical surface of the media be using a pressure washer and a vacuum hose to collect and material on the floor around the cage. Pressure wash down into the media to allow accumulated sediments to flow back into the surrounding perimeter separation area for collection with the vac hose.
   C. Replace the top covers.
   D. Trim any vegetation that is overgrown.
   E. Replace the mulch to cover the top covers.



Maintenance Notes

1. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
2. Entry into chambers may require confined space training based on state and local regulations.
3. No fertilizer shall be used in the Biofiltration Chamber.
4. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment

Inspection Form

Bio Clean, A Forterra Company
P. 760.433-7640
F. 760-433-3176
E. stormwater@forterrabp.com

www.biocleanenvironmental.com

Inspection Report
WetlandMod System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspection Checklist

WetlandMod System: _____ Size (Model): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

398 Via El Centro, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Bio Clean, A Forterra Company
P. 760.433-7640
F. 760-433-3176
E. stormwater@forterrabp.com

www.biocleanenvironmental.com

Cleaning and Maintenance Report
WetlandMod System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	WM Catch Basins						
		WM Sedimentation Basin						
		CPS Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

398 Via El Centro, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

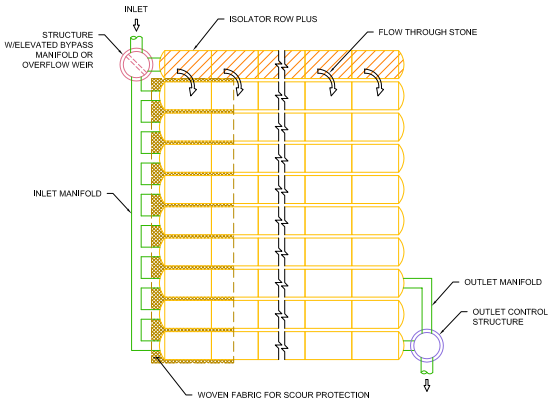
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

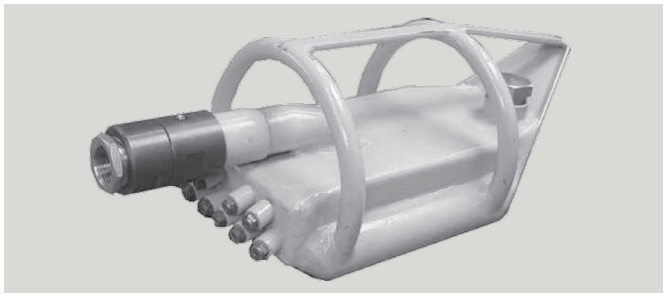
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

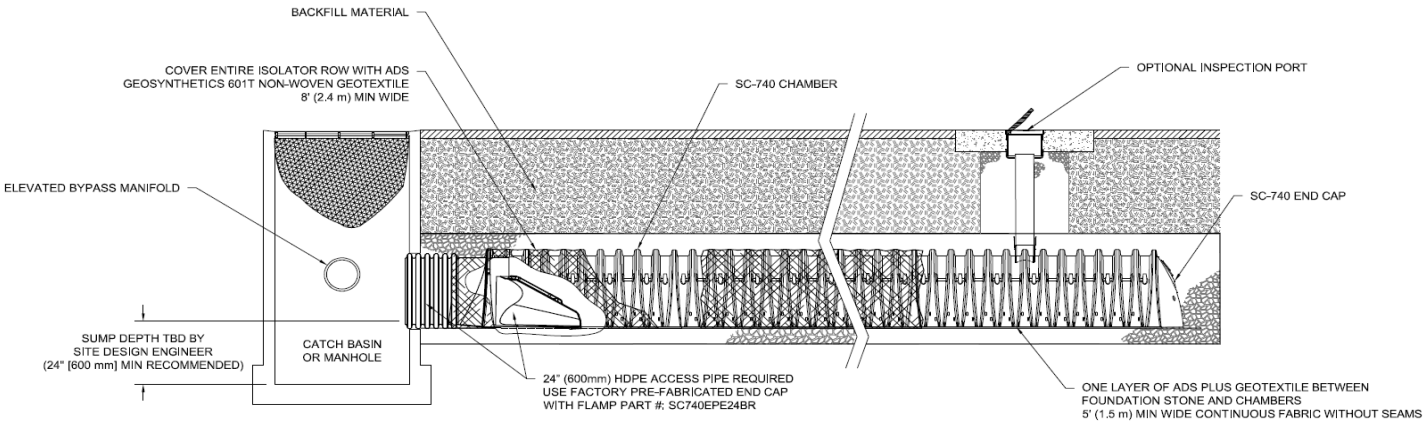
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
- i. Remove lid from floor box frame
- ii. Remove cap from inspection riser
- iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
- iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
- i. Remove cover from manhole at upstream end of Isolator Row Plus
- ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
  1. Mirrors on poles or cameras may be used to avoid a confined space entry
  2. Follow OSHA regulations for confined space entry if entering manhole
- iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
  If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

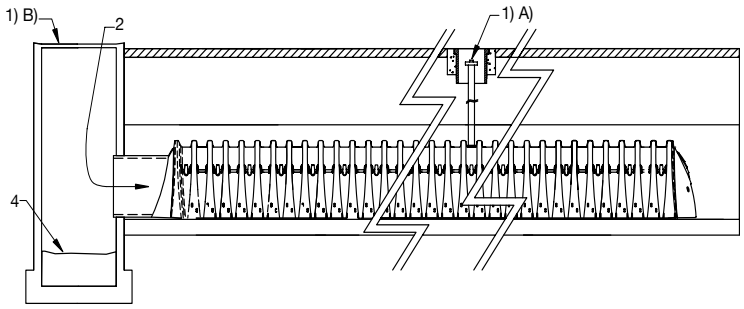
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi-ment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

adspipe.com
800-821-6710

APPENDIX D

Maintenance and Covenant Agreement

RECORDING REQUESTED BY AND MAIL TO:

CITY OF TORRANCE
DEPARTMENT BUILDING & SAFETY
3031 TORRANCE BLVD
TORRANCE, CA 90509-2970

Space above this line is for Recorder's use

MAINTENANCE COVENANT FOR LOW IMPACT DESIGN (LID) REQUIREMENTS

Pursuant to Title 4, Chapter 411.1 of the City of Torrance Municipal Code relating to the control of pollutants carried by stormwater runoff, structural and/or treatment control Best Management Practices (BMP's) have been installed on the following property:

LEGAL DESCRIPTION

ASSESSOR'S ID # 7352-016-001, 7352-016-002 and 7352-016-003 TRACT NO. _____ LOT NO. _____
ADDRESS: XXXX and XXXX Van Ness Avenue, Torrance, CA 90504

I (we) IPERS Sequoia Commerce Center Inc, hereby certify that I (we) am (are) the legal owner(s) of the property indicated above, and as such owners for the mutual benefit of future purchasers, their heirs, successors, and assigns, do hereby fix the following protective conditions to which their property, or portions thereof, shall be held, sold and/or conveyed.

That owner(s) shall maintain the drainage devices such as paved swales, bench drains, inlets, catch basins, downdrains, pipes, and water quality devices on the property indicated above and as shown on plans permitted by the City of Torrance, in a good and functional condition to safeguard the property owners and adjoining properties from damage and pollution.

That owner(s) shall conduct maintenance inspection of all Structural or Treatment Control BMP's on the property at least once a year and retain proof of the inspection. Said maintenance inspection shall verify the legibility of all required stencils and signs and shall repaint and label as necessary.

That owner(s) shall provide printed educational materials with any sale of the property which provide information on what stormwater management facilities are present, the type(s) and location(s) of maintenance signs that are required, and how the necessary maintenance can be performed.

On-site stormwater pollution removal devices include, but are not limited to: SEE EXHIBIT 1
SEE EXHIBIT 2

FILL OUT COMPLETELY WITH ALL DEVICES

Owner s): [NAME], [TITLE] / IPERS Sequoia Commerce Center Inc

By: _____ Date: _____

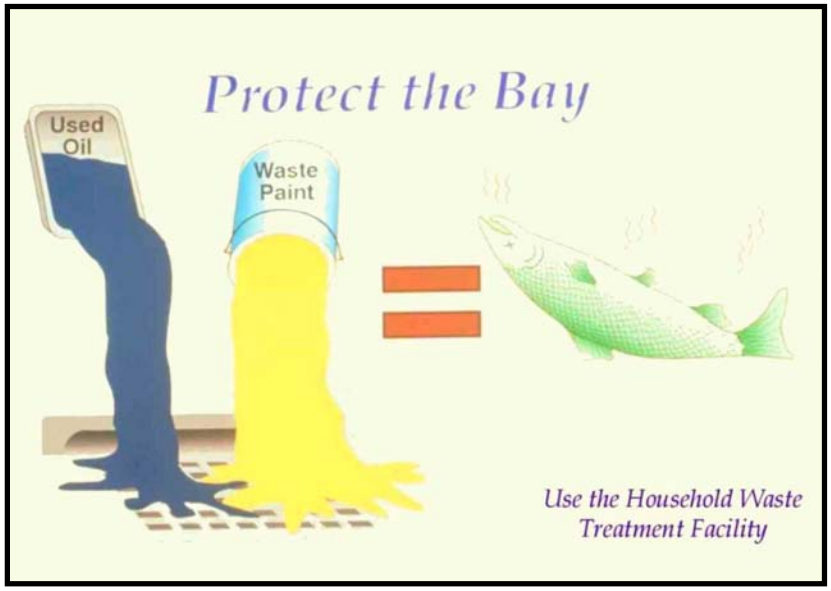
By: _____ Date: _____

(PLEASE ATTACH NOTARY)

APPENDIX E

Educational Materials

Non-Stormwater Discharges SC-10



Art Credit: Margie Winter

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

CASQA California Stormwater Quality Association

Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day/night, month, or year)
- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

Photo Credit: Geoff Brosseau

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- If consistent illegal dumping is observed at the facility:
  - Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

- Routine maintenance:
  - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
  - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
  - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

  - Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Types and quantities (in some cases) of wastes

  - Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

Training

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off' of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Outdoor Loading/Unloading SC-30

Photo Credit: Geoff Brosseau

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

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Suggested Protocols

Loading and Unloading – General Guidelines

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm the loading/unloading area to a drain that is connected to a deadend.

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Have an emergency spill cleanup plan readily available.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Other Considerations (Limitations and Regulations)

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

Requirements

Costs

Costs should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.

- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:

  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.

  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Outdoor Equipment Operations SC-32

Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, solid waste treatment and disposal, are examples of process operations that can lead to contamination of stormwater runoff. Source controls for outdoor process equipment operations and maintenance include reducing the amount of waste created, enclosing or covering all or some of the equipment, installing secondary containment, and training employees.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Approach

Pollution Prevention

- Perform the activity during dry periods.
- Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.

Targeted Constituents

Sediment	✓
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Suggested Protocols

- Consider enclosing the activity in a building and connecting the floor drains to the sanitary sewer.
- Cover the work area with a permanent roof if possible.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention). If possible, connect process equipment area to public sewer or facility wastewater treatment system. Some municipalities require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
- Dry clean the work area regularly.

Training

- Train employees to perform the activity during dry periods only or substituting benign materials for more toxic ones.
- Train employee and contractors in proper techniques for spill containment and cleanup. Employees should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.
- Inspect storage areas regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.

Other Considerations

- Providing cover may be expensive.
- Space limitations may preclude enclosing some equipment.
- Storage sheds often must meet building and fire code requirements.

Requirements

Costs

Costs vary depending on the complexity of the operation and the amount of control necessary for stormwater pollution control.

Maintenance

- Conduct routine preventive maintenance, including checking process equipment for leaks.
- Clean the storm drain system regularly.

Supplemental Information

Further Detail of the BMP

Hydraulic/Treatment Modifications

If stormwater becomes polluted, it should be captured and treated. If you do not have your own process wastewater treatment system, consider discharging to the public sewer system. Use of the public sewer might be allowed under the following conditions:

- If the activity area is very small (less than a few hundred square feet), the local sewer authority may be willing to allow the area to remain uncovered with the drain connected to the public sewer.
- It may be possible under unusual circumstances to connect a much larger area to the public sewer, as long as the rate of stormwater discharges does not exceed the capacity of the wastewater treatment plant. The stormwater could be stored during the storm and then transferred to the public sewer when the normal flow is low, such as at night.

Industries that generate large volumes of process wastewater typically have their own treatment system and corresponding permit. These industries have the discretion to use their wastewater treatment system to treat stormwater within the constraints of their permit requirements for process treatment. It may also be possible for the industry to discharge the stormwater directly to an effluent outfall without treatment as long as the total loading of the discharged process

water and stormwater does not exceed the loading had a stormwater treatment device been used. This could be achieved by reducing the loading from the process wastewater treatment system. Check with your Regional Water Quality Control Board or local sewering agency, as this option would be subject to permit constraints and potentially regular monitoring.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net

Waste Handling & Disposal SC-34

Photo Credit: Geoff Brosseau

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Pollution Prevention

- Accomplish reduction in the amount of waste generated using the following source controls:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

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Suggested Protocols

General

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

Run-on/Runoff Prevention

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropyleneor hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Inspection

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.

- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training

- Train staff in pollution prevention measures and proper disposal methods.
- Train employees and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

Other Considerations (Limitations and Regulations)

Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Requirements

Costs

Capital and O&M costs for these programs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance

- None except for maintaining equipment for material tracking program.

Supplemental Information

Further Detail of the BMP

Land Treatment System

Minimize runoff of polluted stormwater from land application by:

- Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, and there is a closed drainage system

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water
- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site
- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)
- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins
- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples

The port of Long Beach has a state-of-the-art database for identifying potential pollutant sources, documenting facility management practices, and tracking pollutants.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety. Harvard University. 2002.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests by methods that pose a lower risk to employees, the public, and the environment.
- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies

Objectives

- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

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- Procedures
  - Standard operating procedures (SOPs)
  - Purchasing guidelines and procedures
  - Bid packages (services and supplies)
- Materials
  - Preferred or approved product and supplier lists
  - Product and supplier evaluation criteria
  - Training sessions and manuals
  - Fact sheets for employees

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC20 – SC22) and SC41, Building and Grounds Maintenance.

Training

- Employees who handle potentially harmful materials in the use of safer alternatives.
- Purchasing departments should be encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.

Regulations

This BMP has no regulatory requirements. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements,
- Storm water runoff sampling requirements,
- Training and licensing requirements, and
- Record keeping and reporting requirements.

Equipment

- There are no major equipment requirements to this BMP.

Limitations

- Alternative products may not be available, suitable, or effective in every case.

Requirements

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.

- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources listed below.

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Rerefined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps. All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.
- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control (www.dtsc.ca.gov)

California Integrated Waste Management Board (www.ciwmb.ca.gov)

City of Santa Monica (www.santa-monica.org/environment)

City of Palo Alto (www.city.palo-alto.ca.us/cleanbay)

City and County of San Francisco, Department of the Environment (www.ci.sf.ca.us/sfenvironment)

Earth 911 (www.earth911.org/master.asp)

Environmental Finance Center Region IX (www.greenstart.org/efc9)

Flex Your Power (www.flexyourpower.ca.gov)

GreenBiz.com (www.greenbiz.com)

Green Business Program (www.abag.org/bayarea/enviro/gbus/gb.html)

Pacific Industrial and Business Association (www.piba.org)

Sacramento Clean Water Business Partners (www.sacstormwater.org)

USEPA BMP fact sheet – Alternative products (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll_2.cfm)

USEPA Region IX Pollution Prevention Program (www.epa.gov/region09/p2)

Western Regional Pollution Prevention Network (www.westp2net.org)

Metals (mercury, copper)

National Electrical Manufacturers Association - Environment, Health and Safety (www.nema.org)

Sustainable Conservation (www.suscon.org)

- Auto Recycling Project
- Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center (www.birc.org)

California Department of Pesticide Regulation (www.cdpr.ca.gov)

University of California Statewide IPM Program (www.ipm.ucdavis.edu/default.html)

Dioxins

Bay Area Dioxins Project (http://dioxin.abag.ca.gov/)

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building Repair and Construction SC-42

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Recycle

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Modifications are common particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

Approach

Pollution Prevention

- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practical.
- Buy recycled products to the maximum extent practical.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.

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- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Suggested Protocols

Repair & Remodeling

- Follow BMPs identified in Construction BMP Handbook.
- Maintain good housekeeping practices while work is underway.
- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Cover materials of particular concern that must be left outside, particularly during the rainy season.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store materials properly that are normally used in repair and remodeling such as paints and solvents.
- Sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout if when repairing roofs, small particles have accumulated in the gutter. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Properly store and dispose waste materials generated from construction activities. See Construction BMP Handbook.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100% effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.

- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is significant risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Training

Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Limitations

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more requirements for larger projects. The companion "Construction Best Management Practice Handbook" contains specific guidance and best management practices for larger-scale projects.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.

SC-42 Building Repair and Construction

Requirements

Costs

These BMPs are generally low to modest in cost.

Maintenance

N/A

Supplemental Information

Further Detail of the BMP

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. See Treatment Control Fact Sheet TC-20 Wet Pond/Basin in Section 5 of the New Development and Redevelopment Handbook regarding design criteria. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Drain Insert MP-52

General Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Inspection/Maintenance Considerations

Washout problems increase with rain intensity. Susceptibility of accumulated sediments to be re-suspended at low flow rates, can be corrected with an energy dissipater between gate and treatment areas.

Inspection Activities	Suggested Frequency
■ Inspect for sediment buildup and proper functioning.	At the beginning of the wet season and after significant storms
■ Verify that stormwater enters the unit and does not leak around the perimeter.	After construction.
Maintenance Activities	**Suggested Frequency**
■ Remove sediment as needed.	At the beginning of the wet season and as necessary

Maintenance Concerns, Objectives, and Goals

■ Sediment Removal

Targeted Constituents

- ✓ Sediment
- ✓ Nutrients
- ✓ Trash
- ✓ Metals
- Bacteria
- ✓ Oil and Grease
- ✓ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Maintenance Bays & Docks SD-31

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

APPENDIX F

Infiltration Feasibility

January 2, 2024

DWS
13450 Maxella Avenue, Suite 220
Marina Del Rey, CA 90290

Attention: Mr. Nick Zaharov
Value Add & Development Alternatives

Project No.: **23G206-2**

Subject: **Results of Infiltration Testing**
Two Proposed Industrial Buildings
SEC 190th Street and Van Ness Avenue
Torrance, California

Reference: Geotechnical Investigation, Two Proposed Industrial Buildings, SEC 190th Street and Van Ness Avenue, Torrance, California, prepared by Southern California Geotechnical, Inc. (SCG) for DWS, SCG Project No. 23G206-1, dated December 28, 2023.

Mr. Zaharov:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 23P390, dated October 20, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration (GS200.1) published by Los Angeles County Public Works – Geotechnical Engineering and Materials Division, dated June 30, 2021.

Site Description

The subject site is located at the southeast corner of 190th Street and Van Ness Avenue in Torrance, California. The site is bounded to the north by 190th Street, to the west by Van Ness Avenue, to the south by 195th Street, and to the east by existing commercial/industrial buildings. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1.

The site consists of three (3) rectangular- to irregular-shaped properties, totaling 14.01± acres in size. The site is developed with thirteen (13) one-to-two-story commercial/industrial buildings, ranging from 9,500± ft² to 45,000±ft² in size. The buildings are of concrete tilt-up construction, and are assumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. The ground surface cover throughout the site consists of asphaltic concrete (AC)

pavements, with limited areas of Portland cement concrete (PCC) pavements and landscaped planters, which include turf grass, shrubs and trees. The pavements are in poor to fair condition with moderate to severe cracking throughout.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations made at the time of the subsurface investigation, the overall site topography slopes gently downward to the southwest at a gradient of less than 1 percent.

Proposed Development

A conceptual site plan prepared by RGA has been provided to our office by the client. Based on this plan, the subject site will be developed with two (2) new industrial buildings. The new buildings will be 118,037± and 156,098± ft^2 in size, and will be located in the northern and southern areas of the site, respectively. Dock-high doors will be constructed along a portion of the east side of each of the buildings. The proposed buildings are expected to be surrounded by AC pavements in the parking and drive areas, PCC pavements in the loading dock areas, and concrete flatwork and landscaped planters throughout the site.

Detailed structural information has not been provided. It is assumed that the new buildings will be single-story structures of tilt-up concrete construction, typically supported on conventional shallow foundations with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

The proposed development will include on-site stormwater infiltration. Based on our previous experience with similar projects in the area, the infiltration system will consist of four (4) below-grade chamber systems identified as Infiltration System "A" through Infiltration System "D". The bottom of the below-grade chamber systems will be 12 to 15± feet below existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation for the subject site, referenced above. As a part of this study, eight (8) borings were advanced to depths of 15 to 30± feet below the currently existing site grades. All of the borings were logged during drilling by a member of our staff. All of the boring locations were cleared by a private geophysical testing company prior to drilling. Per the County of Los Angeles, the excavated soils were placed into 55-gallon drums, and transported to a staging area for disposal. In addition, the boreholes were backfilled with cement-bentonite grout upon completion of the borings.

AC pavements were encountered at the ground surface at all of the boring locations. The pavement sections at these locations consist of 4 to 5± inches of AC, underlain by 5 to 10± inches of aggregate base. Aggregate base was not present beneath the AC section at Boring No. B-7. Artificial fill soils were encountered beneath the existing pavements at all of the boring locations, extending to depths of 3 to 6½± feet below the existing site grades. The artificial fill soils generally consist of medium stiff to very stiff silty clays and sandy clays with varying fine gravel content. The fill soils possess a disturbed appearance and some samples contain artificial debris, such as AC fragments, resulting in their classification as artificial fill. Native alluvial soils were encountered beneath the artificial fill soils at all of the boring locations, extending to at least the

maximum depth explored of 30± feet below the existing site grades. The alluvial soils within the upper 12 to 27± feet generally consist of stiff to very stiff sandy clays and silty clays, with occasional medium stiff sandy clays and silty clays. At greater depths and extending to the maximum depth explored of 30± feet, the alluvium generally consists of medium dense to dense silty sands and sandy silts.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static groundwater table is at a greater depth than 30± feet below existing site grades.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area is the California Geological Survey (CGS) Seismic Hazard Zone Report 035, Seismic Hazard Zone Report for the Torrance 7.5-Minute Quadrangle, which indicates that the historic high groundwater level for the site is between 20 and 30± feet below the ground surface.

In addition, recent water level data was obtained from the California State Water Resources Control Board, GeoTracker, website, https://geotracker.waterboards.ca.gov/. Several monitoring wells are located as close as 500± feet from the site. Water level readings within these monitoring wells indicate a high groundwater level of 54± feet below the ground surface in April 2017.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of four (4) borings, advanced to a depth of 12 to 15± feet below existing site grades. The borings were logged during excavation by a member of our staff. The approximate locations of the infiltration borings (identified as Infiltration Boring Nos. I-1 through I-4) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

All of the borings were drilled through the existing AC pavements. The pavement sections at these locations generally consist of 4 to 5± inches of AC and 5 to 8± inches of AB. It should be noted that a Petromat geotextile material was clearly observed between the AC and base sections at two of the infiltration test locations (I-1 and I-2). Artificial fill soils were encountered beneath the pavement areas at all infiltration borings, extending to a depth of 4½ to 6± feet below the existing site grades. The fill soils generally consist of stiff silty clays with variable amounts of sand. The fill material appeared to possess a disturbed, mottled appearance, as well as AC fragments resulting in their classification of fill. Native alluvium was encountered beneath the fill soils at all of the infiltration boring locations, extending to the maximum depth explored. The alluvial soils generally consist of stiff silty clays, fine sandy clays, and medium dense clayey fine sands with variable amounts of sand, silt, gravel, calcareous veining and nodules, and iron oxide staining. These materials possess very moist conditions. Free water was not encountered during the drilling of any of the infiltration borings.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration systems that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration (GS200.1) published by Los Angeles County Public Works – Geotechnical Engineering and Materials Division, dated June 30, 2021.

Pre-soaking

All of the infiltration test borings were pre-soaked for at least 1 hour to ensure the sand around the annulus of the perforated pipe was fully saturated. The pre-soaking procedure consisted of filling each test boring with clean potable water to an elevation of at least 12± inches above the bottom of each test boring. In accordance with the Los Angeles County guidelines, since the water in both of the infiltration test borings did not completely infiltrate within a 30-minute time period after filling each boring, a falling head test was the appropriate test method.

Infiltration Testing Procedure

After the completion of the pre-soaking process, SCG performed the infiltration testing. A sufficient amount of water was added to the test borings so that the water level was approximately 12± inches higher than the bottom of the borings and less than or equal to the water level used during the pre-soaking process. Readings were taken at 30-minute intervals at all of the infiltration test locations. A stabilized rate of drop, where the highest and lowest readings from three consecutive readings are within 10 percent of each other, was obtained for each of the test borings. These water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates for the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used for design. These rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-1	15	Dark Gray Brown fine Sandy Clay, little Silt, trace medium to coarse Sand, trace fine Gravel	0.0
I-2	12	Dark Brown Clayey fine Sand, little Silt, trace medium Sand	0.8
I-3	15	Gray Brown fine Sandy Clay, little Silt, trace medium to coarse Sand	0.0
I-4	12	Gray Brown Silty Clay, trace to little fine Sand	0.0

Laboratory Testing

Moisture Content

The moisture contents for selected soil samples from the trenches were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test trench has been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of the grainsize analysis are presented on Plates C-1 through C-4 of this report.

Design Recommendations

Four (4) infiltration tests were performed at the subject site. As noted above, the measured infiltration rates at the infiltration test locations range from 0.0 to 0.8 inches per hour. The Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration, GS200.1 prepared by the County of Los Angeles, Department of Public Works, Geotechnical and Materials Division (GMED) on June 30, 2021 dictate that a reduction factor be utilized in the design infiltration rate. The following reduction factors are considered in the design assumed infiltration rate:

Reduction Factor	
Small Diameter Boring	$RF_t = 1$
Site Variability, number of tests, and thoroughness of subsurface investigation	$RF_v = 1$
Long-term siltation plugging and maintenance	$RF_s = 1$
Total Reduction Factor, RF= $RF_t + RF_v + RF_v$	RF = 3
Design Infiltration Rate (DIR) = Measured Infiltration Rate (MIR)/RF	**DIR = see below**

Infiltration System	**Depth**	**Location**	**Design Infiltration Rate (in/hr)**
A	15	Southern	0.0
B	12	Southeastern	0.3
C	15	Western	0.0
D	12	Northeastern	0.0

Based on the results of infiltration testing, and the subsurface provide identified in the referenced report and herein, the site is underlain by soils which are not considered to be conducive to infiltration. Therefore, infiltration is not recommended for this project.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rates contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between trench locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

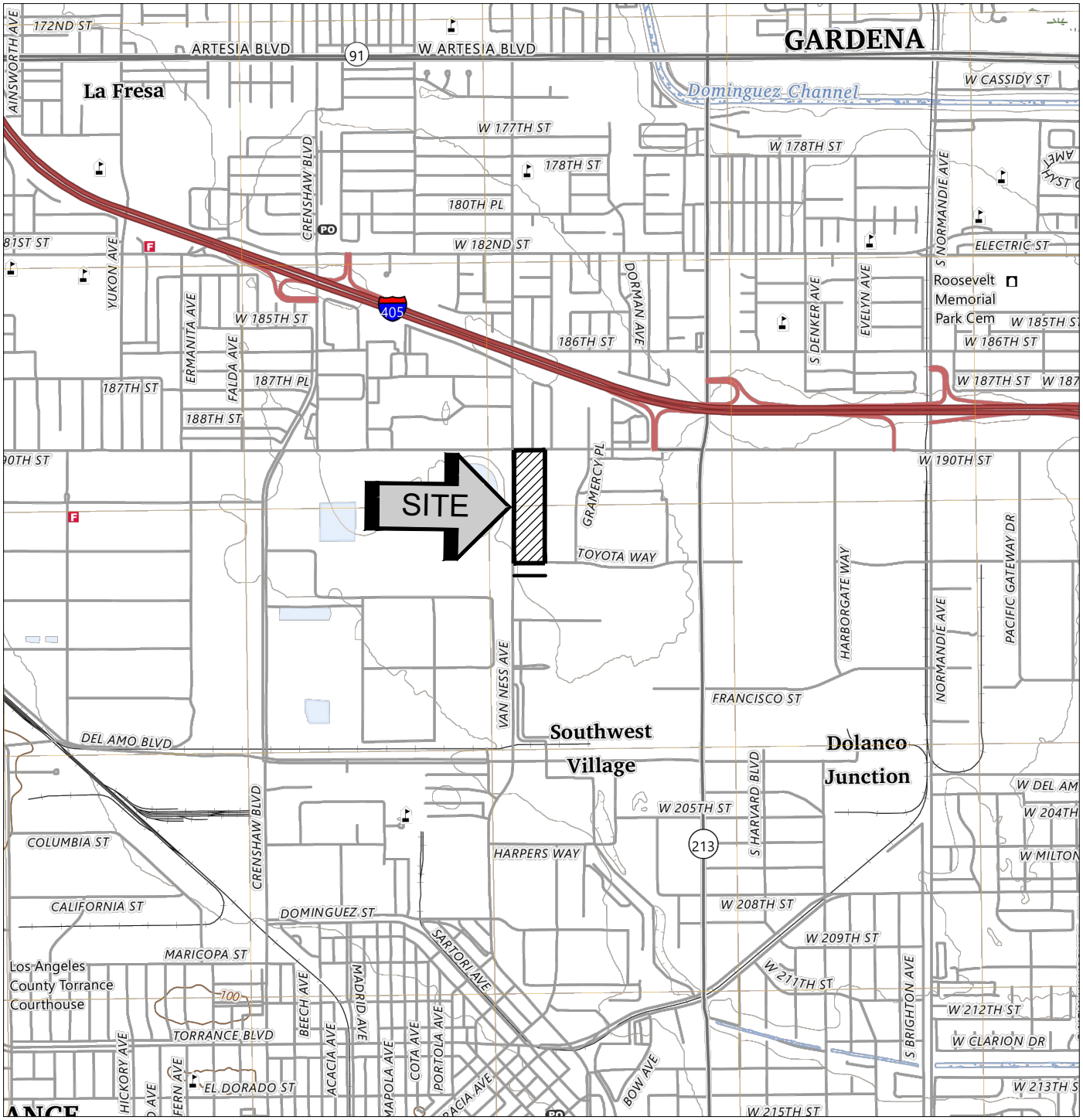
Respectfully Submitted,
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Michelle Krizek
Staff Geologist

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Logs and Legend (6 pages)
Infiltration Test Results Spreadsheets (4 pages)
Grain Size Distribution Graphs (4 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF THE TORRANCE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA, 2023.

SITE LOCATION MAP

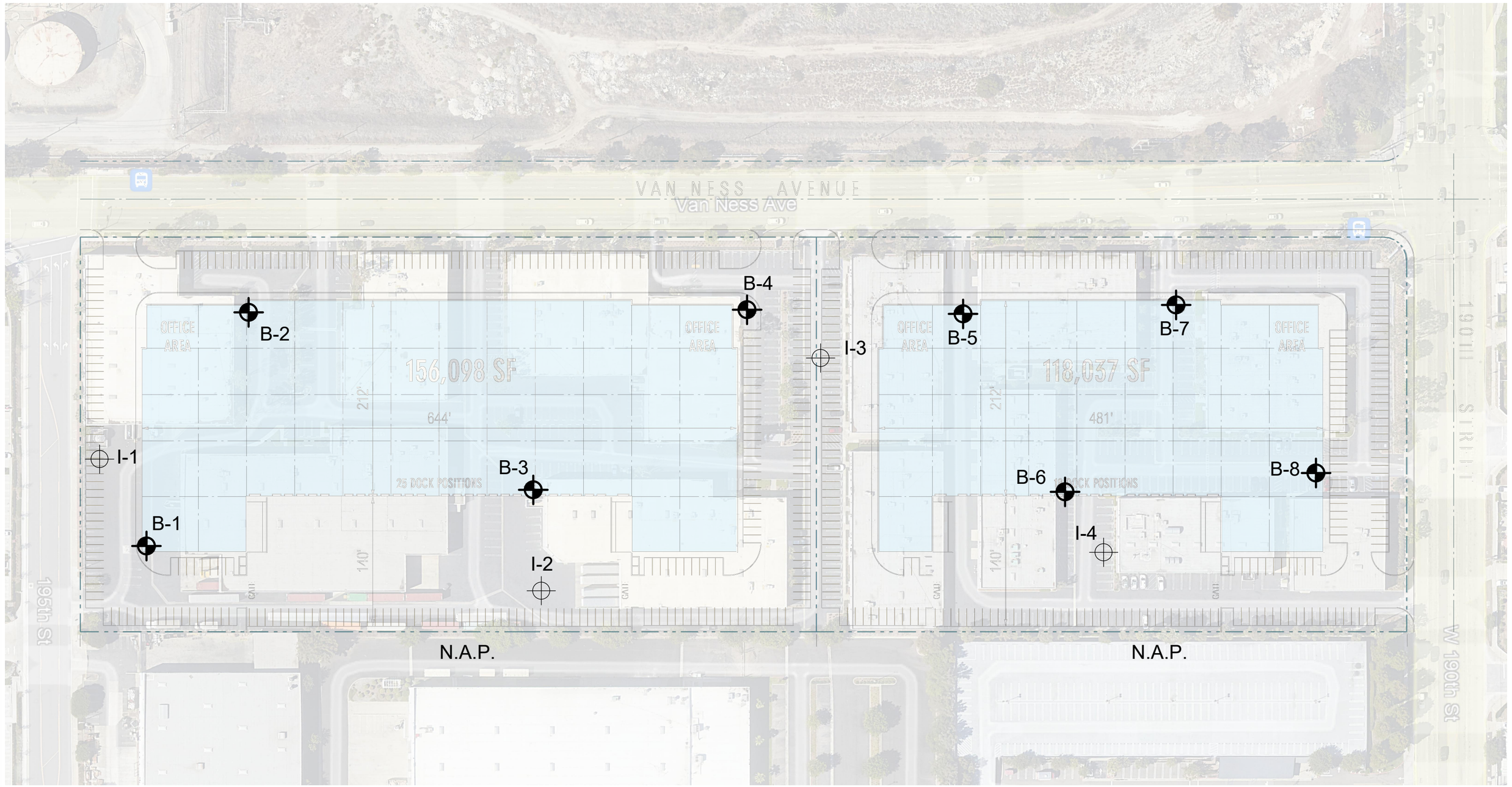
TWO PROPOSED INDUSTRIAL BUILDINGS

TORRANCE, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: MK CHKD: RGT	
SCG PROJECT 23G206-2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO. 23G206-1)

NORTH

SoCalGeo

NOTE: SITE PLAN PREPARED BY RGA.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

INFILTRATION TEST LOCATION PLAN

TWO PROPOSED INDUSTRIAL BUILDINGS

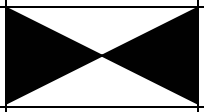
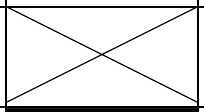
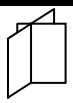
TORRANCE, CALIFORNIA

SCALE: 1" =100'	
DRAWN: MK CHKD: RGT	
SCG PROJECT 23G206-2	
PLATE 2	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

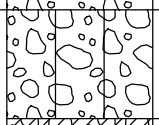
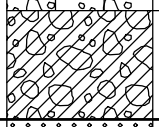
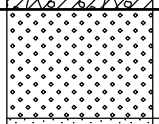
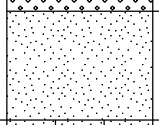
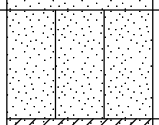
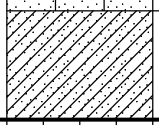
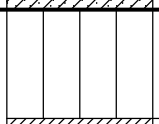
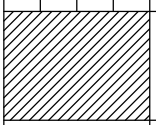
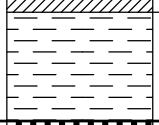
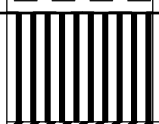
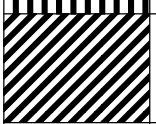
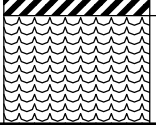
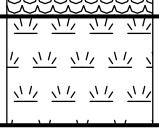
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-1

JOB NO.: 23G206-2
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Not Applicable
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete; 6± inches Aggregate Base							
					ALLUVIUM: Dark Gray Brown fine Sandy Clay, little Silt, trace Calcareous veining and nodules, little Iron Oxide staining, stiff to very stiff-very moist							
		10					20					
5												
		12	4.5				24					
10												
		23			@ 13½ feet, trace medium to coarse Sand, trace fine Gravel		19			65		
15					Boring Terminated at 15 feet							

TBL 23G206-2.GPJ SOCALGEO.GDT 1/2/24

TEST BORING LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-2

JOB NO.: 23G206-2
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Not Applicable
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 5± inches Asphaltic Concrete; 7± inches Aggregate Base							
					FILL: Dark Brown Silty Clay, trace fine to coarse Sand, trace Asphaltic Concrete fragments, disturbed and mottled appearance, stiff to very stiff-very moist							
		17	4.5+				17					
5												
		10	3.5		ALLUVIUM: Dark Gray Brown fine Sandy Clay, little Silt, trace Calcareous veining and nodules, stiff-very moist		18					
					Dark Brown Clayey fine Sand, little Silt, trace medium Sand, medium dense-very moist							
10		22					14			33		
					Boring Terminated at 12 feet							

TBL 23G206-2.GPJ SOCALGEO.GDT 1/2/24

TEST BORING LOG **PLATE B-2**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-3

JOB NO.: 23G206-2
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Not Applicable
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 5± inches Asphaltic Concrete; 8± inches Aggregate Base							
					FILL: Dark Brown Silty Clay, disturbed and mottled appearance, stiff to very stiff-very moist							
		13	4.5				22					
5			2.5		ALLUVIUM: Gray Brown fine Sandy Clay, little Silt, little Calcareous veining and nodules, stiff to very stiff-very moist		22					
		15	3.5				28					
10												
		21	4.5+		@ 13½ feet, trace medium to coarse Sand		21			79		
15					Boring Terminated at 15 feet							

TBL 23G206-2.GPJ SOCALGEO.GDT 1/2/24

TEST BORING LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-4

JOB NO.: 23G206-2
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Not Applicable
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete; 5± inches Aggregate Base							
					FILL: Dark Brown Silty Clay, trace fine to medium Sand, disturbed and mottled appearance, stiff-very moist							
		13	4.0				21					
5												
					ALLUVIUM: Gray Brown Silty Clay, little Calcareous veining and nodules, stiff-very moist							
		11	2.5				22					
10												
		18	4.5+		@ 10½ feet, trace to little fine Sand, trace Iron Oxide staining, very stiff		25			96		
					Boring Terminated at 12 feet							

TBL 23G206-2.GPJ SOCALGEO.GDT 1/2/24

TEST BORING LOG

PLATE B-4

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Torrance, California
Project Number	23G206-2
Engineer	Michelle Krizek

Test Hole Radius	4.00	(in)
Test Depth	15.10	(ft)

Infiltration Test Hole: I-1

Start Time for Pre-Soak	7:25 AM	Water Remaining in Boring (Y/N)	Y
Start Time for Standard	8:25 AM	Time Interal Between Readings	30min

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Measured Infiltration Rate Q (in/hr)	Reduction Factor (RF)	Design Infiltration Rate Q (in/hr)
1	Initial	8:25 AM	30.0	12.72	0.02	2.4	0.0	3.0	0.0
	Final	8:55 AM		12.74					
2	Initial	8:55 AM	30.0	12.72	0.02	2.4	0.0	3.0	0.0
	Final	9:25 AM		12.74					
3	Initial	9:25 AM	30.0	12.72	0.02	2.4	0.0	3.0	0.0
	Final	9:55 AM		12.74					
4	Initial	9:55 AM	30.0	12.72	0.02	2.4	0.0	3.0	0.0
	Final	10:25 AM		12.74					
5	Initial	10:25 AM	30.0	12.72	0.02	2.4	0.0	3.0	0.0
	Final	10:55 AM		12.74					
6	Initial	10:55 AM	30.0	12.72	0.01	2.4	0.0	3.0	0.0
	Final	11:25 AM		12.73					

Design Infiltration Rate = (Measured Infiltration Rate)/(Reduction Factor)
Reduction Factor (RF) = $RF_t+RF_v+RF_s$

Reduction Factors	
Double-ring Infiltrometer	RF_t = 1 to 3
Shallow Test Pit	
Small Diameter Boring	
Large Diameter Boring	
High Fow-rate	RF_t = 3
Grain Size Analysis Method	RF_t = 2 to 3
Site variability, number of tests and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging, and maintenance	RF_s = 1 to 3

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Measured Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Torrance, California
Project Number	23G206-2
Engineer	Michelle Krizek

Test Hole Radius	4.00	(in)
Test Depth	12.14	(ft)

Infiltration Test Hole: I-2

Start Time for Pre-Soak	7:45 AM	Water Remaining in Boring (Y/N)	Y
Start Time for Standard	8:45 AM	Time Interal Between Readings	30min

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Measured Infiltration Rate Q (in/hr)	Reduction Factor (RF)	Design Infiltration Rate Q (in/hr)
1	Initial	8:45 AM	30.0	10.00	1.73	1.3	4.8	3.0	1.6
	Final	9:15 AM		11.73					
2	Initial	9:15 AM	30.0	10.00	1.06	1.6	2.4	3.0	0.8
	Final	9:45 AM		11.06					
3	Initial	9:45 AM	30.0	10.00	0.76	1.8	1.6	3.0	0.5
	Final	10:15 AM		10.76					
4	Initial	10:15 AM	30.0	10.00	0.53	1.9	1.0	3.0	0.3
	Final	10:45 AM		10.53					
5	Initial	10:45 AM	30.0	10.00	0.46	1.9	0.9	3.0	0.3
	Final	11:15 AM		10.46					
6	Initial	11:15 AM	30.0	10.00	0.41	1.9	0.8	3.0	0.3
	Final	11:45 AM		10.41					

Design Infiltration Rate = (Measured Infiltration Rate)/(Reduction Factor)
Reduction Factor (RF) = $RF_t+RF_v+RF_s$

Reduction Factors	
Double-ring Infiltrometer	RF_t = 1 to 3
Shallow Test Pit	
Small Diameter Boring	
Large Diameter Boring	
High Fow-rate	RF_t = 3
Grain Size Analysis Method	RF_t = 2 to 3
Site variability, number of tests and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging, and maintenance	RF_s = 1 to 3

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Measured Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Torrance, California
Project Number	23G206-2
Engineer	Michelle Krizek

Test Hole Radius	4.00	(in)
Test Depth	15.18	(ft)

Infiltration Test Hole: I-3

Start Time for Pre-Soak	10:33 AM	Water Remaining in Boring (Y/N)	Y
Start Time for Standard	11:33 AM	Time Interal Between Readings	30min

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Measured Infiltration Rate Q (in/hr)	Reduction Factor (RF)	Design Infiltration Rate Q (in/hr)
1	Initial	11:33 AM	30.0	12.41	0.00	2.8	0.0	3.0	0.0
	Final	12:03 PM		12.41					
2	Initial	12:03 PM	30.0	12.41	0.00	2.8	0.0	3.0	0.0
	Final	12:33 PM		12.41					
3	Initial	12:33 PM	30.0	12.41	0.00	2.8	0.0	3.0	0.0
	Final	1:03 PM		12.41					
4	Initial	1:03 PM	30.0	12.41	0.00	2.8	0.0	3.0	0.0
	Final	1:33 PM		12.41					
5	Initial	1:33 PM	30.0	12.41	0.00	2.8	0.0	3.0	0.0
	Final	2:03 PM		12.41					
6	Initial	2:03 PM	30.0	12.41	0.00	2.8	0.0	3.0	0.0
	Final	2:33 PM		12.41					

Design Infiltration Rate = (Measured Infiltration Rate)/(Reduction Factor)
Reduction Factor (RF) = $RF_t+RF_v+RF_s$

Reduction Factors	
Double-ring Infiltrometer	RF_t = 1 to 3
Shallow Test Pit	
Small Diameter Boring	
Large Diameter Boring	
High Fow-rate	RF_t = 3
Grain Size Analysis Method	RF_t = 2 to 3
Site variability, number of tests and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging, and maintenance	RF_s = 1 to 3

$$Q = \frac{\Delta H(60r)}{\Delta t(r+2H_{avg})}$$

Where:
- Q = Measured Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Two Proposed Industrial Buildings
Project Location	Torrance, California
Project Number	23G206-2
Engineer	Michelle Krizek

Test Hole Radius	4.00	(in)
Test Depth	12.04	(ft)

Infiltration Test Hole: I-4

Start Time for Pre-Soak	10:40 AM	Water Remaining in Boring (Y/N)	Y
Start Time for Standard	11:40 AM	Time Interal Between Readings	30min

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Measured Infiltration Rate Q (in/hr)	Reduction Factor (RF)	Design Infiltration Rate Q (in/hr)
1	Initial	11:40 AM	30.0	10.10	0.02	1.9	0.0	3.0	0.0
	Final	12:10 PM		10.12					
2	Initial	12:10 PM	30.0	10.10	0.01	1.9	0.0	3.0	0.0
	Final	12:40 PM		10.11					
3	Initial	12:40 PM	30.0	10.10	0.00	1.9	0.0	3.0	0.0
	Final	1:10 PM		10.10					
4	Initial	1:10 PM	30.0	10.10	0.00	1.9	0.0	3.0	0.0
	Final	1:40 PM		10.10					
5	Initial	1:40 PM	30.0	10.10	0.00	1.9	0.0	3.0	0.0
	Final	2:10 PM		10.10					
6	Initial	2:10 PM	30.0	10.10	0.00	1.9	0.0	3.0	0.0
	Final	2:40 PM		10.10					

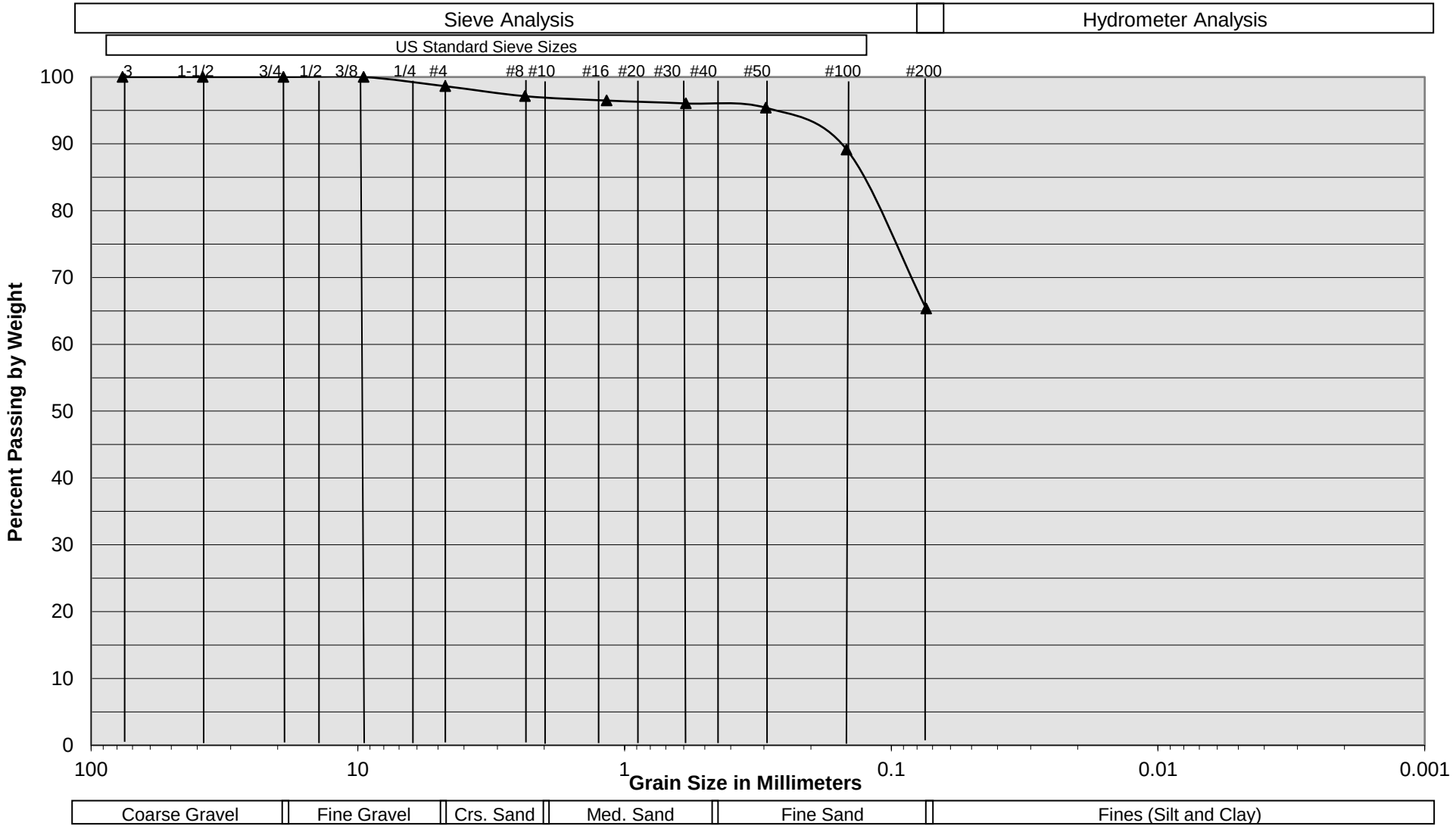
Design Infiltration Rate = (Measured Infiltration Rate)/(Reduction Factor)
Reduction Factor (RF) = $RF_t+RF_v+RF_s$

Reduction Factors	
Double-ring Infiltrometer	RF_t = 1 to 3
Shallow Test Pit	
Small Diameter Boring	
Large Diameter Boring	
High Fow-rate	RF_t = 3
Grain Size Analysis Method	RF_t = 2 to 3
Site variability, number of tests and thoroughness of subsurface investigation	RF_v = 1 to 3
Long-term siltation, plugging, and maintenance	RF_s = 1 to 3

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Measured Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

Grain Size Distribution

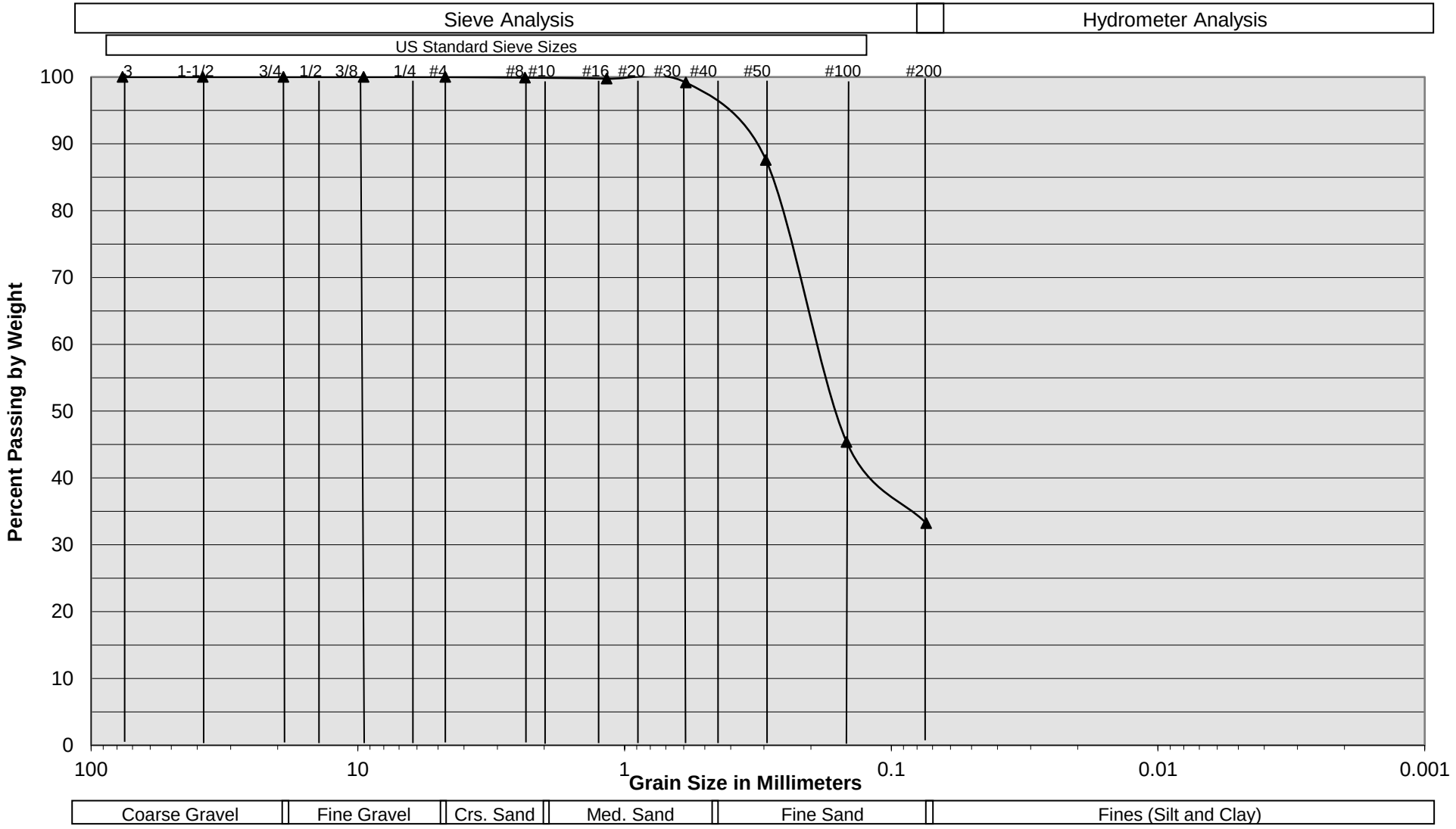


Sample Description	I-1 @ 13½'
Soil Classification	Dark Gray Brown fine Sandy Clay, little Silt, trace medium to coarse Sand, trace fine Gravel

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-2
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

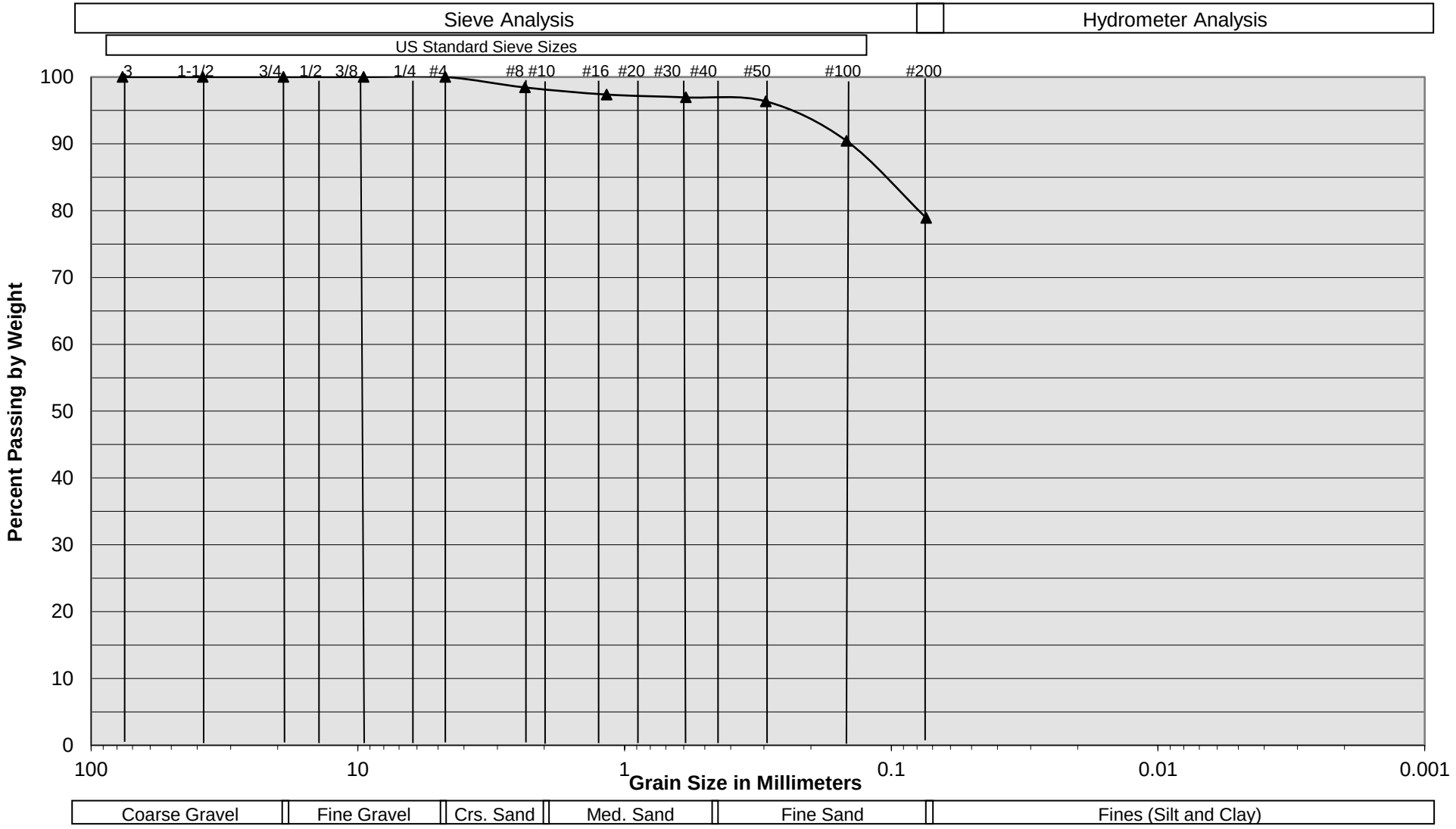


Sample Description	I-2 @ 10½'
Soil Classification	Gray Brown Clayey fine Sand, little Silt, trace medium Sand

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-2
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

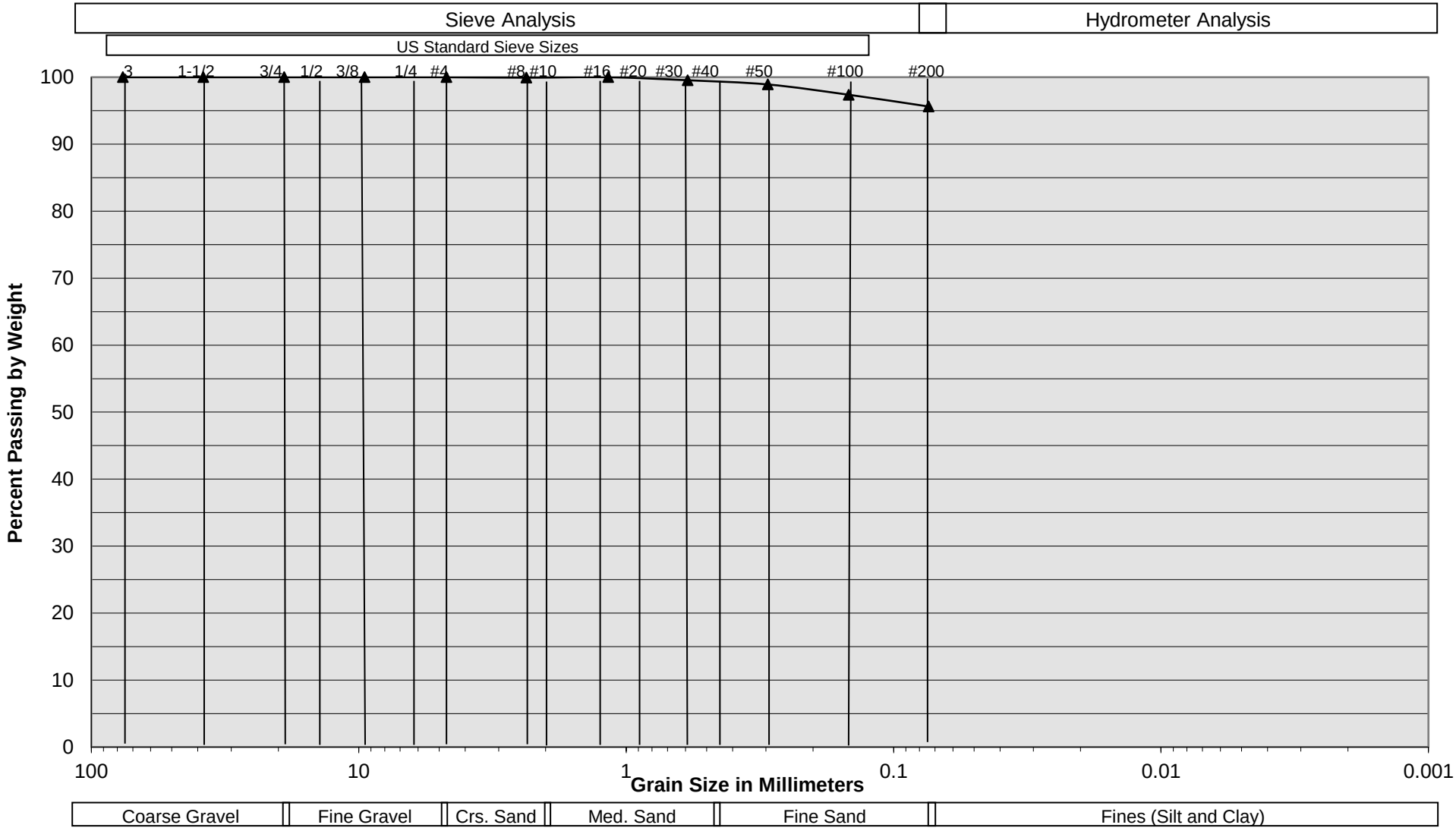


Sample Description	I-3 @ 13½'
Soil Classification	Gray Brown fine Sandy Clay, little Silt, trace medium to coarse Sand

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-2
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-4 @ 10½'
Soil Classification	Gray Brown Silty Clay, trace to little fine Sand

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-2
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

GEOTECHNICAL INVESTIGATION
TWO PROPOSED INDUSTRIAL BUILDINGS

SEC 190th Street and Van Ness Avenue
Torrance, California
for
DWS

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

December 28, 2023

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

DWS
13450 Maxella Avenue, Suite 220
Marina Del Rey, CA 90290

Attention: Mr. Nick Zaharov
Value Add & Development Alternatives

Project No.: **23G206-1**

Subject: **Geotechnical Investigation**
Two Proposed Industrial Buildings
SEC 190th Street and Van Ness Avenue
Torrance, California

Mr. Zaharov:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Joseph Lozano Leon
Staff Engineer

Gregory K. Mitchell, GE 2364
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
GREGORY K. MITCHELL
No. 2364
GEOTECHNICAL
STATE OF CALIFORNIA

Distribution: (1) Addressee

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Geotechnical Design Considerations

- All of the borings encountered artificial fill materials, extending from the ground surface to depths of 3 to 6½± feet. The fill soils possess varying densities and strengths. In addition, no documentation regarding the placement and compaction of these soils has been provided. The fill soils are therefore considered to be undocumented fill materials. The fill soils are underlain by native alluvium which possesses variable strengths and composition.
- The artificial fill materials and the near-surface alluvium, in their present condition, are not considered suitable for support of the foundations and floor slabs of the new structures.
- Laboratory testing performed on representative samples of the near-surface soils indicates that the on-site soils possess low to very high expansion potentials (EI = 39 and 136). However, we expect that blending these expansive soils during grading will result in soils possessing an EI less than 90.

Site Preparation Recommendations

- Demolition of the existing structures and pavements will be required in order to facilitate construction of the new buildings. Demolition should also include all utilities and any other subsurface improvements that will not remain in place for use with the new development. The resultant excavations should be backfilled with compacted structural fill. Debris resultant from demolition should be disposed of off-site. Alternatively, concrete and asphalt debris may be processed into miscellaneous base (CMB). It may also be feasible to crush the concrete and asphalt debris to a 2 to 4-inch particle size and utilize for subgrade stabilization material.
- Initial site preparation should also include stripping of vegetation from the existing landscape planters. Any significant root masses should also be removed from the site.
- Remedial grading should be performed within the proposed building areas in order to remove all of the undocumented fill soils, any soils disturbed during demolition, and a portion of the near-surface native alluvium. The soils within the proposed building areas should also be overexcavated to a depth of 4 feet below existing grade and to a depth of at least 3 feet below proposed building pad subgrade elevations, whichever is greater. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 3 feet below proposed foundation bearing grade.
- The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade, whichever is greater.
- After overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated, moisture conditioned, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill. **However, it is recommended that the upper 24 inches of the building pad subgrade soils consist of very low to non-expansive soil.** The 2-foot-thick layer of very low to

non-expansive soil should consist of either the on-site CMB resultant from demolition, cement-treated or lime-treated on-site soils, or non-expansive granular imported, structural fill.
- Based on our experience with other projects located in the city of Torrance, we expect that the city will require that all existing undocumented fill soils within parking and drive areas be removed and replaced as structural fill.

Foundation Design Recommendations
- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft^2 maximum allowable soil bearing pressure.
- Reinforcement consisting of at least six (6) No. 5 rebars (3 top and 3 bottom) in strip footings due to the presence of expansive soils. Additional reinforcement may be necessary for structural considerations.

Building Floor Slabs
- Conventional Slabs-on-Grade, at least 6 inches thick.
- Modulus of Subgrade Reaction: k = 150 psi/in.
- Reinforcement consisting of at least No. 4 bars at 16 inches on center, in both directions, due to the presence of expansive soils. Additional reinforcement may be necessary for structural considerations.
- The actual thickness and reinforcement of the floor slabs should be determined by the structural engineer.

Pavement Design Recommendations

ASPHALT PAVEMENTS (R = 10)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	9	12	15	16	19
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 10)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	7	8½
Aggregate Base	Not Required	6	6	6
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 23P390, dated October 20 2023. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the southeast corner of 190th Street and Van Ness Avenue in Torrance, California. The site is bounded to the north by 190th Street, to the west by Van Ness Avenue, to the south by 195th Street, and to the east by existing commercial/industrial buildings. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of three (3) rectangular- to irregular-shaped properties, totaling 14.01± acres in size. The site is developed with thirteen (13) one-to-two-story commercial/industrial buildings, ranging from 9,500± ft² to 45,000±ft² in size. The buildings are of concrete tilt-up construction, and are assumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. The ground surface cover throughout the site consists of asphaltic concrete (AC) pavements, with limited areas of Portland cement concrete (PCC) pavements and landscaped planters, which include turf grass, shrubs and trees. The pavements are in poor to fair condition with moderate to severe cracking throughout.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations made at the time of the subsurface investigation, the overall site topography slopes gently downward to the southwest at a gradient of less than 1 percent.

3.2 Proposed Development

A conceptual site plan prepared by RGA has been provided to our office by the client. Based on this plan, the subject site will be developed with two (2) new industrial buildings. The new buildings will be 118,037± and 156,098± ft^2 in size, and will be located in the northern and southern areas of the site, respectively. Dock-high doors will be constructed along a portion of the east side of each of the buildings. The proposed buildings are expected to be surrounded by AC pavements in the parking and drive areas, PCC pavements in the loading dock areas, and concrete flatwork and landscaped planters throughout the site.

Detailed structural information has not been provided. It is assumed that the new buildings will be single-story structures of tilt-up concrete construction, typically supported on conventional shallow foundations with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

No significant amounts of below-grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of up to 2 to 3± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of eight (8) borings (identified as Boring Nos. B-1 through B-8) advanced to depths of 15 to 30± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff. All of the boring locations were cleared by a private geophysical testing company prior to drilling.

The borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed soil samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. Standard penetration test (SPT) samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

Per the County of Los Angeles, the excavated soils were placed into 55-gallon drums, and transported to a staging area for disposal. In addition, the boreholes were backfilled with cement-bentonite grout upon completion of the borings.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Pavements

AC pavements were encountered at the ground surface at all of the boring locations. The pavement sections at these locations consist of 4 to 5± inches of AC, underlain by 5 to 10± inches of aggregate base. Aggregate base was not present beneath the AC section at Boring No. B-7. It should be noted that a Petromat geotextile material was clearly observed between the AC and base sections at two of the infiltration test locations (I-1 and I-2). The approximate infiltration test locations are documented in the infiltration study report, published by Southern California Geotechnical, Inc. under separate cover.

Artificial Fill

Artificial fill soils were encountered beneath the existing pavements at all of the boring locations, extending to depths of 3 to 6½± feet below the existing site grades. The artificial fill soils generally consist of medium stiff to very stiff silty clays and sandy clays with varying fine gravel content. The fill soils possess a disturbed appearance and some samples contain artificial debris, such as AC fragments, resulting in their classification as artificial fill.

Alluvium

Native alluvial soils were encountered beneath the artificial fill soils at all of the boring locations, extending to at least the maximum depth explored of 30± feet below the existing site grades. The alluvial soils within the upper 12 to 27± feet generally consist of stiff to very stiff sandy clays and silty clays, with occasional medium stiff sandy clays and silty clays. At greater depths and extending to the maximum depth explored of 30± feet, the alluvium generally consists of medium dense to dense silty sands and sandy silts.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static groundwater table is at a greater depth than 30± feet below existing site grades.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area is the California Geological Survey (CGS) Seismic Hazard Zone Report 035, Seismic Hazard Zone Report for the Torrance 7.5-Minute Quadrangle, which indicates that the historic high groundwater level for the site is between 20 and 30± feet below the ground surface.

In addition, recent water level data was obtained from the California State Water Resources Control Board, GeoTracker, website, https://geotracker.waterboards.ca.gov/. Several monitoring wells are located as close as 500± feet from the site. Water level readings within these monitoring wells indicate a high groundwater level of 54± feet below the ground surface in April 2017.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

The recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. The field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Consolidation

Selected soil samples were tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-8 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557. These tests are generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date. The result of this testing is plotted on Plate C-9 in Appendix C of this report.

Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829 as required by the California Building Code (CBC). The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot.

The sample is then inundated with water, and allowed to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the expansion index (EI) testing are as follows:

Sample Identification	Expansion Index	Expansive Potential
B-2 @ 1 to 5 feet	39	Low
B-5 @ 1 to 5 feet	136	Very High

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	Severity	Class
B-3 @ 1 to 5 feet	0.002	Not Applicable	S0
B-5 @ 1 to 5 feet	0.009	Not Applicable	S0

Corrosivity Testing

Representative samples of the near-surface soils were submitted to a subcontracted corrosion engineering laboratory for determination of electrical resistivity, pH, and chloride concentrations. The resistivity of the soils is a measure of their potential to attack buried metal improvements such as utility lines. The results of some of these tests are presented below.

Sample Identification	Saturated Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Nitrates (mg/kg)	Sulfides (mg/kg)	Redox Potential (mV)
B-3 @ 1 to 5 feet	804	8.1	4.5	3.0	1.6	158
B-5 @ 1 to 5 feet	1,005	8.0	15.9	0.8	4.3	170

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon the grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site-specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low. The potential for other geologic hazards such as seismically induced settlement, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The 2022 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters

presented below are based on the soil profile and the proximity of known faults with respect to the subject site. Based on the adoption of the 2022 CBC on January 1, 2023, we expect that the proposed development will be designed in accordance with the 2022 CBC.

The 2022 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-16, upon which the 2022 CBC is based. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The table below was created using data obtained from the application. The output generated from this program is included as Plate E-1 in Appendix E of this report.

The 2022 CBC states that for Site Class D sites with a mapped S_1 value greater than 0.2, a site-specific ground motion analysis may be required in accordance with Section 11.4.8 of ASCE 7-16. Supplement 3 to ASCE 7-16 modifies Section 11.4.8 of ASCE 7-16 and states that "a ground motion hazard analysis is not required where the value of the parameter S_{M1} determined by Eq. (11.4-2) is increased by 50% for all applications of S_{M1} in this Standard. The resulting value of the parameter S_{D1} determined by Eq. (11.4-4) shall be used for all applications of S_{D1} in this Standard."

The seismic design parameters presented in the table below were calculated using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC. It should be noted that the site coefficient Fv and the parameters SM1 and SD1 were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the ASCE 7-16 standard. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2022 CBC using the value of S_1 obtained from the Seismic Design Maps Tool. **The values of S_{M1} and S_{D1} tabulated below** were evaluated using equations 11.4-2 and 11.4-4 of ASCE 7-16 (Equations 16-20 and 16-23, respectively, of the 2022 CBC) and **do not include a 50 percent increase.** As discussed above, if a ground motion hazard analysis has not been performed, S_{M1} and S_{D1} must be increased by 50 percent for all applications with respect to ASCE 7-16.

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.756
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.627
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.756
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.066*
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.171
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.711*

*Note: These values must be increased by 50 percent if a site-specific ground motion hazard analysis has not been performed. However, this increase is not expected to affect the design of the structure type proposed for this site. This assumption should be confirmed by the project structural engineer. The values tabulated above do not include a 50-percent increase.

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles (d<0.005mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

Research of the map, Earthquake Zones of Required Investigation, Torrance Quadrangle, published by the CGS, indicates that the site is not located in a designated liquefaction hazard zone. In addition, the subsurface investigation encountered native alluvium consisting of stiff to very stiff sandy clays and silty clays, and medium dense to dense silty sands and sandy silts. The subsurface conditions encountered at the subject site are not considered to be conducive to liquefaction. Based on the conditions encountered at the boring locations and the mapping performed by the CGS, liquefaction is not considered to be a significant design concern for this project.

6.2 Geotechnical Design Considerations

General

All of the borings encountered artificial fill materials, extending from the ground surface to depths of 3 to 6½± feet. The fill soils possess varying densities and strengths. In addition, no documentation regarding the placement and compaction of these soils has been provided. The fill soils are therefore considered to be undocumented fill materials. The fill soils are underlain by native alluvium which possesses variable strengths and composition. Based on these conditions, the artificial fill materials and the near-surface alluvium, in their present condition, are not considered suitable for support of the foundations and floor slabs of the new structures. Additionally, it is anticipated that demolition of the existing structures and associated improvements will cause disturbance of the upper 3 to 5± feet of soil. Furthermore, the city of Torrance does not allow new buildings to be constructed on existing undocumented fill soils. Remedial grading will be necessary within the proposed building areas to remove the undocumented fill soils in their entirety, the upper portion of the near-surface native alluvial soils and any soils disturbed during the demolition process, and to replace these soils as compacted structural fill.

Settlement

The recommended remedial grading will remove the existing fill soils from the new building areas as well as a portion of the variable strength alluvium and replace these materials as compacted structural fill. The native soils that will remain in place below the recommended depth of

overexcavation possess will not be subject to significant load increases from the foundations of the new structures. Provided that the recommended remedial grading is completed, the post-construction settlements of the proposed structures are expected to be within tolerable limits.

Expansion

The near-surface soils at this site generally consist of sandy clays and silty clays. Laboratory testing performed on representative samples of the near-surface soils indicates that the test samples possess low to very high expansion potentials (EI = 39 and 136). **We expect that blending these expansive soils during grading will result in soils possessing an EI less than 90. The EI of the blended mixture should be verified during grading by a representative of the geotechnical engineer.** Based on the presence of expansive soils at this site, care should be given to proper moisture conditioning the building pad subgrade soils to a moisture content of 3 to 5 percent above the ASTM D-1557 optimum during site grading. In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintaining moisture content of these soils at 3 to 5 percent above the optimum moisture content. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather. Civil and structural design considerations are presented in Section 6.4 of this report.

Soluble Sulfates

The results of the soluble sulfate testing, discussed in Section 5.0 of this report, indicate soluble sulfate concentrations less than 0.009 percent. These concentrations are considered to be negligible or "not applicable" with respect to the American Concrete Institute (ACI) Publication 318-05 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building areas.

Corrosion Potential

The results of laboratory testing indicate that the tested samples of the near-surface soils possess saturated resistivities ranging from 804 to 1,005 ohm-cm, and pH values of 8.0 and 8.1. The soils possess redox potentials of up to 170 mV and sulfide concentrations of up to 4.3 mg/kg. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity, pH, sulfide concentration, redox potential, and moisture content are the five factors that enter into the evaluation procedure. **Based on the labor factors, the on-site soils are considered to be corrosive to ferrous pipes. Therefore, corrosion protection is expected to be required for cast iron or ductile iron pipes.**

Based on American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary, reinforced concrete that is exposed to external sources of chlorides requires corrosion protection for the steel reinforcement contained within the concrete. ACI 318 defines concrete exposed to moisture and an external source of chlorides as "severe" or exposure category C2. ACI 318 does not clearly define a specific chloride concentration at which

contact with the adjacent soil will constitute a "C2" or severe exposure. However, the Caltrans Memo to Designers 10-5, Protection of Reinforcement Against Corrosion Due to Chlorides, Acids and Sulfates, dated June 2010, indicates that soils possessing chloride concentrations greater than 500 mg/kg are considered to be corrosive to reinforced concrete. The results of the laboratory testing indicate chloride concentrations ranging from 4.5 to 15.9 mg/kg. Although the soils contain some chlorides, we do not expect that the chloride concentrations of the tested soils are high enough to constitute a "severe" or C2 chloride exposure. Therefore, a chloride exposure category of C1 is considered appropriate for this site.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested samples possess nitrate concentrations of up to 3.0 mg/kg. Based on the test results, the on-site soils are not considered to be corrosive to copper pipe.

Since SCG does not practice in the area of corrosion engineering, we recommend that the client contact a corrosion engineer to provide a more thorough evaluation of these test results.

Shrinkage/Subsidence

Removal and recompaction of the near-surface alluvium is estimated to result in an average shrinkage of 5 to 15 percent. However, potential shrinkage for individual samples ranged locally between 1 and 20 percent. The potential shrinkage estimate is based on dry density testing performed on small-diameter samples taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1± feet.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

Grading and foundation plans were unavailable at the time of this report. It is therefore recommended that we be provided with copies of the preliminary grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations, and our understanding of the proposed development. We recommend that the grading activities be completed in accordance with the Grading Guide

Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping and Demolition

The proposed development will require demolition of the existing pavements and structures. Additionally, any existing improvements that will not remain in place for use with the new development should be removed in their entirety. This should include utilities, and any other subsurface improvements associated with the existing development. The existing pavements are not expected to be reused with the new development. Debris resultant from demolition should be disposed of off-site. Concrete and asphalt debris may be re-used as compacted fill, provided it is processed into miscellaneous base (CMB) at the site. Asphalt and concrete debris resultant from demolition may also be crushed to 2 to 4-inch particle size and used as a subgrade stabilization material. **Due to the clay content of the existing soils, mixing concrete and asphalt debris with the on-site soils is not recommended.**

Detailed structural information regarding the existing buildings has not been provided to our office. Therefore, the foundation systems supporting the existing buildings are generally unknown by SCG. We expect that the existing buildings are supported on conventional shallow foundations. However, if the buildings are supported on deep foundations, any existing piles or drilled piers located within the proposed building areas should be cut off at a depth of at least 3 feet below the bottom of the planned overexcavation. Where drilled pier or pile foundations are encountered within proposed pavement areas, they should be cut off at a depth of at least 2 feet below the proposed pavement subgrade elevation or at a depth of at least 1 foot below the bottom of any planned utilities.

Initial site stripping should also include removal of any surficial vegetation from the unpaved areas of the site. This should include any weeds, grasses, shrubs, and trees. Root systems associated with the trees should be removed in their entirety, and the resultant excavations should be backfilled with compacted structural fill soils. Any organic materials should be removed and disposed of off-site, or in non-structural areas of the property. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the new building pad areas to remove the undocumented fill soils, any soils disturbed during demolition, and a portion of the near-surface native alluvium. Based on the conditions encountered at the borings, the fill soils extend to depths of 3 to 6½± feet below the existing site grades at the boring locations.

We also recommend that the building pad areas be overexcavated to a depth of at least 4 feet below existing site grades elevation and to a depth of 3 feet below the proposed building pad subgrade elevations, whichever is greater. Additional overexcavation should be performed within the influence zones of the new foundations, extending to a depth of at least 3 feet below proposed foundation bearing grades.

The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade,

whichever is greater. If the proposed structures incorporate any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the overexcavation areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structures. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if additional fill materials or loose, porous, or low density native soils are encountered at the base of the overexcavation.

Based on the conditions encountered at the exploratory boring locations, very moist soils will be encountered at or near the base of the recommended overexcavation. Stabilization of the exposed overexcavation subgrade soils will likely be necessary. Scarification and air drying of these materials may be sufficient to obtain a stable subgrade. However, if highly unstable soils are identified, and if the construction schedule does not allow for delays associated with drying, mechanical stabilization, usually consisting of coarse crushed stone or geotextile, could be necessary. In this event, the geotechnical engineer should be contacted for supplementary recommendations. Typically, an unstable subgrade can be stabilized using a suitable geotextile fabric, such as Mirafi RS580I, and/or a 12- to 18-inch-thick layer of coarse (2 to 4-inch particle size) crushed stone. Asphalt and concrete debris resultant from demolition could be crushed to 2 to 4-inch particle size and used as a subgrade stabilization material. Other options, including lime or cement treatment are also available. Typically, an unstable subgrade may be stabilized by treating the upper 12 to 18± inches of subgrade material with cement to concentrations between 5 to 7 percent (by dry weight of soil).

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches and moisture conditioned or air dried to achieve a moisture content of 3 to 5 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The building pad areas may then be raised to grade with previously excavated soils or imported, structural fill. **However, it is recommended that the upper 24 inches of the building pad subgrade soils consist of very low to non-expansive soil.** The 2-foot-thick layer of very low to non-expansive soil should consist of either the on-site CMB resultant from demolition, cement-treated or lime-treated on-site soils, or non-expansive granular imported, structural fill.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 3 feet below foundation bearing grade and replaced as compacted structural fill. Any undocumented fill soils within any of these foundation areas should be removed in their entirety. The overexcavation areas should extend at least 3 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Please note that erection pads are considered to be part of the foundation system. These overexcavation recommendations apply to erection pads also. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning to within 3 to 5 percent above the optimum moisture content, and recompacting the upper 12 inches

of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

If the full lateral extent of overexcavation is not achievable for the proposed walls, foundation elements must be redesigned using a lower bearing pressure. The geotechnical engineer of record should be contacted for recommendations pertaining to this type of condition.

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing soils in the new parking and drive areas is not considered warranted from a geotechnical standpoint, with the exception of areas where lower strength, or unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new parking and drive areas should initially consist of removal of soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12 inches, moisture conditioned to at least 3 to 5 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking areas. The grading recommendations presented above do not completely mitigate the extent of the existing fill soils in the parking areas. As such, settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the removed soils replaced as compacted structural fill.

Please note that based on our experience with recent projects located in the city of Torrance, it is our understanding that the city of Torrance requires that all undocumented fill soils within parking and drive areas be removed and replaced as structural fill. These recommendations exceed SCG's typical recommendations for pavement subgrade preparation, which are presented above. Based on the conditions encountered at the borings located within proposed parking and drive areas, fill soils extend to depths of 3 to 6½± below the existing site grades. We recommend that research be performed at the City of Torrance in order to determine if a compaction report documenting the placement and compaction of the existing fill soils at this site is available. **If it is determined that the fill soils within the proposed parking and drive areas are undocumented fill soils, then any undocumented fill soils present within the proposed parking and drive areas should be removed in their entirety as required by the city of Torrance.** The pavement subgrade may then be raised to grade with previously excavated soils or imported, structural fill.

Treatment of Existing Soils: Flatwork Areas

Subgrade preparation in the new flatwork areas should initially consist of removal of the soils disturbed during stripping and demolition operations. The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 3 to 5 percent above the optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Some movement and associated cracking of the flatwork materials should be expected, due to the presence of low to very high expansive soils. If this movement and the associated cracking cannot be tolerated, consideration should be given to the use of an imported, non-expansive, granular fill material in order to reduce the potential for differential movements of lightly loaded slabs. Such select fill material could be placed within the upper 1 to 2± feet below the flatwork subgrade as compacted structural fill.

Fill Placement

- **Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 3 to 5 percent above the optimum moisture content, and compacted**.
- Fill consisting of very low-expansive on-site or imported soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- Grading and fill placement activities should be completed in accordance with the requirements of the 2022 CBC and the grading code of the city of Torrance.
- Fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

Imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, utility trench backfill should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Torrance. Utility

trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v (horizontal to vertical) plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

Any soils used to backfill voids around subsurface utility structures, such as manholes or vaults, should be placed as compacted structural fill. If it is not practical to place compacted fill in these areas, then such void spaces may be backfilled with lean concrete slurry. Uncompacted pea gravel or sand is not recommended for backfilling these voids since these materials have a potential to settle and thereby cause distress of pavements placed around these subterranean structures.

6.4 Construction Considerations

Excavation Considerations

The near-surface soils generally consist of sandy clays and silty clays. Some of these materials may be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, temporary excavation slopes should be made no steeper than 1.5h:1v within clayey soils, and where sandier soils are encountered, temporary excavation slopes should be no steeper than 2h:1v. **The contractor should take all necessary precautions during grading and foundation construction to prevent damage to structures and improvements which are adjacent to the proposed development.** Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. Excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Moisture Sensitive Subgrade Soils

The near-surface soils generally consist of very moist sandy clays and silty clays, and will become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. If grading occurs during a period of relatively wet weather, an increase in subgrade instability should also be expected. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

As discussed in Section 6.3 of this report, unstable subgrade soils will likely be encountered at the base of the overexcavations within the proposed building areas. The extent of unstable subgrade soils will to a large degree depend on methods used by the contractor to avoid adding additional moisture to these soils or disturbing soils which already possess high moisture contents. **Due to the potential for subgrade instability, it is recommended that only tracked vehicles be utilized for grading or construction activities that require traffic over the exposed subgrade soils.**

If the construction schedule dictates that site grading will occur during a period of wet weather, allowances should be made for costs and delays associated with drying the on-site soils or import of a drier, less moisture sensitive fill material. Grading during wet or cool weather may also increase the depth of overexcavation in the pad areas as well as the need for and/or the thickness of the crushed stone stabilization layer, discussed in Section 6.3 of this report.

Expansive Soils

The near-surface soils have been determined to possess low to very high expansion potentials. Therefore, care should be given to proper moisture conditioning the subgrade soils to a moisture content of 3 to 5 percent above the Modified Proctor optimum during site grading. Imported fill soils should have low expansive (EI < 50) characteristics. **In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintain the moisture content of these soils at 3 to 5 percent above the Modified Proctor optimum. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather**.

Due to the presence of expansive soils at this site, provisions should be made to limit the potential for surface water to penetrate the soils immediately adjacent to the structures. These provisions should include directing surface runoff into rain gutters and area drains, reducing the extent of landscaped areas around the structures, and sloping the ground surface away from the buildings. Where possible, it is recommended that landscaped planters not be located immediately adjacent to the buildings. If landscaped planters around the buildings are necessary, it is recommended that drought tolerant plants or a drip irrigation system be utilized, to minimize the potential for deep moisture penetration around the structures. Presented below is a list of additional soil moisture control recommendations that should be considered by the owner, developer, and civil engineer:

- Ponding and areas of low flow gradients in unpaved walkways, grass and planter areas should be avoided. In general, minimum drainage gradients of 2 percent should be maintained in unpaved areas.
- Bare soil within five feet of proposed structures should be sloped at a minimum five percent gradient away from the structures (about three inches of fall in five feet), or the same area could be paved with a minimum surface gradient of one percent. Pavement is preferable.
- Decorative gravel ground cover tends to provide a reservoir for surface water and may hide areas of ponding or poor drainage. Decorative gravel is, therefore, not recommended and should not be utilized for landscaping unless equipped with a subsurface drainage system designed by a licensed landscape architect.
- Positive drainage devices, such as graded swales, paved ditches, and catch basins should be installed at appropriate locations within the area of proposed development.
- Concrete walks and flatwork should not obstruct the free flow of surface water to the appropriate drainage devices.
- Area drains should be recessed below grade to allow free flow of water into the drain. Concrete or brick flatwork joints should be sealed with mortar or flexible mastic.
- Gutter and downspout systems should be installed to capture all discharge from roof areas. Downspouts should discharge directly into a pipe or paved surface system to be conveyed offsite.
- Enclosed planters adjoining, or in close proximity to proposed structures, should be sealed at the bottom and provided with subsurface collection systems and outlet pipes.

- Depressed planters should be raised with soil to promote runoff (minimum drainage gradient two percent or five percent, see above), and/or equipped with area drains to eliminate ponding.
- Drainage outfall locations should be selected to avoid erosion of slopes and/or properly armored to prevent erosion of graded surfaces. No drainage should be directed over or towards adjoining slopes.
- All drainage devices should be maintained on a regular basis, including frequent observations during the rainy season to keep the drains free of leaves, soil and other debris.
- Landscape irrigation should conform to the recommendations of the landscape architect and should be performed judiciously to preclude either soaking or excessive drying of the foundation soils. This should entail regular watering during the drier portions of the year and little or no irrigation during the rainy season. Automatic sprinkler systems should, therefore, be switched to manual operation during the rainy season. Good irrigation practice typically requires frequent application of limited quantities of water that are sufficient to sustain plant growth, but do not excessively wet the soils. Ponding and/or run-off of irrigation water are indications of excessive watering.

Other provisions, as determined by the landscape architect or civil engineer, may also be appropriate.

Groundwater

The static groundwater table is considered to have existed at a depth in excess of 30± feet at the time of the subsurface exploration. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pads will be underlain by structural fill soils used to replace undocumented fill soils and a portion of the underlying native alluvium. These new structural fill soils are expected to extend to a depth of at least 3 feet below proposed foundation bearing grade, underlain by 1± foot of additional soil that has been densified and moisture conditioned in place. Based on this subsurface profile, the proposed structures may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.

- Reduced net allowable soil bearing pressure: 1,500 lbs/ft^2 if the full recommended extent of remedial grading cannot be achieved, typically for new footings along the property lines.

- Minimum wall/column footing width: 14 inches/24 inches.

- Minimum longitudinal steel reinforcement within strip footings: Six (6) No. 5 rebars (3 top and 3 bottom) based on the presence of expansive soils.

- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 24 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.

- It is recommended that the perimeter building foundations be continuous across the exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. **Within the new building areas, soils suitable for direct foundation support should consist of newly placed structural fill, compacted to at least 90 percent of the ASTM D-1557 maximum dry density**. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill or competent native alluvial soils, with the resulting excavations backfilled with non-expansive compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 3 to 5 percent of the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. **Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.**

Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 50-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 250 lbs/ft^3
- Friction Coefficient: 0.28

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume

that footings will be poured directly against compacted structural fill soils. The maximum allowable passive pressure is 2,500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support the new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floors of the proposed structures may be constructed as conventional slabs-on-grade supported on newly placed structural fill, extending to a depth of at least 3 feet below finished pad grades. The upper 24 inches of the building pad subgrade soils should consist of very low to non-expansive soil. Based on geotechnical considerations, the floor slabs may be designed as follows:

- Minimum slab thickness: 6 inches.

- Modulus of Subgrade Reaction: k = 150 psi/in.

- Minimum slab reinforcement: No. 4 bars at 16-inches on-center, in both directions, due to the expansive potential of the on-site soils. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Slab underlayment: If moisture sensitive floor coverings will be used the minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire area where such moisture sensitive floor coverings are anticipated. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as a 15 mil. Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with the applicable manufacturer specifications. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview.

- Moisture condition the floor slab subgrade soils to 3 to 5 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

- The floor slabs should be structurally connected to the foundations as detailed by the structural engineer.

The actual design of the floor slabs should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Exterior Flatwork Design and Construction

Subgrades which will support new exterior slabs-on-grade for sidewalks, patios, and other concrete flatwork, should be prepared in accordance with the recommendations contained in the ***Grading Recommendations*** section of this report. As noted previously, flatwork supported on the existing expansive soils will be subject to minor to moderate amounts of movement as the moisture content within the subgrade soils fluctuates. This movement may cause cracking or other distress within the flatwork. If additional protection against flatwork cracking is desired, consideration should be given to the placement of a 1 to 2-foot-thick layer of very low expansive structural fill beneath the flatwork sections. Assuming that the flatwork is supported on the existing soils, exterior slabs on grade may be designed as follows:

- Minimum slab thickness: 4½ inches due to the presence of expansive site soils.

- Minimum slab reinforcement: No. 3 bars at 18 inches on center, in both directions, due to the presence of expansive soils.

- The flatwork at building entry areas should be structurally connected to the perimeter foundation that is recommended to span across the door opening. This recommendation is designed to reduce the potential for differential movement at this joint.

- Moisture condition the flatwork subgrade soils to at least 3 to 5 percent above optimum moisture content, to a depth of at least 12 inches. Adequate moisture conditioning should be verified by the geotechnical engineer 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

- Control joints should be provided at a maximum spacing of 8 feet on center in two directions for slabs and at 6 feet on center for sidewalks. Control joints are intended to direct cracking. Minor cracking of exterior concrete slabs on grade should be expected.

- Where flatwork is immediately adjacent to landscape planters, a thickened edge should be utilized. This edge should extend to a depth of at least 12 inches and incorporate longitudinal reinforcement consisting of at least two No. 4 bars.

- Expansion or felt joints should be used at the interface of exterior slabs on grade and any fixed structures to permit relative movement.

These recommendations are contingent upon additional expansion index testing being conducted at the completion of rough grading, to verify the actual expansion potential of the flatwork subgrade soils.

6.8 Retaining Wall Design and Construction

Although not indicated on the site plans, some small (less than 6 feet in height) retaining walls may be required to facilitate the new site grades. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. **Most of the near-surface soils encountered at the boring locations consist of low to very high expansive sandy clays and silty clays. These materials are not considered suitable for use as retaining wall.** It is recommended that a select imported material be used to backfill the retaining walls. These materials are recommended to consist of sands or silty sands possessing an expansion index less than 20, and an internal angle of friction of at least 30 degrees when compacted to 90 percent relative compaction.

The select fill materials must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type
		Imported Silty Sands or Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		125 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	42 lbs/ft^3
	Active Condition (2h:1v backfill)	67 lbs/ft^3
	At-Rest Condition (level backfill)	63 lbs/ft^3

The walls should be designed using a soil-footing coefficient of friction of 0.28 and an equivalent passive pressure of 250 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive

resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Seismic Lateral Earth Pressures

In addition to the lateral earth pressures presented in the previous section, retaining walls which are more than 6 feet in height should be designed for a seismic lateral earth pressure, in accordance with the 2022 CBC. Based on the current site plan, it is not expected that any walls in excess of 6 feet in height will be required for this project. If any such walls are proposed, our office should be contacted for supplementary design recommendations.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 3 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

Retaining wall backfill soils should consist of imported select structural fill possessing an expansion index less than 20. Backfill material placed within 3 feet of the back wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls, be placed against the face on the back side of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. A 12-inch-thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils.

Retaining wall backfill should be placed and compacted under engineering-controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, the weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system. The actual design of this type of system should be determined by the civil engineer to verify that the drainage system possesses the adequate capacity and slope for its intended use.

Weep holes or a footing drain will not be required for building stem walls.

6.9 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of sandy clays and silty clays. These soils are considered to possess poor pavement support characteristics with estimated R-values ranging from 5 to 20. The subsequent pavement design is therefore based upon an assumed R-value of 10. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering-controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20-year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35
9.0	93

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 10)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	9	12	15	16	19
Compacted Subgrade	12	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the batch plant-reported maximum density. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils and aggregate base course within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 10)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	7	8½
Aggregate Base	Not Required	6	6	6
Compacted Subgrade (95% minimum compaction)	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. Reinforcement within the PCC pavements should be evaluated by the project structural engineer. The maximum joint spacing within the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness.

7.0 GENERAL COMMENTS

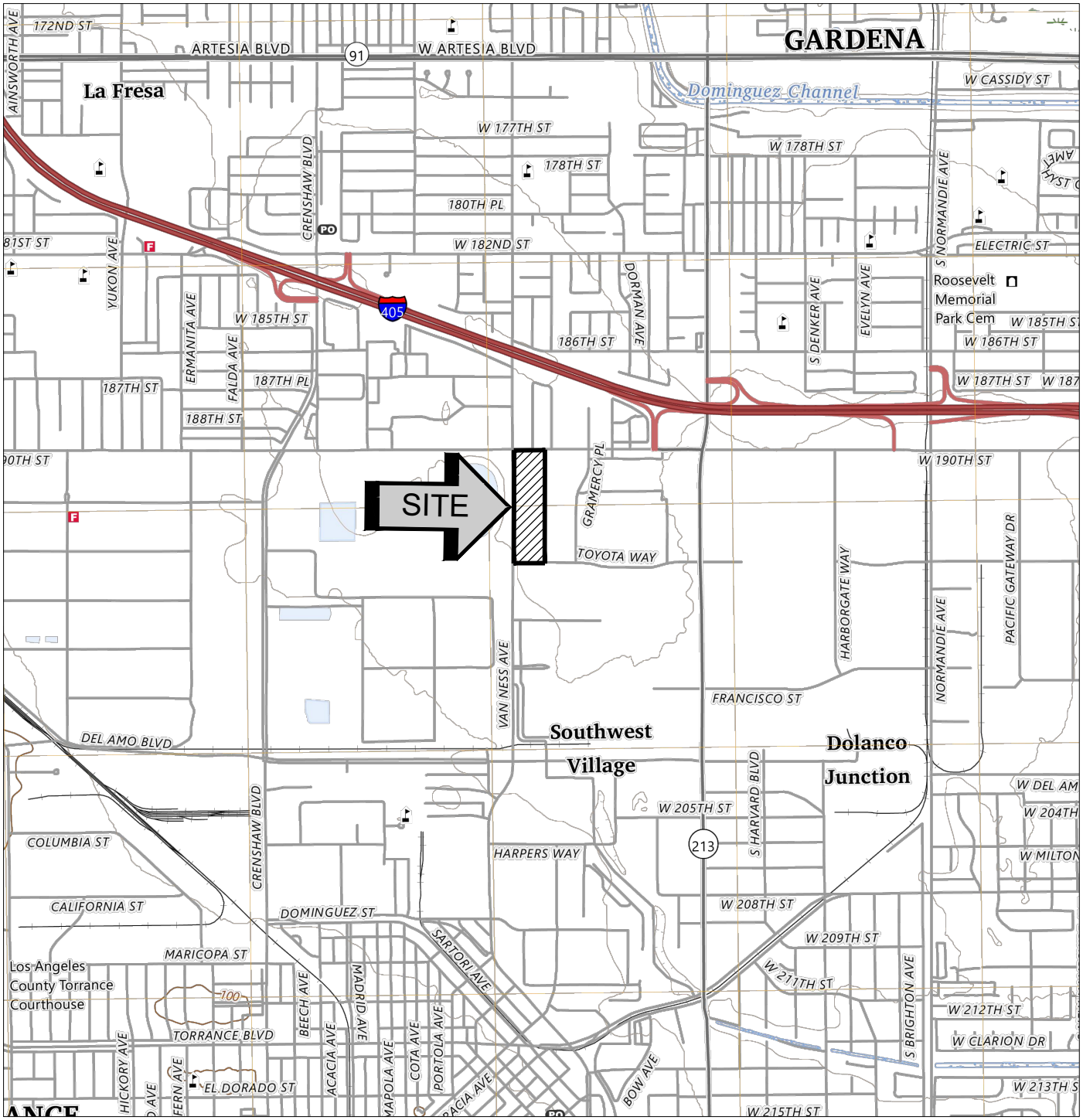
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: USGS TOPOGRAPHIC MAP OF THE TORRANCE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA, 2023.

SITE LOCATION MAP

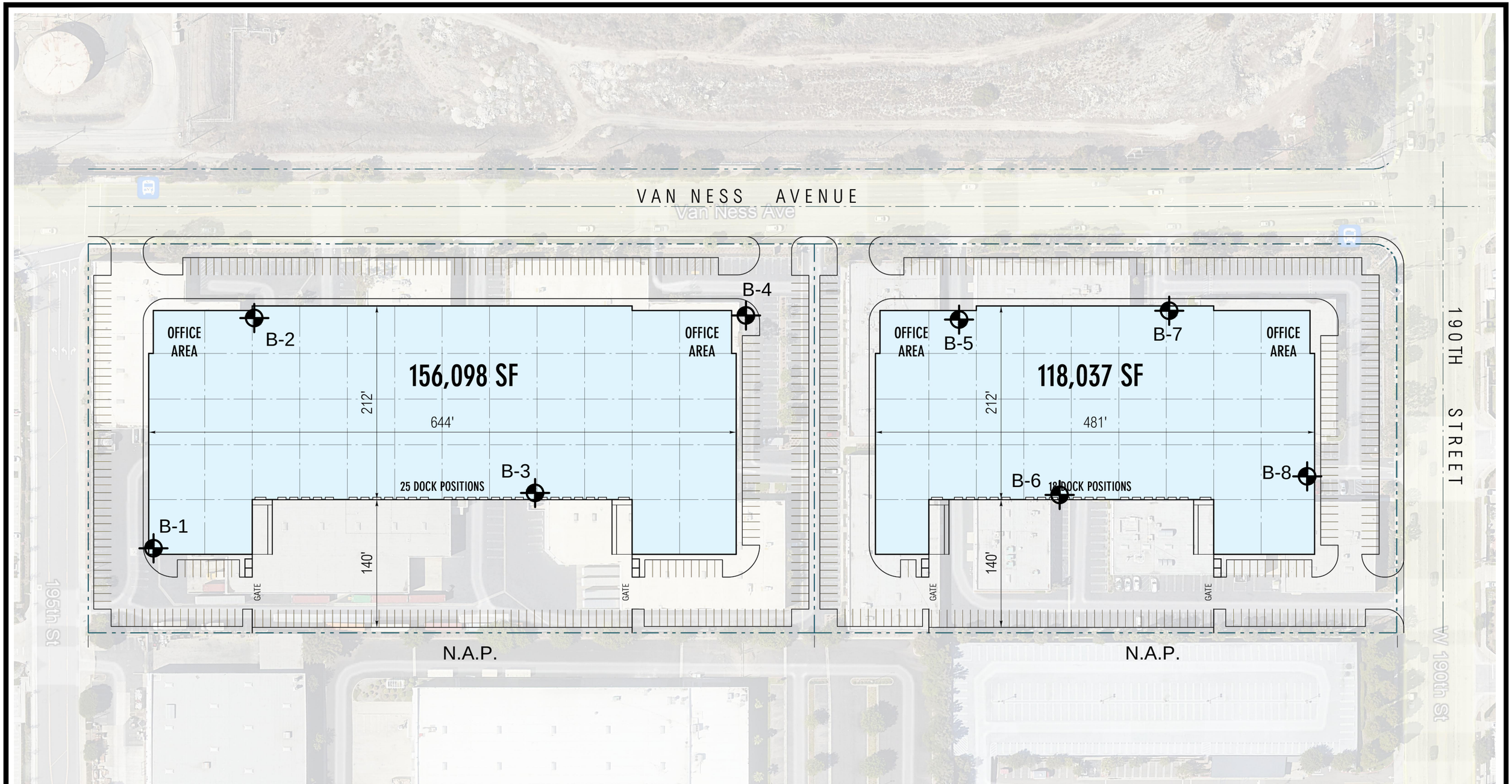
TWO PROPOSED INDUSTRIAL BUILDINGS

TORRANCE, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: MK CHKD: RGT	
SCG PROJECT 23G206-1	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

NORTH

SoCalGeo

NOTE: SITE PLAN PREPARED BY RGA.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

BORING LOCATION PLAN

TWO PROPOSED INDUSTRIAL BUILDINGS

TORRANCE, CALIFORNIA

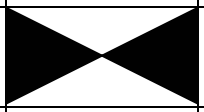
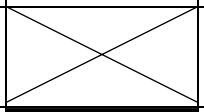
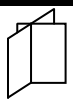
SCALE: 1" =100'	
DRAWN: MK CHKD: RGT	
SCG PROJECT 23G206-1	
PLATE 2	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

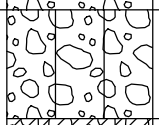
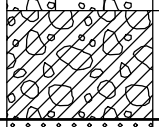
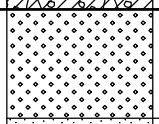
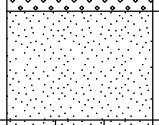
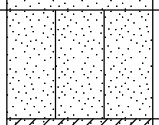
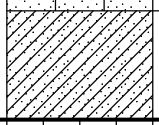
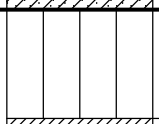
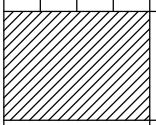
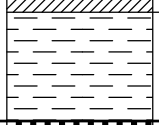
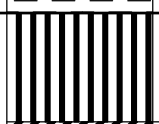
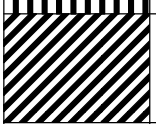
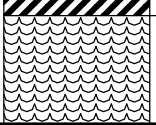
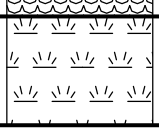
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 28 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete, 10± inches Aggregate Base							
		31	4.5		FILL: Dark Gray Brown fine Sandy Clay, some Silt, trace AC fragments, very stiff to hard-moist to very moist	118	11					
		27	4.5			113	17					
5		14	4.5		ALLUVIUM: Brown fine Sandy Clay, some Silt, trace Calcareous nodules/veining, very stiff to hard-very moist	104	20					
		15	4.5			99	24					
		25	4.0			101	26					
10												
		27	4.5				23					
15												
					Light Gray Brown Silty fine Sand, trace Clay, medium dense-damp to moist							
		19					8					
20												
		29					11					
25												
		26					7					
30					Boring Terminated at 30 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 14½ feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 5± inches Asphaltic Concrete, 8± inches Aggregate Base							
		17	4.5		FILL: Dark Gray Brown Silty Clay, little fine to medium Sand, very stiff- very moist		18					EI = 39 @ 1 to 5 feet
		15	4.5		ALLUVIUM: Brown fine Sandy Clay, some Silt, trace Calcareous nodules/veining, stiff to very stiff-very moist		20					
5		14	3.0				30					
		18	4.5				23					
10					Light Gray Brown fine Sandy Silt, trace to little Clay, medium dense-very moist							
		19					15					
15					Boring Terminated at 15 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 17 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete, 7± inches Aggregate Base							
		7	3.0		FILL: Dark Brown Silty Clay, trace fine to coarse Sand, medium stiff to very stiff- very moist		21					
		6	2.5				30					
5					ALLUVIUM: Brown fine Sandy Clay, some Silt, stiff to very stiff-very moist							
		11	2.0				24					
		19	3.0				25					
10												
		24	4.0				21					
15												
		31	4.5				23					
20					Boring Terminated at 20 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/30/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 22 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 5± inches Asphaltic Concrete, 8± inches Aggregate Base							
		12	3.0		FILL: Dark Brown Silty Clay, trace fine to coarse Sand, trace fine Gravel, trace AC fragments, stiff to very stiff-moist to very moist	107	19					
		15	4.5			106	17					
5		11	3.5		ALLUVIUM: Brown fine Sandy Clay, some Silt, trace Calcareous nodules/veining, medium stiff to very stiff-very moist	97	20					
		23	4.5			100	24					
10		24	4.0			93	27					
		19	3.5				27					
15												
					Light Brown fine Sandy Silt, trace Calcareous nodules/veining, medium dense to dense-moist to very moist							
		19					13					
20												
		35					15					
25					Boring Terminated at 25 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG

PLATE B-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/29/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Grout
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
			3.5		PAVEMENT: 5± inches Asphaltic Concrete, 8± inches Aggregate Base							
					FILL: Dark Gray Brown Silty Clay, trace fine to medium Sand, trace fine Gravel, medium stiff-moist to very moist		23					EI = 136 @ 1 to 5 feet Hand Auger Upper 5 feet
			2.5				20					
5		22	4.5			111	17					
		16	4.5		ALLUVIUM: Brown fine Sandy Clay, some Silt, stiff to very stiff-very moist	97	27					
		14	4.5			95	29					
10		26	4.5			91	30					
		21	2.5				26					
15												
					Gray Brown Silty fine Sand, litle Iron oxide staining, medium dense-damp to moist							
		21					10					
20												
		26					9					
25					Boring Terminated at 25 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG

PLATE B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/29/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Grout
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 5± inches Asphaltic Concrete, 6± inches Aggregate Base							
		19	4.5		FILL: Dark Gray Brown Silty Clay, trace fine to medium Sand, very stiff- very moist		19					
		18	4.5				18					
5												
		23	1.5		ALLUVIUM: Brown fine Sandy Clay, some Silt, trace Calcareous nodules/veining, stiff to very stiff-very moist		23					
		25	1.0				25					
10												
		27	1.5				27					
15					Boring Terminated at 15 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG **PLATE B-6**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/29/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: Grout
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete with No Discernible Aggregate Base							
		8	2.5		FILL: Dark Brown Silty Clay, some fine Sand, medium stiff- very moist		21					
		5	2.5				21					
5												
		12	1.0		ALLUVIUM: Brown fine Sandy Clay, some Silt, medium stiff to very stiff-very moist		17					
		11	1.0				21					
10												
		23	4.5				21					
15												
					Light Brown Silty fine Sand, some Clay, dense-moist							
		39					10					
20												
					Boring Terminated at 20 feet							

TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG **PLATE B-7**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-8

JOB NO.: 23G206-1
PROJECT: Two Proposed Industrial Buildings
LOCATION: Torrance, California

DRILLING DATE: 11/29/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 28 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					PAVEMENT: 4± inches Asphaltic Concrete, 5± inches Aggregate Base							
		24	3.0		FILL: Dark Brown Silty Clay, stiff to very stiff-moist to very moist	111	15					
		13	4.5			106	20					
5		11	4.5		ALLUVIUM: Brown Silty Clay, little fine Sand, trace Calcareous nodules/veining, medium stiff to very stiff-very moist	107	19					
		12	4.5			102	23					
10		23	4.5			100	24					
		15	4.5				27					
15												
		15	2.5				26					
20												
		19	3.5		Gray Brown fine Sandy Clay, little Silt, trace medium Sand, trace Calcareous nodules/veining, very stiff-very moist		21					
25												
		36			Gray Brown Silty fine Sand, trace Calcareous nodules/veining, trace Iron Oxide staining, dense-damp		7					
30					Boring Terminated at 30 feet							

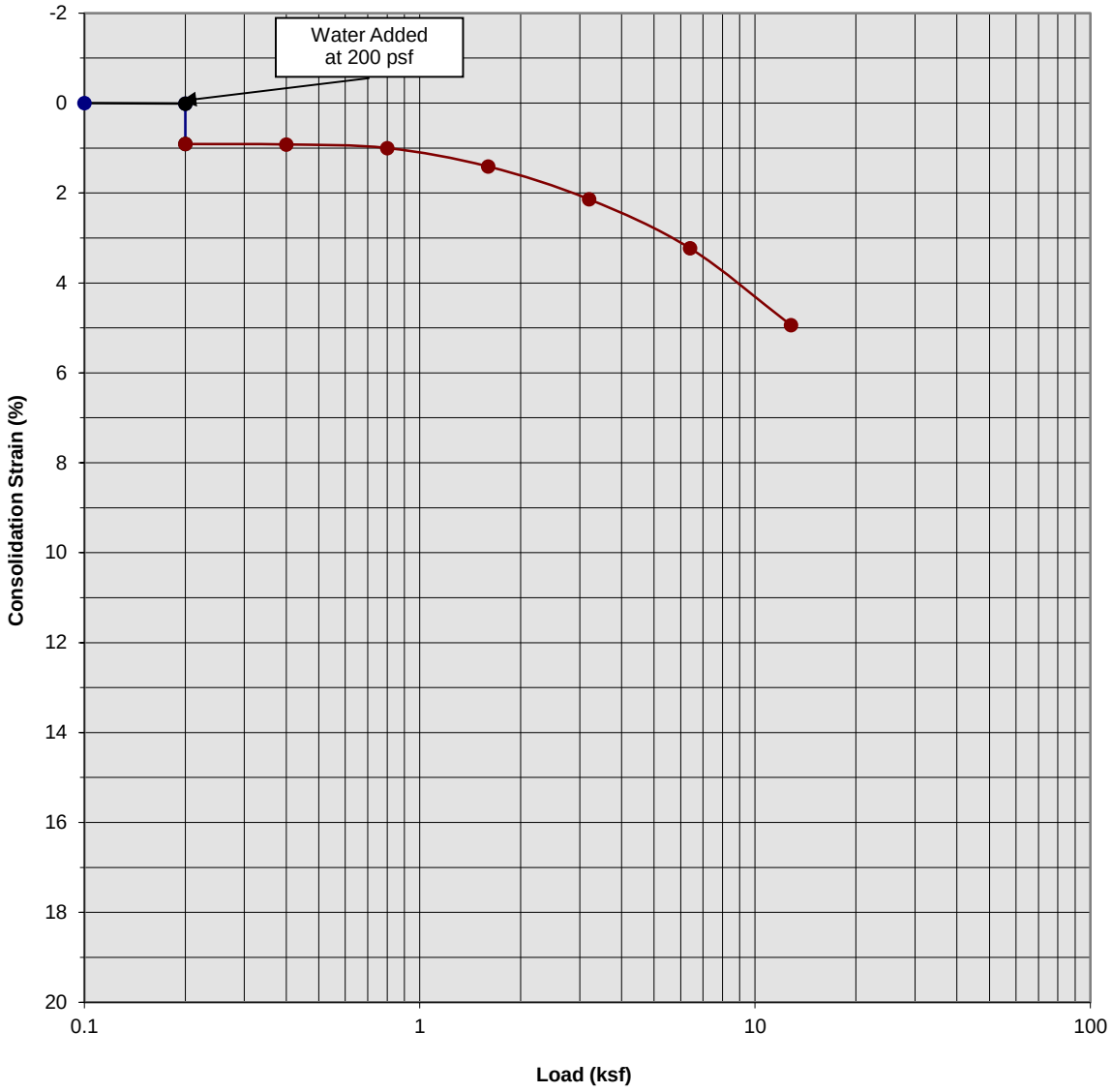
TBL 23G206-1.GPJ SOCALGEO.GDT 12/28/23

TEST BORING LOG

PLATE B-8

APPENDIX C

Consolidation/Collapse Test Results



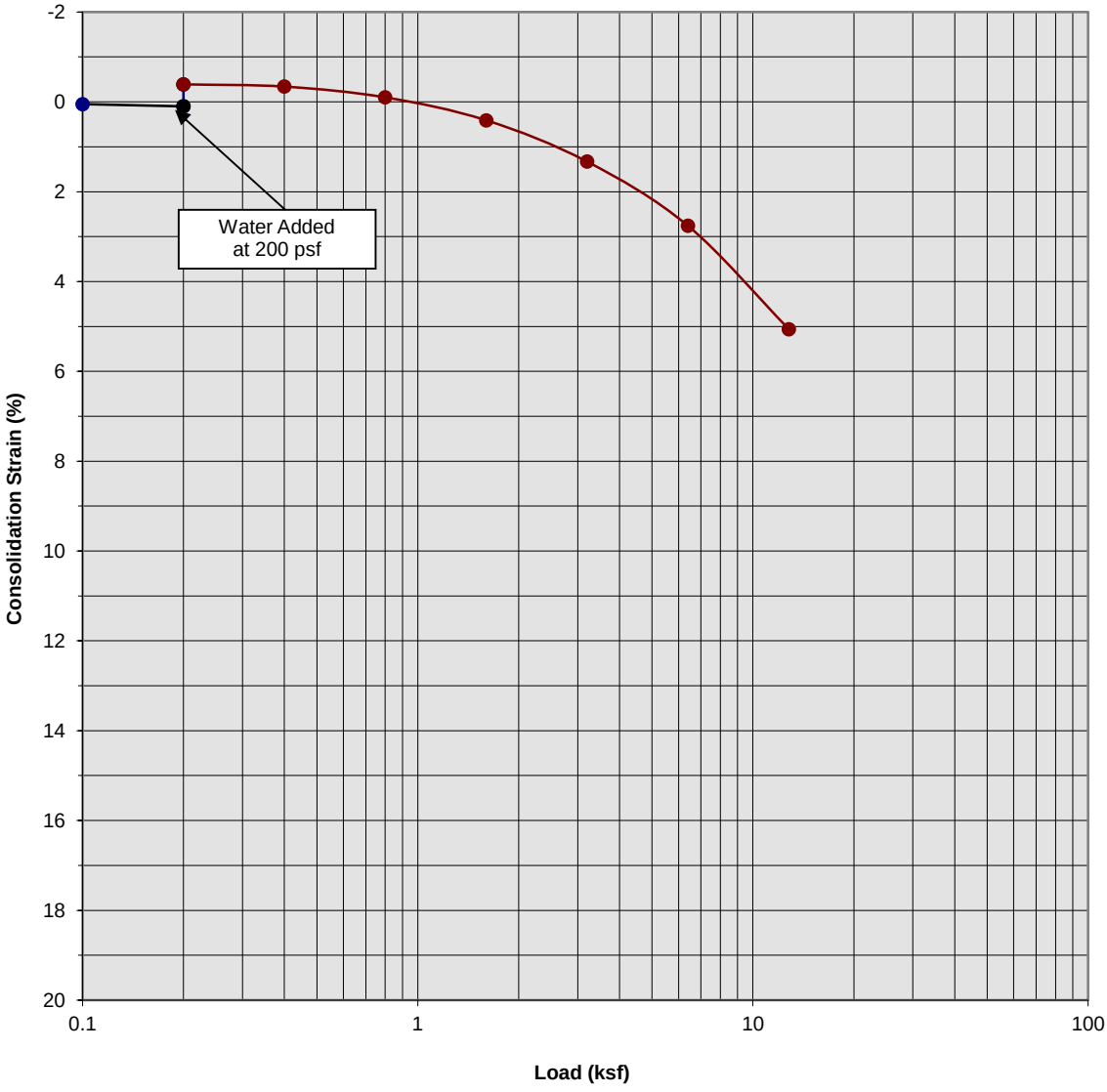
Classification: FILL: Dark Brown fine Sandy Clay, some Silt

Boring Number:	B-1	Initial Moisture Content (%)	17
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	3 to 4	Initial Dry Density (pcf)	113.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.90

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



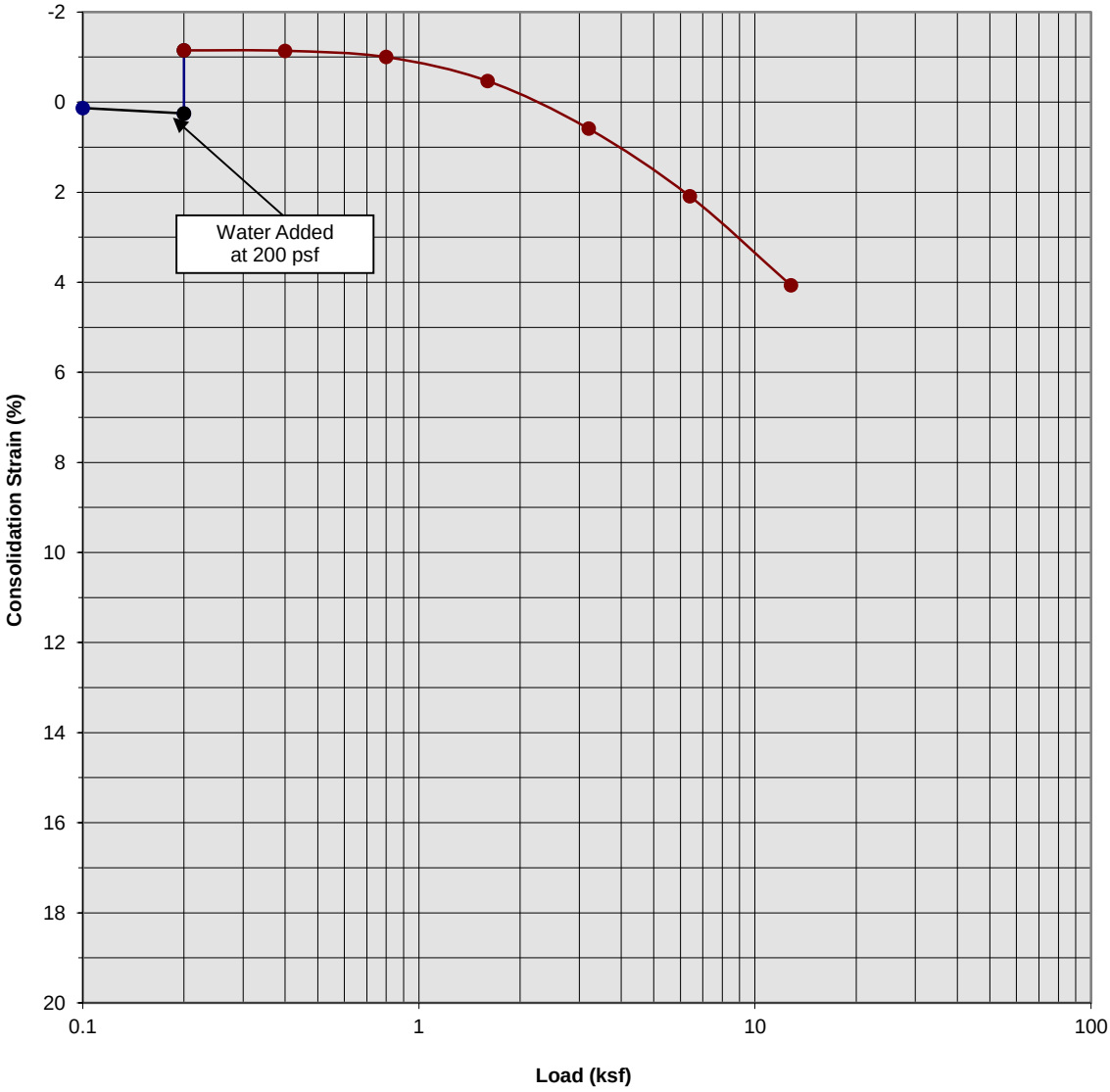
Classification: Brown fine Sandy Clay, some Silt

Boring Number:	B-1	Initial Moisture Content (%)	20
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	5 to 6	Initial Dry Density (pcf)	103.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	109.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.49

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



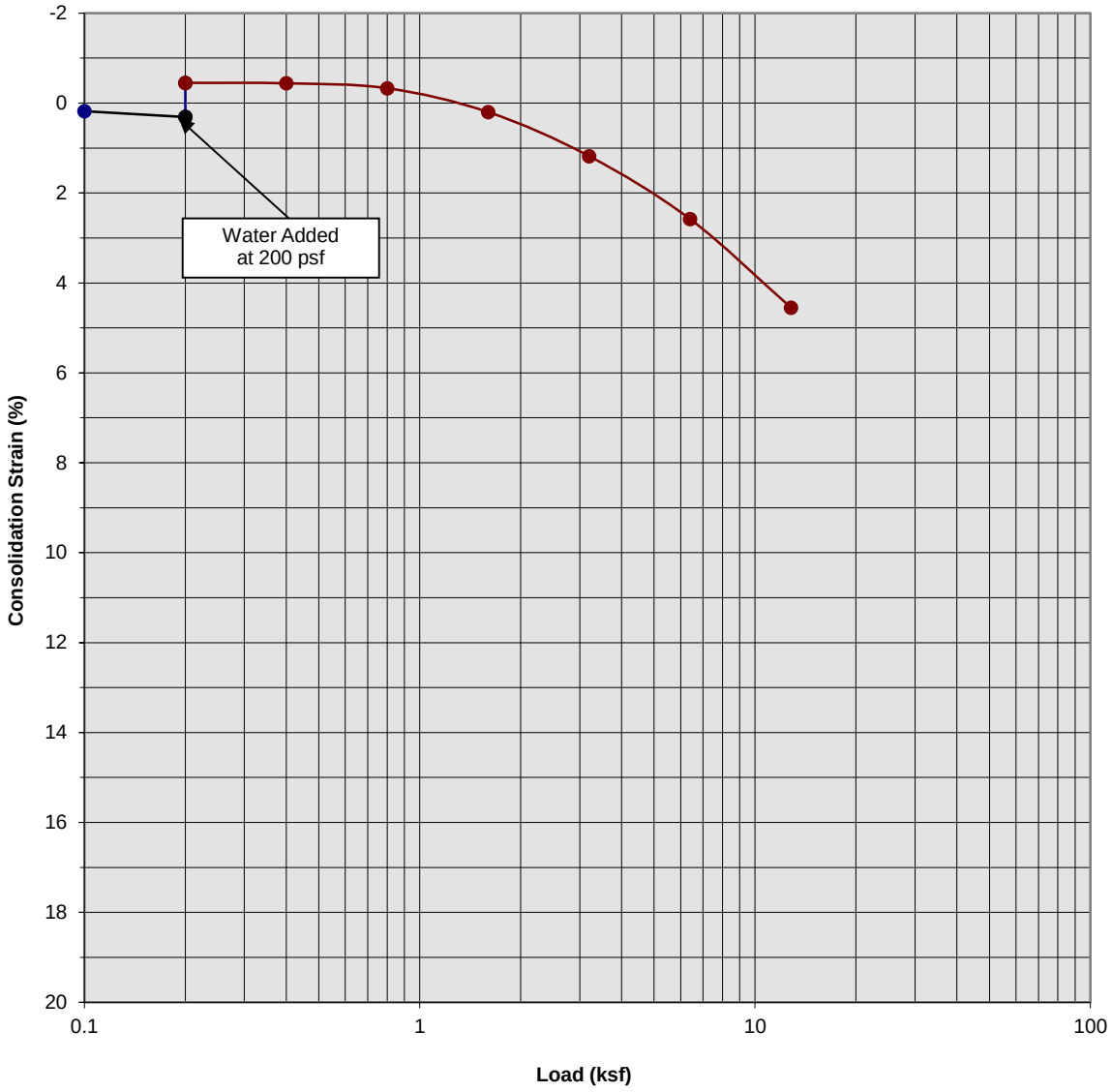
Classification: Brown fine Sandy Clay, some Silt

Boring Number:	B-1	Initial Moisture Content (%)	24
Sample Number:	---	Final Moisture Content (%)	21
Depth (ft)	7 to 8	Initial Dry Density (pcf)	99.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	102.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	-1.40

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



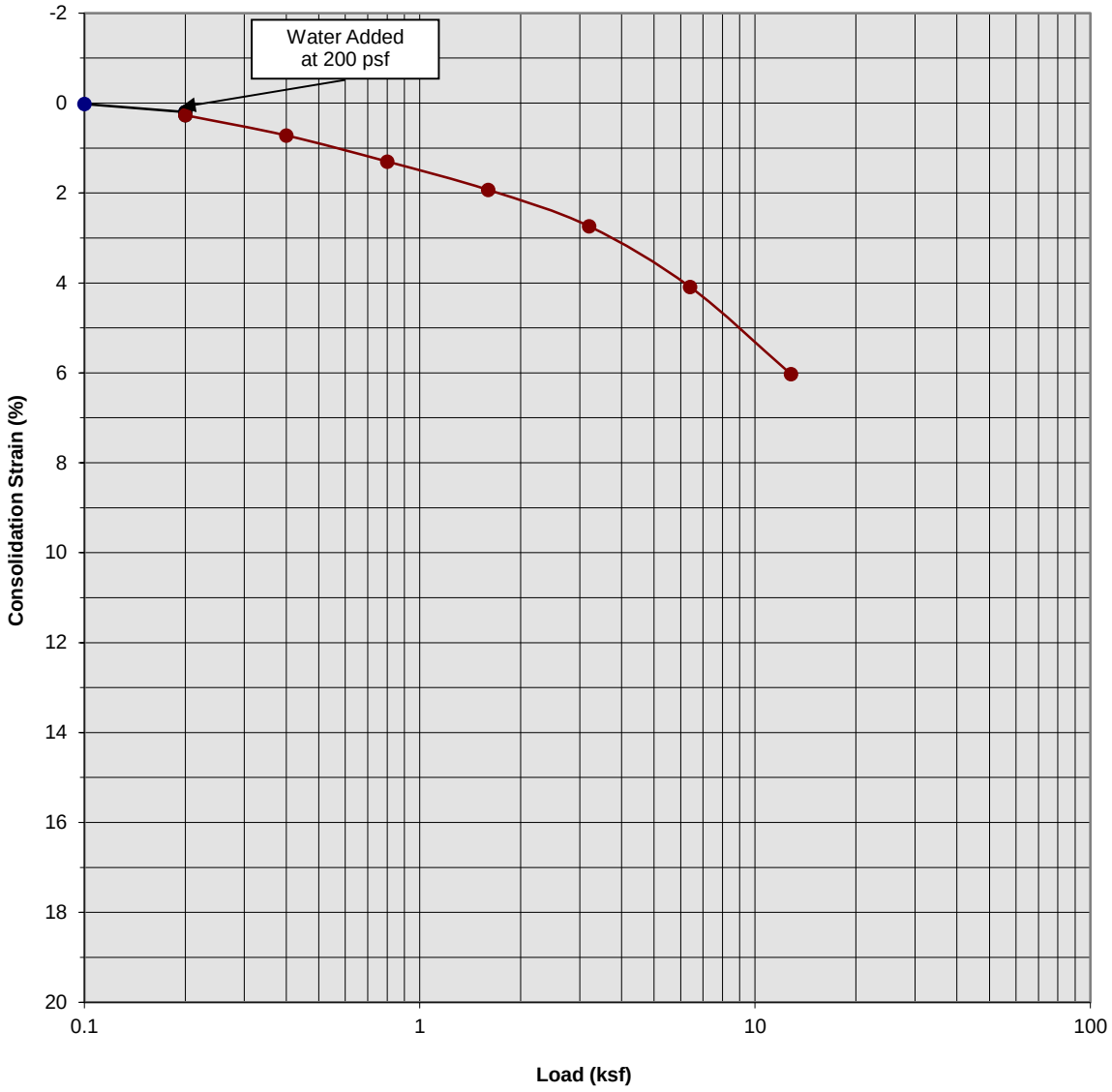
Classification: Brown fine Sandy Clay, some Silt

Boring Number:	B-1	Initial Moisture Content (%)	26
Sample Number:	---	Final Moisture Content (%)	27
Depth (ft)	9 to 10	Initial Dry Density (pcf)	101.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	104.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.76

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



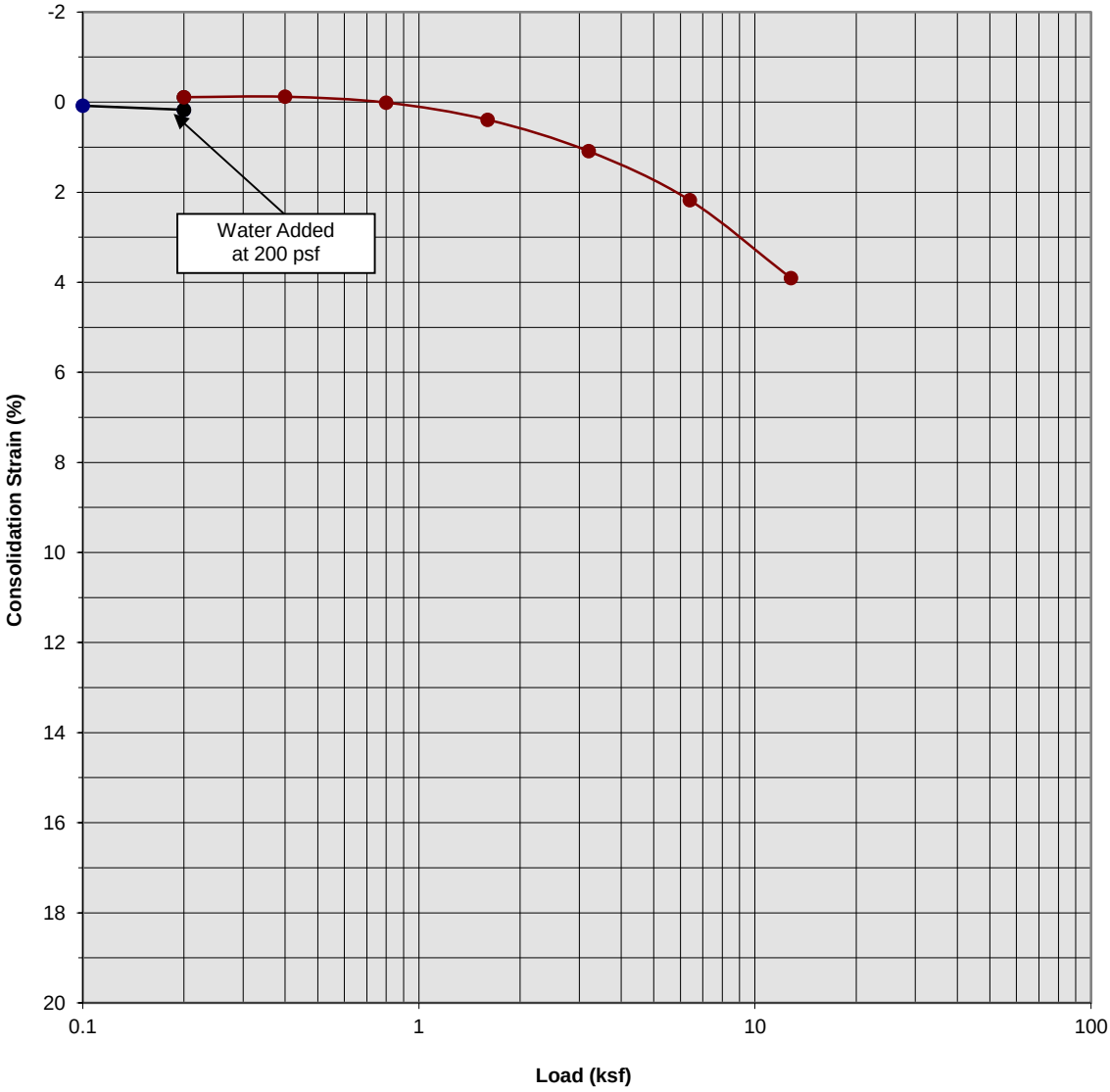
Classification: FILL: Dark Gray Brown Silty Clay

Boring Number:	B-8	Initial Moisture Content (%)	20
Sample Number:	---	Final Moisture Content (%)	21
Depth (ft)	3 to 4	Initial Dry Density (pcf)	106.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	112.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.07

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1
PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown Silty Clay, trace to little fine Sand

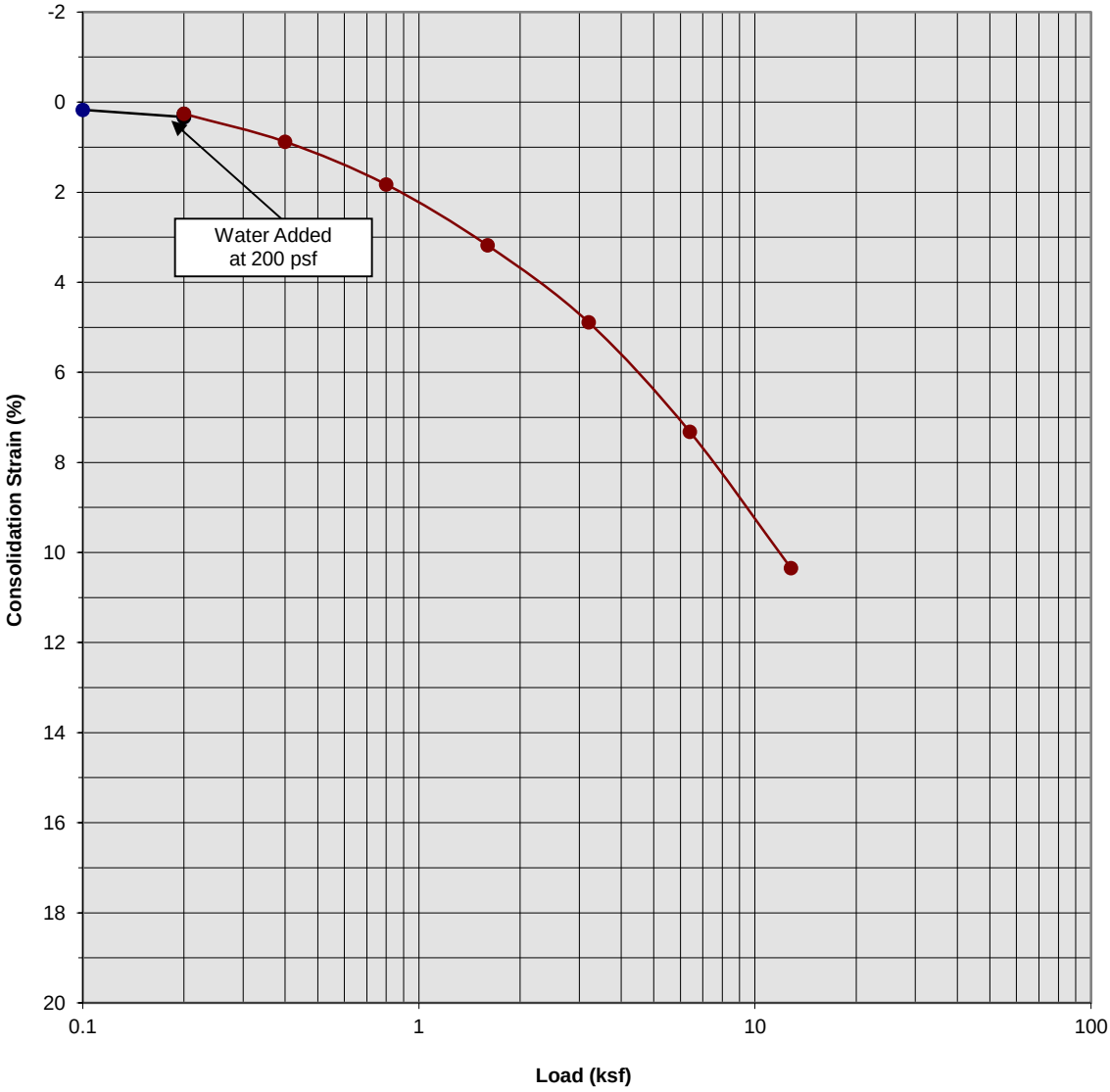
Boring Number:	B-8	Initial Moisture Content (%)	19
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	5 to 6	Initial Dry Density (pcf)	106.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	111.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.28

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1

PLATE C- 6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



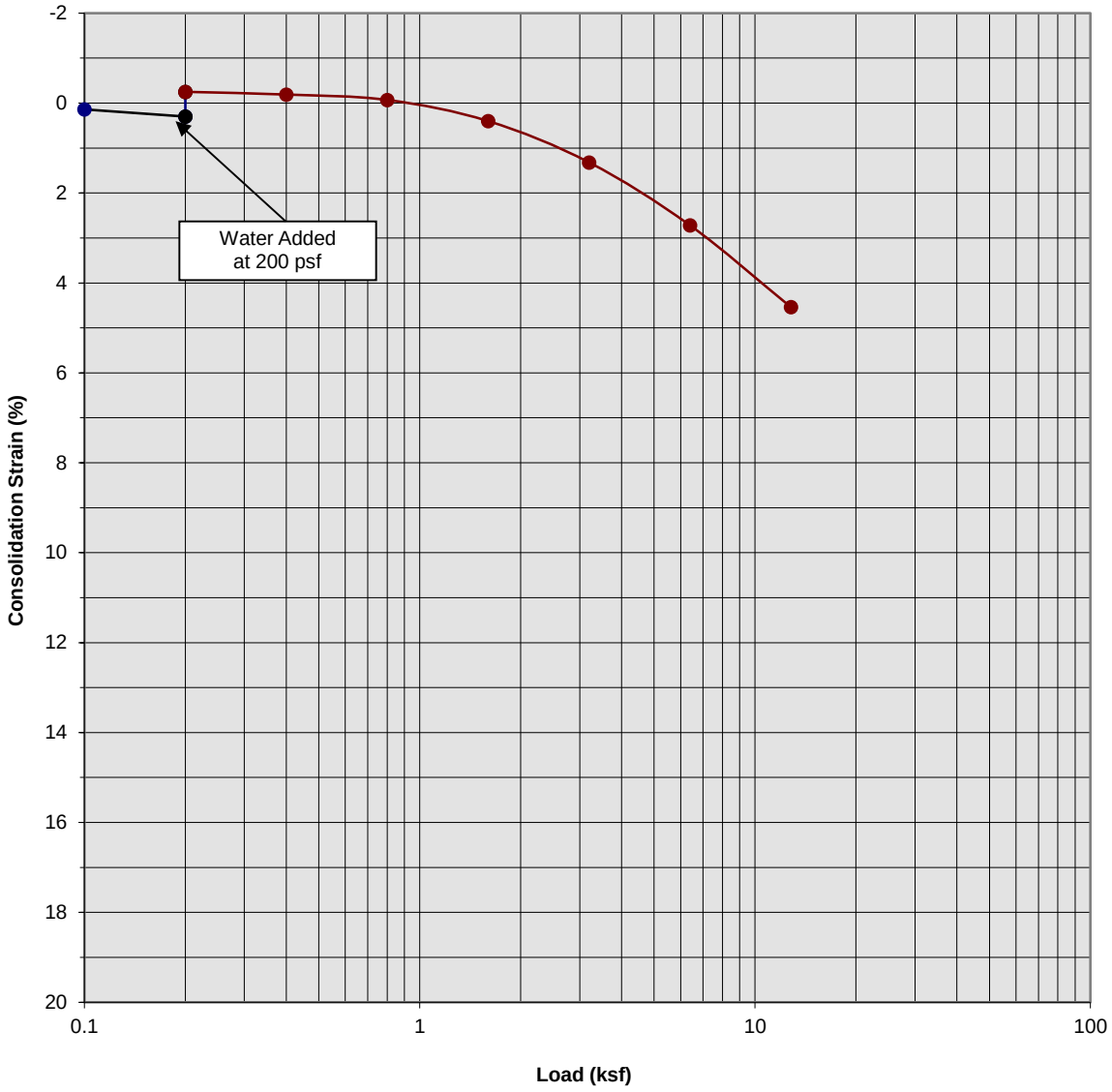
Classification: Brown Silty Clay, trace to little fine Sand

Boring Number:	B-8	Initial Moisture Content (%)	23
Sample Number:	---	Final Moisture Content (%)	21
Depth (ft)	7 to 8	Initial Dry Density (pcf)	102.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	113.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.07

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1
PLATE C- 7

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown Silty Clay, trace to little fine Sand

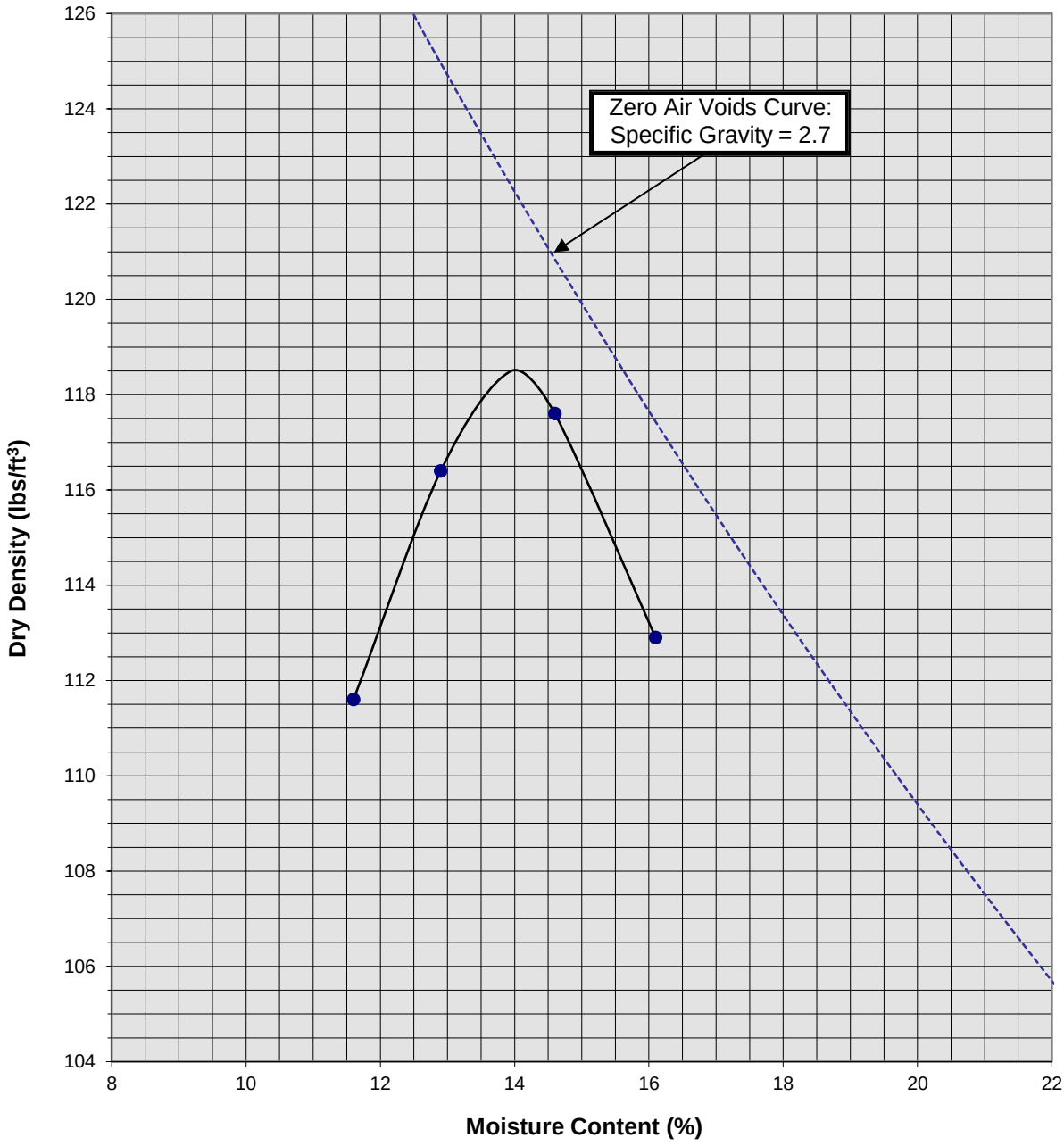
Boring Number:	B-8	Initial Moisture Content (%)	24
Sample Number:	---	Final Moisture Content (%)	26
Depth (ft)	9 to 10	Initial Dry Density (pcf)	100.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	104.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.55

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1

PLATE C- 8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Moisture/Density Relationship
ASTM D-1557



Soil ID Number	B-5 @ 1-5'
Optimum Moisture (%)	14
Maximum Dry Density (pcf)	118.5
Soil Classification	Gray Brown Silty Clay, trace fine to medium Sand, Trace fine Gravel

Two Proposed Industrial Buildings
Torrance, California
Project No. 23G206-1

PLATE C- 9

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as “contaminated,” and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

    - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

    - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

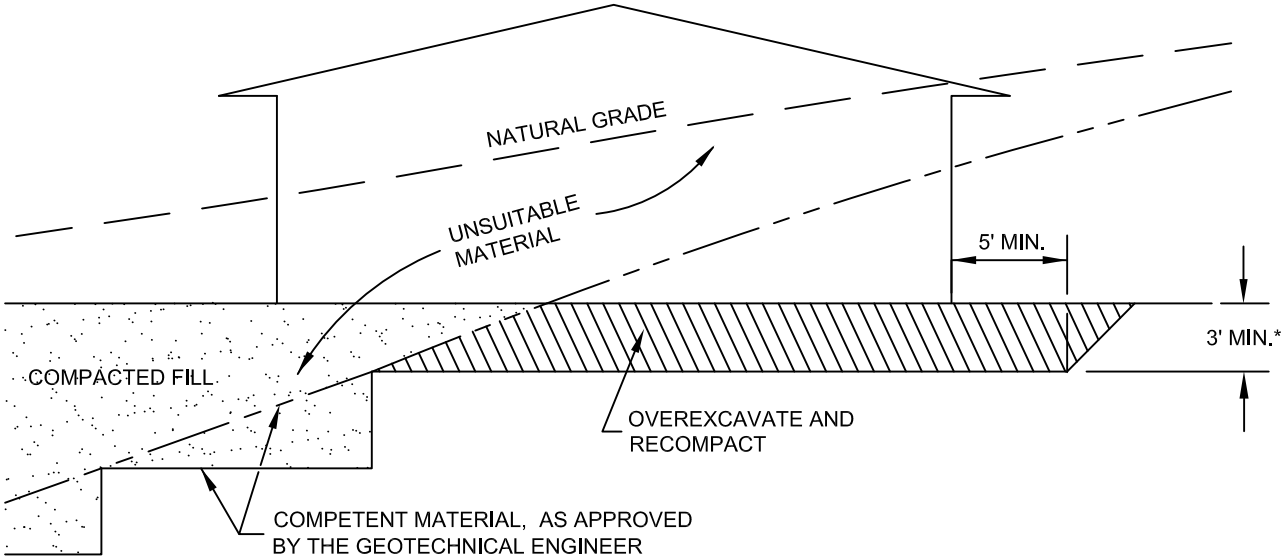
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

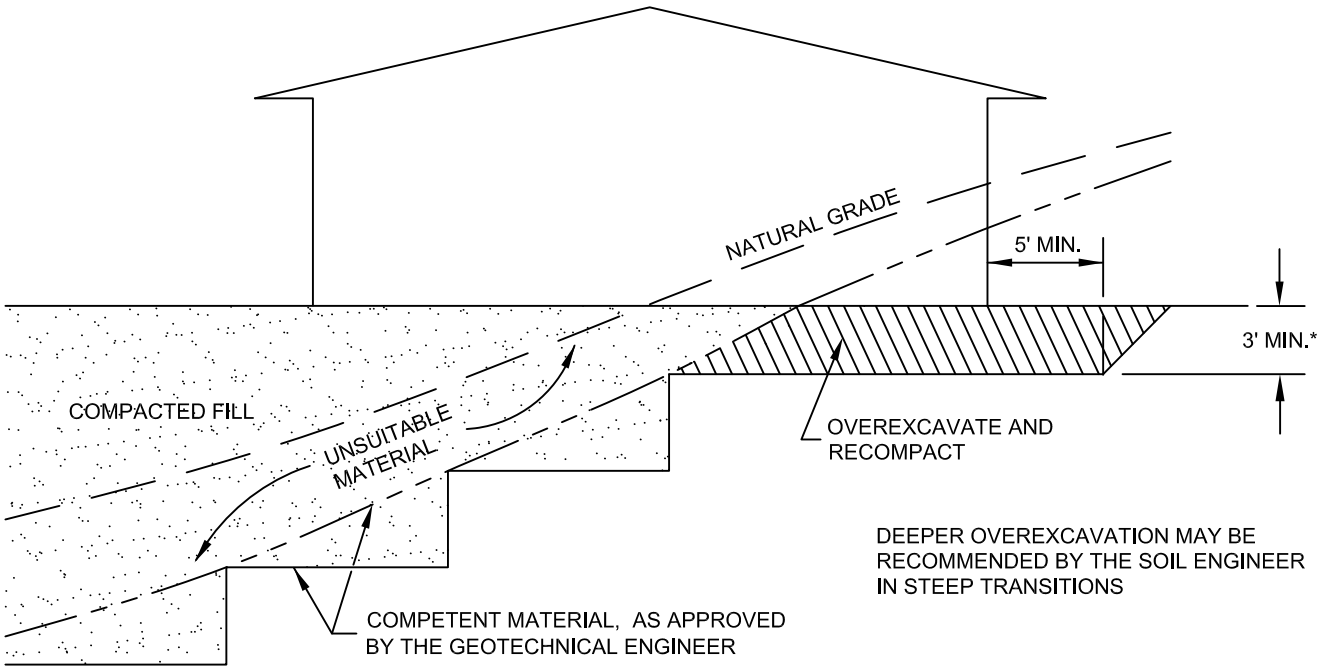
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION. ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

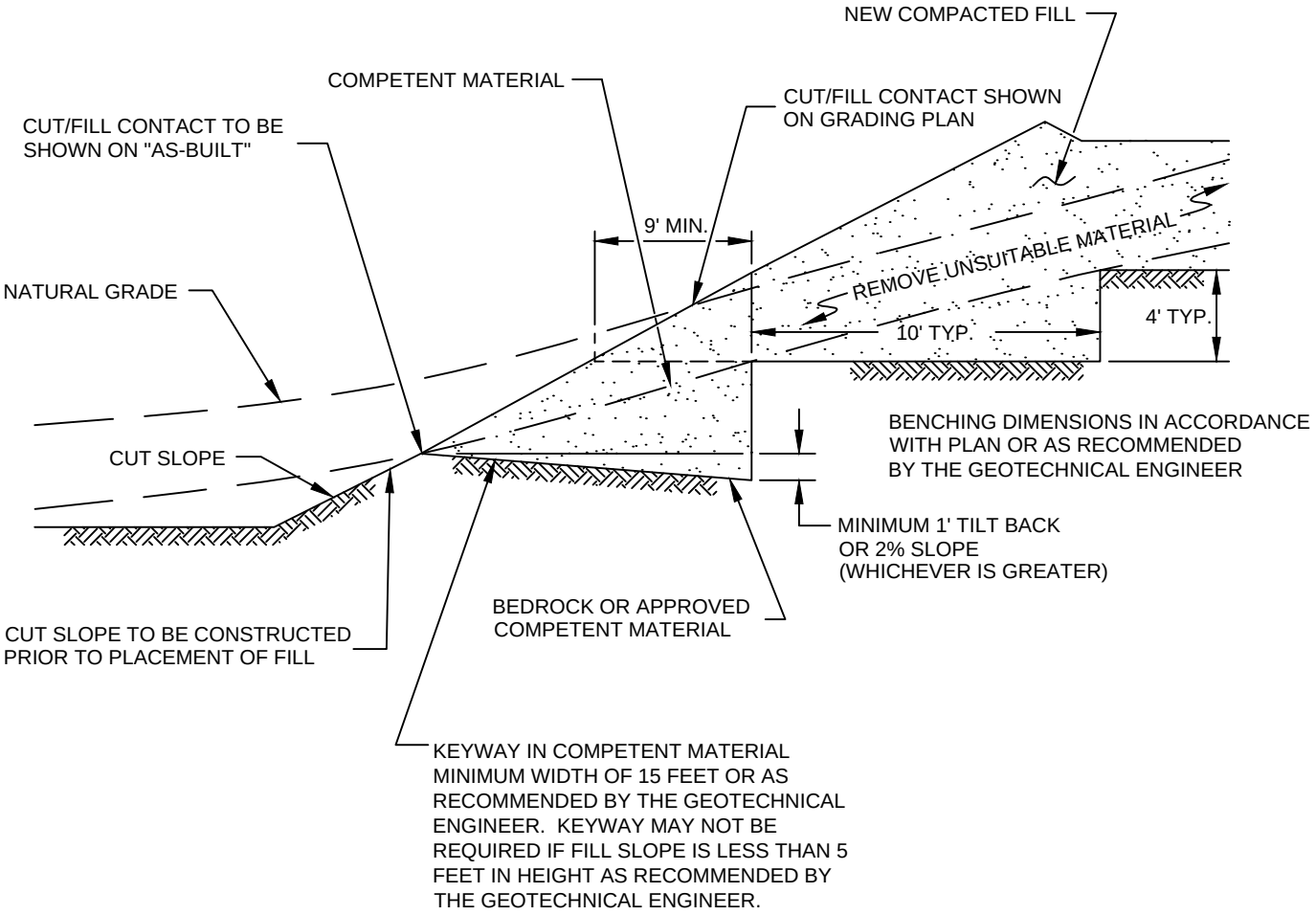
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

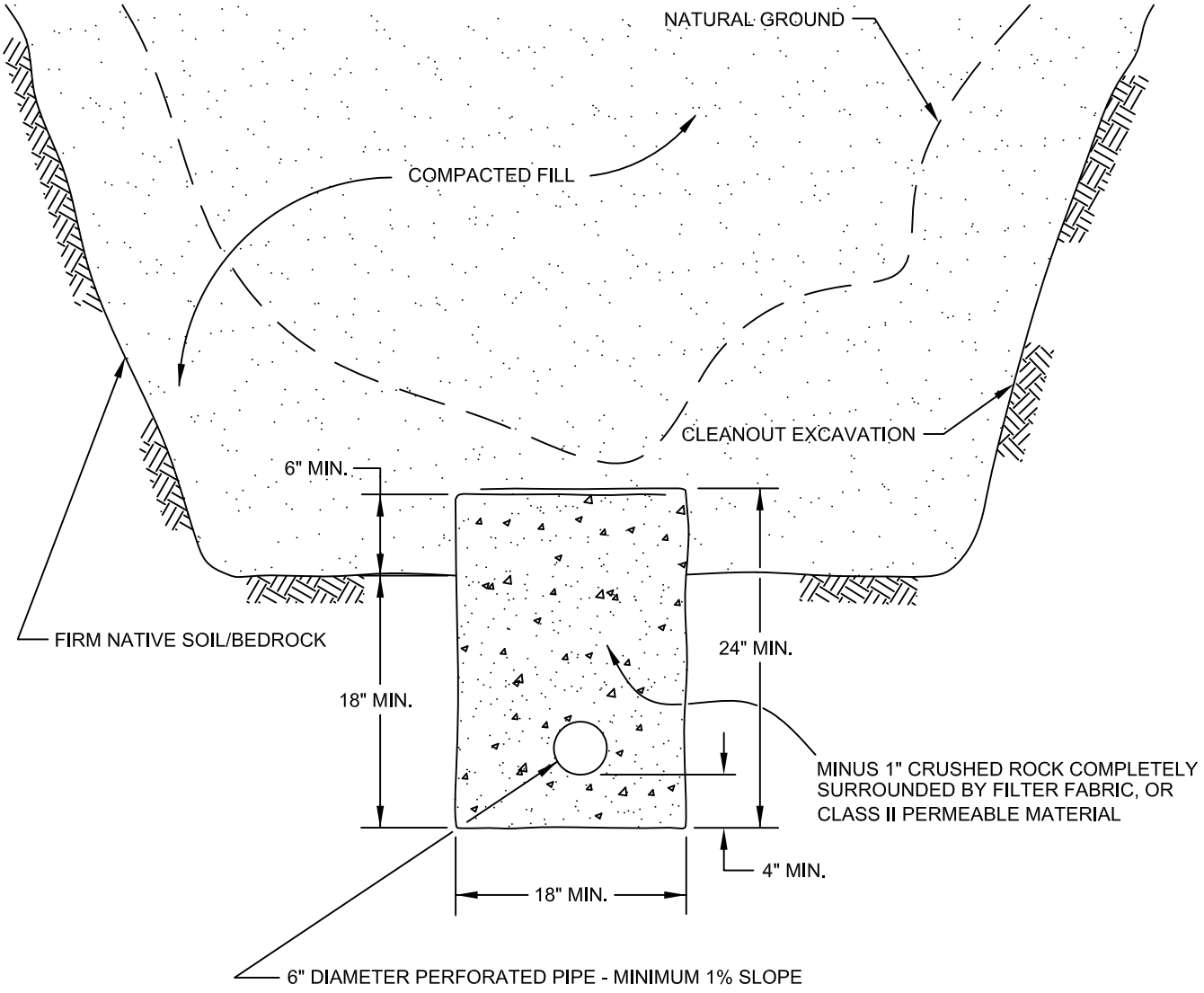
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

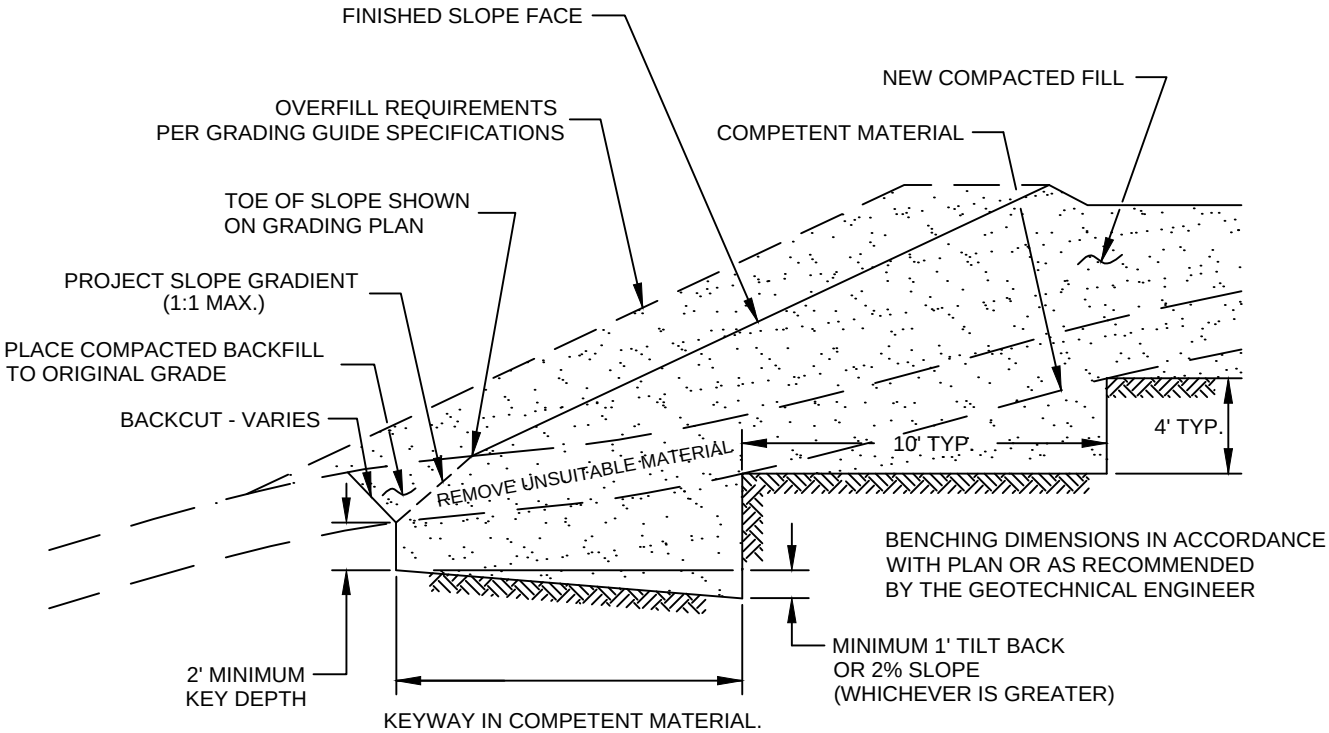
SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE
DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL

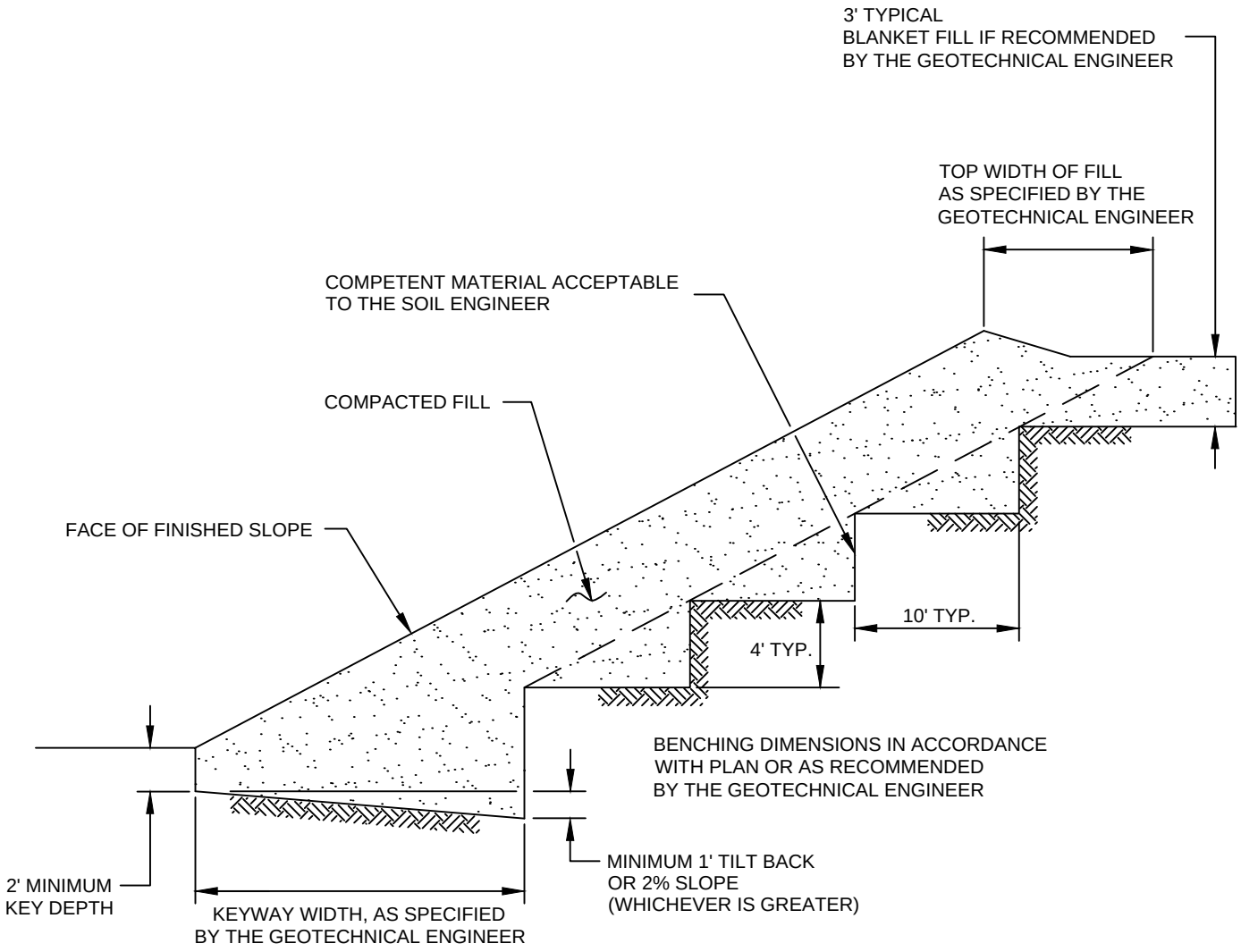
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

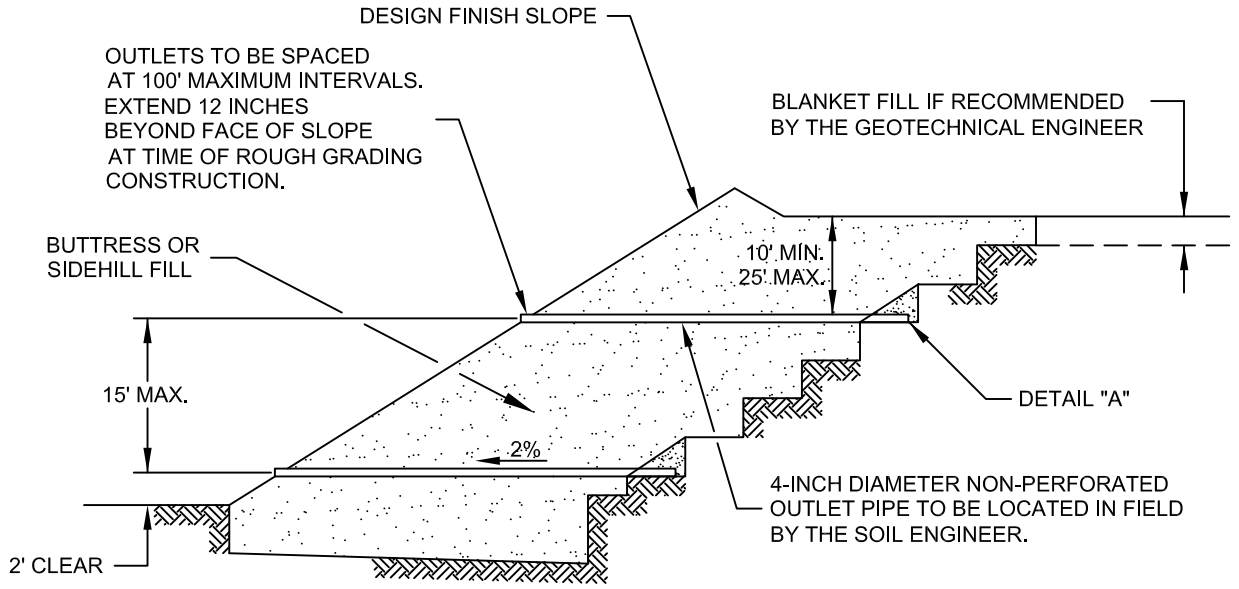
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



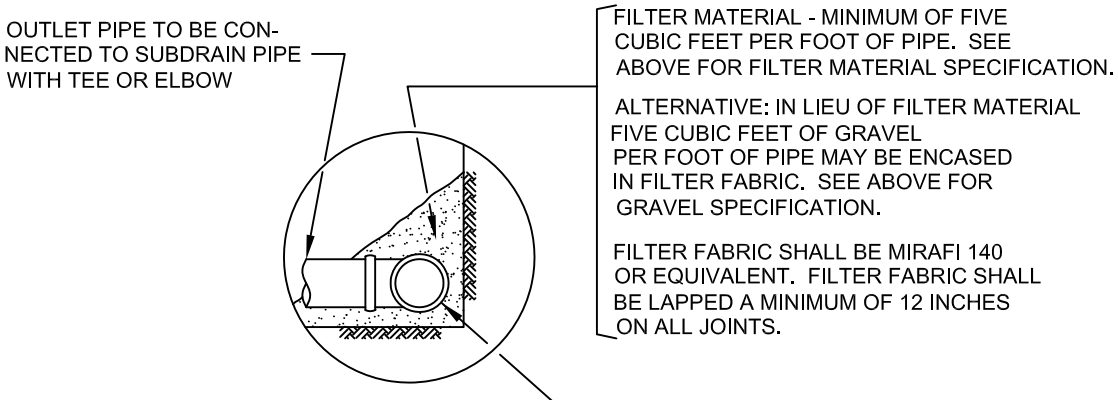
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

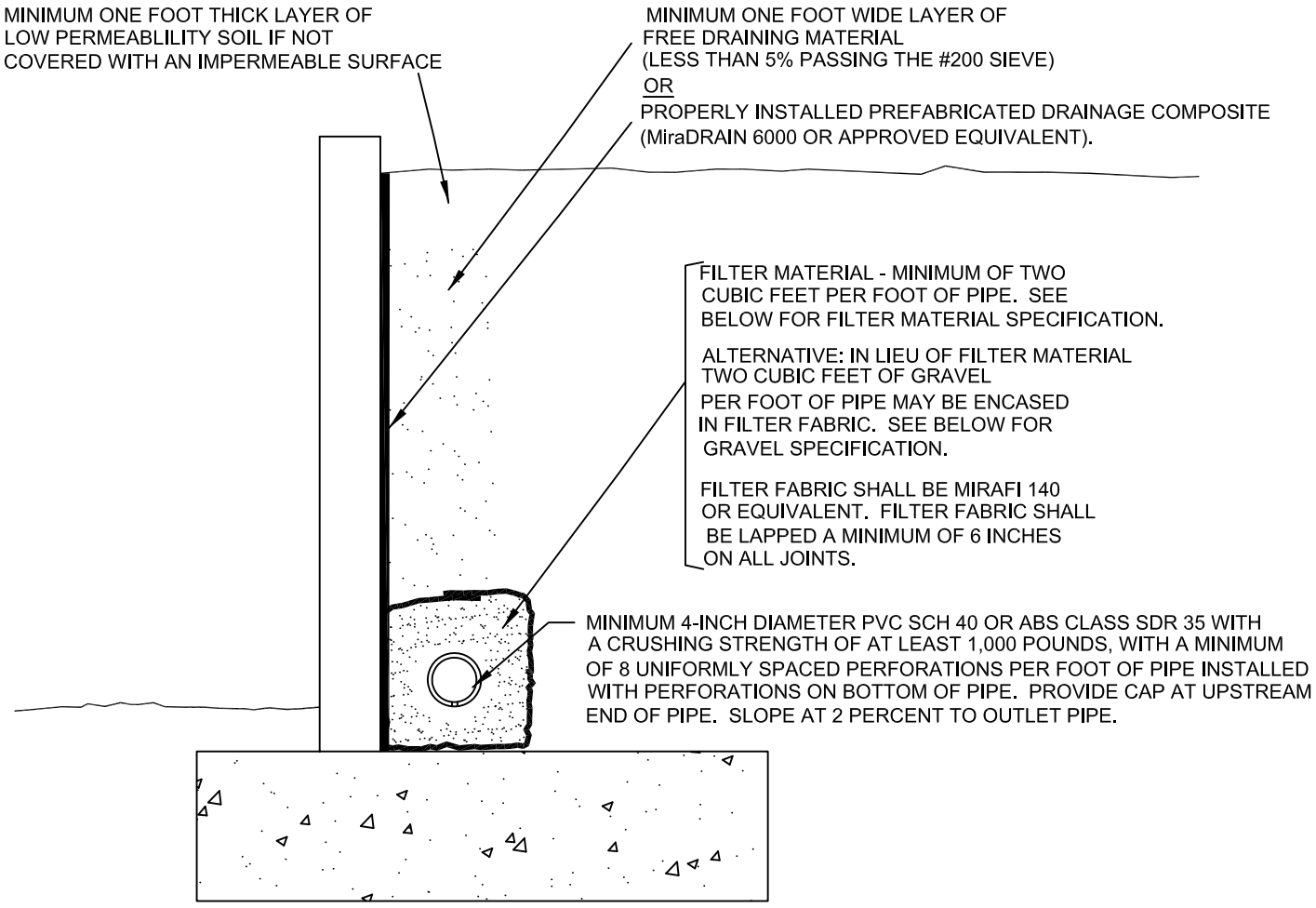
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

GRADING GUIDE SPECIFICATIONS

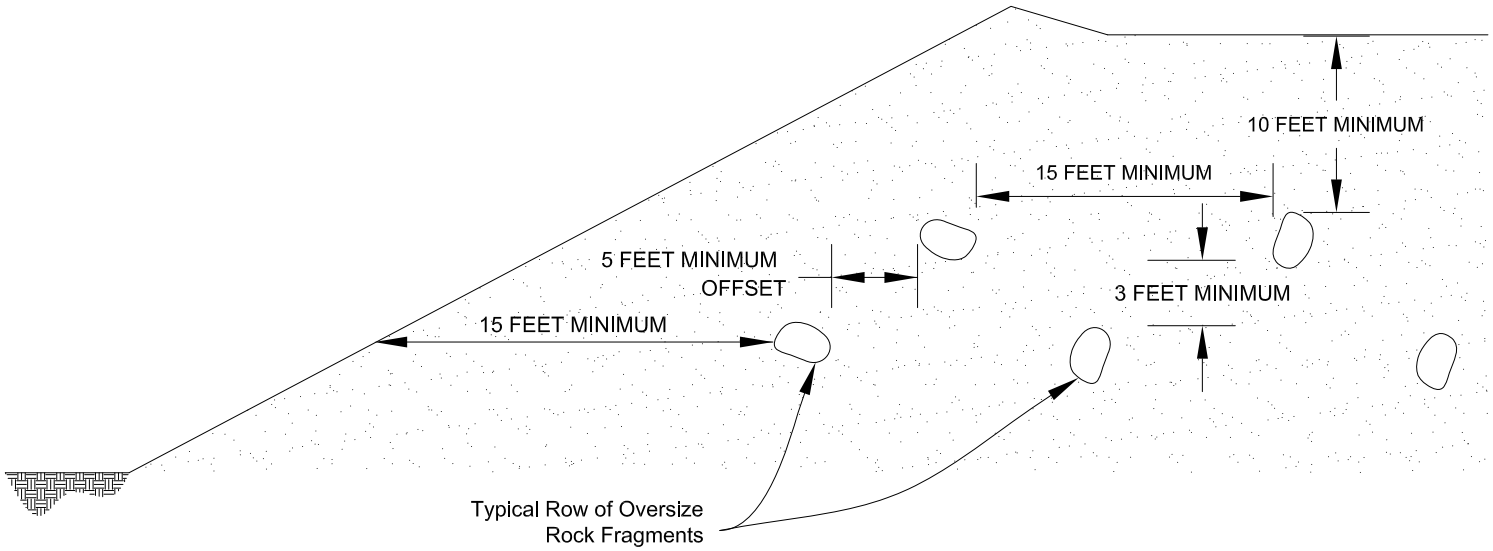
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

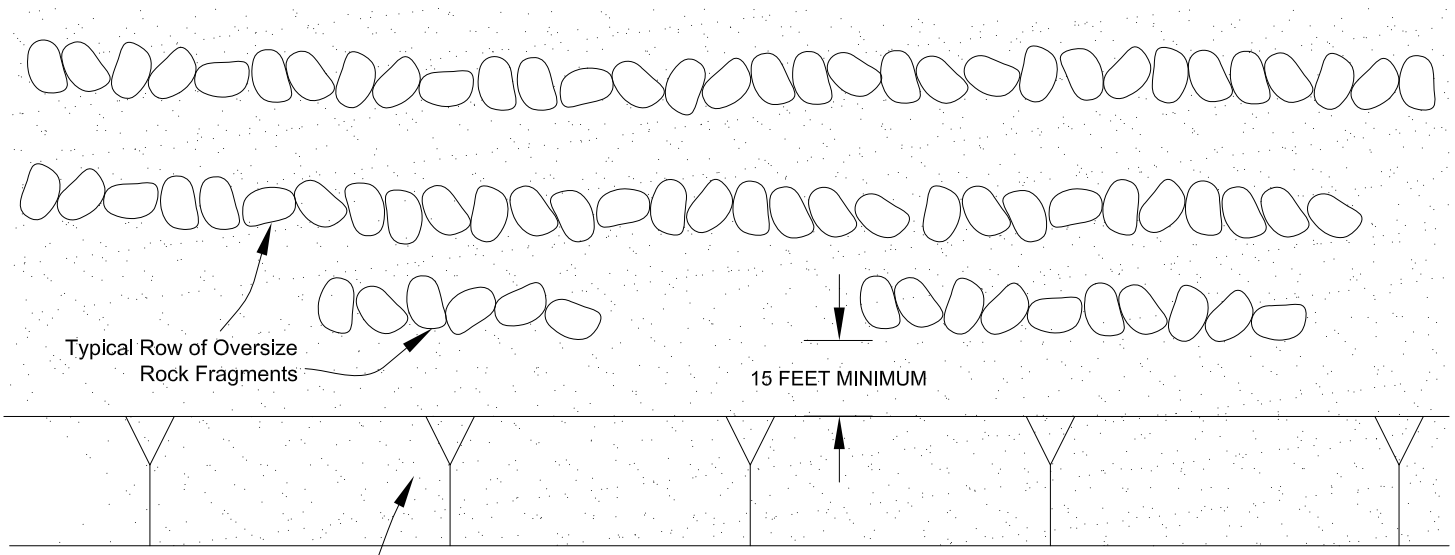
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

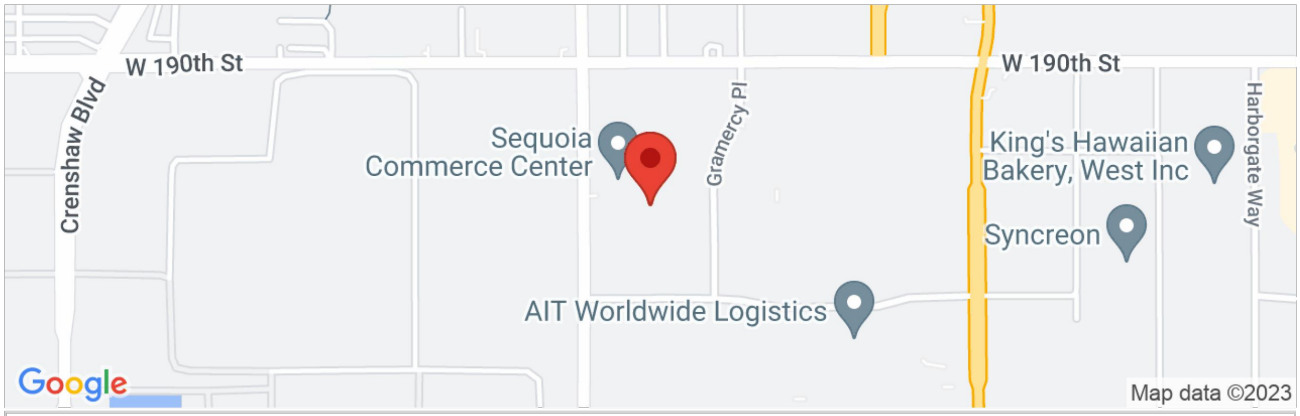
PLATE D-8

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

Latitude, Longitude: 33.85580037, -118.31635278



Date	12/5/2023, 11:16:13 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.756	MCE_R ground motion. (for 0.2 second period)
S_1	0.627	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.756	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.171	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.763	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.84	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.756	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.949	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.397	Factored deterministic acceleration value. (0.2 second)
S1RT	0.627	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.699	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.832	Factored deterministic acceleration value. (1.0 second)
PGAd	0.978	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.763	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.901	Mapped value of the risk coefficient at short periods

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2022 CBC
TWO PROPOSED INDUSTRIAL BUILDINGS
TORRANCE, CALIFORNIA

DRAWN: MK
CHKD: RGT
SCG PROJECT 23G206-1
PLATE E-1

SOUTHERN CALIFORNIA GEOTECHNICAL