County of Orange/Santa Ana Region
Priority Project
Water Quality Management Plan
(WQMP)

Project Name:

DUR2 Santa Ana
Application No. DP #2020-20
511 N. Grand Avenue
Santa Ana, CA 92701
APNs: 398-061-36, -37, -38, -39 // 398-111-31, -32 // 398-391-18, -29, -30

Prepared for:

Panattoni Development Company, Inc.
2442 Dupont Drive
Irvine, CA 92612
(949) 275-4202

Prepared by:

Thienes Engineering Inc.
Reinhard Stenzel, RCE 56155
14349 Firestone Boulevard
La Mirada, CA 90638
(714) 521-4811
Contact: Luis Prado (luisp@thieneseng.com)

1st Submittal: November 24, 2020
2nd Submittal: January 15, 2021
3rd Submittal: March 1, 2021
4th Submittal: March 29, 2021

Project Owner's Certification			
Planning Application No. (If applicable)	DP #2020-20	Grading Permit No.	Grading permit 50101254
Tract/Parcel Map and Lot(s) No.		Building Permit No.	Building plan check number 101105371
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)		511 N. Grand Avenue, Santa Ana, CA 92701 APNs: 398-061-36, -37, -38, -39 // 398-111-31, -32 // 398-391-18, -29, -30	

This Water Quality Management Plan (WQMP) has been prepared for Panattoni Development Company, Inc by Thienes Engineering Inc. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: Amazon.com Services LLC			
Name, Title	Joshua Abells, Authorized Signatory		
Company	Amazon.com Services LLC, a Delaware limited liability company		
Address	c/o Amazon.com Services, Inc. 410 Terry Ave N., Seattle, WA 98109 Subject: NA Ops DUR2		
Email	abellsj@amazon.com		
Telephone #			
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature	J. abells Authorized Signatory	Date	4/13/2021

Preparer (Engineer): Reinhard Stenzel			
Title	Director of Engineering	PE Registration #	56155
Company	Thienes Engineering, Inc.		
Address	14349 Firestone Boulevard, La Mirada, CA 90638		
Email	reinhard@thieneseng.com		
Telephone #	(714) 521-4811		
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board**.**			
Preparer Signature		Date	3/29/2021
Place Stamp Here	REGISTERED PROFESSIONAL ENGINEER REINHARD STENZEL R.C.E. NO. 56155 Exp. 12-31-22 CIVIL STATE OF CALIFORNIA		

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Attachments

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (ocplanning.net).*

Project Infomation			
Permit/Application No. (If applicable)	DP #2020-20	Grading or Building Permit No. (If applicable)	Grading permit 50101254; Building plan check number 101105371
Address of Project Site (or Tract Map and Lot Number if no address) and APN	511 N. Grand Avenue, Santa Ana, CA 92701 APNs: 398-061-36, -37, -38, -39 // 398-111-31, -32 // 398-391-18, -29, -30		

Water Quality Conditions of Approval or Issuance	
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	A copy of the Conditions of Approval (COA) is included in Attachment F. 31. Submit two copies of the preliminary WQMP for review and approval to the Public Works Agency. Go to www.santa-ana.org/pwa/stormdrain/WaterQualityManagement PlanTemplates.asp for information on preparation of WQMPs. a. Preliminary Water Quality Management Plan (WQMP)/surface drainage/utility plan should depict all applicable "Site Design," structural "Source Control," and "Treatment Control" Best Management Practices (BMPs) in accordance with the most current Orange County Drainage Area Management Plan (DAMP) and the City of Santa Ana Local Implementation Plan (LIP). b. The site plan shall incorporate improvements as determined by the Public Works Agency from the review of the preliminary WQMP and surface drainage plan. c. The site plan to incorporate construction of any proposed "Site Design", BMPs, (such as walkways with open joints,

	sidewalks and parking lot aisles with minimum widths, draining sidewalks into adjacent landscaping, incorporating the landscape area into drainage system, etc.) to minimize the impervious areas and to maximize permeability and natural areas. Reference the most current Orange County DAMP and the LIP. d. Any proposed "Treatment Control" BMPs using the Best Available Technology (such as biofilters, dry or wet detention basins, landscape detentions, wet ponds or wetlands, drainage inserts, filtration basins, etc.) and recommended sizing calculations near pollutant source, so as to infiltrate and filter the pollutants of concern in post development runoff flow prior to its discharge into any receiving body of water or urban storm drain. Reference the most current Orange County DAMP and the City of Santa Ana LIP.

Conceptual WQMP

Was a Conceptual Water Quality Management Plan previously approved for this project?	Yes (PWQMP approval was obtained on October 9, 2020)

Watershed-Based Plan Conditions

Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	There are currently no approved WIHMPs for the Newport Bay Watershed.

Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the Technical Guidance Document (TGD) for information that must be included in the project description.*

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	Priority Project Category 6 Parking lots 5,000 square feet or more including associated drive aisle, and potentially exposed to urban stormwater runoff. Priority Project Category 8 All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site.			
Project Area (ft^2): 716,562	Number of Dwelling Units: N/A		SIC Code: 4225	
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	5.55 ac.	34%	10.90 ac.	66%
Post-Project Conditions	2.19 ac.	13%	14.26 ac.	87%
Drainage Patterns/Connections	**Existing drainage patterns:** The northerly portion of the project site is a vacant dirt lot. The remainder of the site consists of an existing commercial site with a large building in the middle of the site and a paved parking lot on the southerly portion of the project site.			

Runoff from the northerly dirt lot, the easterly prolongation of Fruit Street and areas near the cul-de-sac drain to existing inlets located at the northwesterly portion of the project site. Here, existing storm drains convey runoff to the existing catch basin at the cul-de-sac in Fruit Street.

Flow from the dirt portion of the site south of the prolongation of Fruit Street, a portion of the existing building and the truck yard area at the easterly portion of the site surface drain to Sixth Street and McClay Street via existing parkway culvert. Flow to the street continues southerly to the existing storm drain system in East 4th Street.

A portion of the building and the existing drive aisle (the westerly prolongation of Sixth Street) drains to onsite catch basins near Grand Avenue. It appears there is an existing onsite storm drain system that conveys this flow to an existing catch basin on Grand Avenue ultimately to the Grand Avenue storm drain.

Finally, the southerly parking lot drains westerly and discharges into Grand Avenue via existing parkway culverts. This flow is intercepted in an existing catch basin in Grand Avenue north of East 4th Street.

All runoff from the site under existing conditions ultimately drains to Grand Avenue storm drain system via the above described conduits.

Proposed drainage patterns: Runoff from the proposed site will alter the localized discharge locations, but will continue to convey flow to the Grand Avenue storm drain as tabled per the City's Master Plan of Drainage. Runoff from the project site will be directed to the Grand Avenue storm drain system via existing and proposed connections. This will relieve runoff to the adjacent residential neighborhood as well as reduce flow to Grand Avenue compared to existing conditions.

DMA 1: The truck yard north of the proposed building, the most northerly parking areas and the northwest canopy area of the building will be either hardlined into the proposed onsite storm drain or intercepted into sev4eral catch basins located in the truck and vehicle parking areas. A proposed storm drain will convey this flow westerly and connect to the relocated catch basin within Fruit Street. A diversion manhole and trench drain will divert low flows from these areas into a sump pump that is directed towards the proposed flow-based proprietary biofiltration (MWS #1) for flow-based treatment. The pump system will include a back-up pump capable of handling 100% of the flowrate in the event that the primary pump fails. The pumps will be inspected and maintained by the owner twice a year for proper operation. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems at the manhole diversion structure with a pipe set at a higher elevation. These flows ultimately discharge into the relocated catch basin within Fruit Street.

<u>DMA 2</u>: Runoff from the proposed building, the majority of the canopy area west of the building, the easterly drive aisle and all of the southerly parking areas will be either hardlined into the proposed onsite storm drain or intercepted into several catch basins located in the parking areas. The onsite storm drain system will convey runoff southerly to the southwesterly corner of the project site and to the underground detention system. A diversion manhole (located immediately downstream of proposed hydrodynamic separator) will divert low flows into the underground detention system that is used for HCOC and 100-year storm mitigation. <u>The underground detention system is not used as a LID BMP, however, the water quality flowrate is routed through it in order for the system to function as designed for HCOC/100-year storm mitigation</u>. A pipe with the invert set at the bottom of the underground detention system will direct water quality flows immediately to a sump pump that is directed towards the proposed flow-based proprietary biofiltration (MWS #2) for flow-based treatment. The pump system will include a back-up pump capable of handling 100% of the flowrate in the event that the primary pump fails. The pumps will be inspected and maintained by the owner twice a year for proper operation. The flow-based proprietary biofiltration units utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems via two locations both set at higher elevations (one within the underground detention system and the other at the mahole diversion structure). Flows ultimately discharge into the existing public storm drain in Grand Avenue.

<u>DMA 3</u>: Runoff from a portion of the most southerly drive aisle and driveway will surface drain to a proposed catch basin that ties into the onsite storm drain system immediately before discharging offsite into the existing Grand Avenue public storm drain. Prior to that, a Dvert device installed within the catch basin will intercept and divert low flows into the proposed flow-based proprietary biofiltration (MWS #3) for flow-based treatment. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands

Systems via the installed Dvert device within the catch basin. Flows ultimately discharge into the existing public storm drain in Grand Avenue.

Portions of the westerly frontage areas (0.25 acres total; shown in purple on WQMP Site Map) will sheet flow directly offsite without being routed through an LID BMP. These areas are mostly comprised of self-treating landscaping that does not comingle with any onsite impervious surfaces before draining offsite. Small portions of driveway approaches along Fruit Street and Grand Avenue will leave the site "untreated" due to physical constraints (ie. sloped frontage and City driveway approach standards). It is impractical to collect stormwater runoff from these locations and route them to the LID BMPs.

Project Description: The project site is located at 511 N. Grand Avenue, City of Santa Ana, (Orange County) with the following lat/long coordinates: 33.867680, -117.901268

The proposed project site is 16.45 acres (716,562 square feet). Proposed improvements to the site include a warehouse type building of approximately 112,485 square feet. There will be an aboveground truck dock area at the northerly portion of the building where loading/unloading activities will occur indoors, at the back of the truck against the building. Additionally, along the west side of the proposed building, van loading/unloading activities will occur underneath the proposed canopy away from rainfall. The canopy itself flows into roof drain leaders that are hardlined into their respective storm drains.

The remainder of the site is generally used for vehicle parking. There will be landscaping around the perimeter of the site and other areas throughout the parking lot.

There is no outdoor storage on the project site and no food preparation, cooking or eating area. There are currently no activities that are routinely conducted outdoors (ie. vehicle maintenance and associated activities). All activities occur indoors or beneath the canopy.

Narrative Project Description: (Use as much space as necessary.)	Portions of the westerly frontage areas (0.25 acres total; shown in purple on WQMP Site Map) will sheet flow directly offsite without being routed through an LID BMP. These areas are mostly comprised of self-treating landscaping that does not comingle with any onsite impervious surfaces before draining offsite. Small portions of driveway approaches along Fruit Street and Grand Avenue will leave the site "untreated" due to physical constraints (ie. sloped frontage and City driveway approach standards). It is impractical to collect stormwater runoff from these locations and route them to the LID BMPs. Per the letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), infiltration testing results varied from 0.05 in/hr to 1.20 in/hr. This variability in the infiltration rates were due to highly layered and variable subsurface soils. Additionally, because of the highly layered stratigraphy, granular soil layers that supported infiltration during testing appear to be limited in thickness and underlain by less permeable soils. Due to these conditions, the Geotechnical Engineer of Record has deemed stormwater infiltration infeasible at the project site. Instead, the project proposes to use at-grade proprietary biofiltration units (Modular Wetlands Systems) to meet the design treatment flowrate; see <u>Worksheet D's Capture Efficiency Method for Flow-Based BMPs</u> located in Attachment D of this WQMP report. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows.

II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the Technical Guidance Document (TGD) for guidance.*

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E ☒	N ☐	Potentially expected due to landscaping
Nutrients	E ☒	N ☐	Potentially expected due to landscaping
Heavy Metals	E ☒	N ☐	Expected due to vehicles
Pathogens (Bacteria/Virus)	E ☒	N ☐	Potentially expected due to uncovered parking areas
Pesticides	E ☒	N ☐	Potentially expected due to landscaping
Oil and Grease	E ☒	N ☐	Expected due to vehicles
Toxic Organic Compounds	E ☒	N ☐	Expected due to solvents
Trash and Debris	E ☒	N ☐	Expected

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the Technical Guidance Document (TGD) for North Orange County or Section 2.2.3.2 for South Orange County.*

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the Technical Guidance Document (TGD).*

2 year, 24-hr Storm Event[1]		
	Volume (ac-ft)	**Time of Concentration (min)**
Pre-Development	1.55	16.1
Post-Development	2.13	11.1

[1] See Attachment B for supporting documentation.

HCOCs are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to Hydromodification impacts and either of the following conditions exists:

- Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent.
  OR
- Time of concentration of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent.

Per Figure XVI.3d in Attachment B of this WQMP report, the site is located within an area that is susceptible to hydromodification.

Volume requiring mitigation: (2.13 ac-ft x 0.95) – 1.55 ac-ft = 0.474 ac-ft
Detention provided: 4,000 lf of 60″ pipe = 0.51 ac-ft (HCOC vol. depth met @ 1.75′) = 22,216 cu-ft
Post 0.51 ac-ft > Mitigation Volume 0.474 ac-ft

Post-development 2-yr,24-hr peak flowrate: 21.71 cfs
Time it will take to fill up the detention system: 22,216 cu-ft ÷ 21.71 cfs = 1,023 seconds = 17 mins
17 mins > Pre-development Tc 16.1 mins

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the Technical Guidance Document (TGD).*

Runoff from the proposed site will alter the localized discharge locations, but will continue to convey flow to the Grand Avenue storm drain as tabled per the City's Master Plan of Drainage. Runoff from the project site will be directed to the Grand Avenue storm drain system via existing and proposed connections. This will relieve runoff to the adjacent residential neighborhood as well as reduce flow to Grand Avenue compared to existing conditions.

<u>DMA 1</u>: The truck yard north of the proposed building, the most northerly parking areas and the northwest canopy area of the building will be either hardlined into the proposed onsite storm drain or intercepted into several catch basins located in the truck and vehicle parking areas. A proposed storm drain will convey this flow westerly and connect to the relocated catch basin within Fruit Street. A diversion manhole and trench drain will divert low flows from these areas into a sump pump that is directed towards the proposed flow-based proprietary biofiltration (MWS #1) for flow-based treatment. The pump system will include a back-up pump capable of handling 100% of the flowrate in the event that the primary pump fails. The pumps will be inspected and maintained by the owner twice a year for proper operation. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems at the manhole diversion structure with a pipe set at a higher elevation. These flows ultimately discharge into the relocated catch basin within Fruit Street.

<u>DMA 2</u>: Runoff from the proposed building, the majority of the canopy area west of the building, the easterly drive aisle and all of the southerly parking areas will be either hardlined into the proposed onsite storm drain or intercepted into several catch basins located in the parking areas. The onsite storm drain system will convey runoff southerly to the southwesterly corner of the project site and to the underground detention system. A diversion manhole (located immediately downstream of proposed hydrodynamic separator) will divert low flows into the underground detention system that is used for HCOC and 100-year storm mitigation. <u>The underground detention system is not used as a LID BMP, however, the water quality flowrate is routed through it in order for the system to function as designed for HCOC/100-year storm mitigation</u>. A pipe with the invert set at the bottom of the underground detention system will direct water quality flows immediately to a sump pump that is directed towards the proposed flow-based proprietary biofiltration (MWS #2) for flow-based treatment. The pump system will include a back-up pump capable of handling 100% of the flowrate in the event that the primary pump fails. The pumps will be inspected and maintained by the owner twice a year for proper operation. The flow-based proprietary biofiltration units utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems via two locations both set at higher elevations (one within the underground detention system and the other at the mahole diversion structure).

Flows ultimately discharge into the existing public storm drain in Grand Avenue.

DMA 3: Runoff from a portion of the most southerly drive aisle and driveway will surface drain to a proposed catch basin that ties into the onsite storm drain system immediately before discharging offsite into the existing Grand Avenue public storm drain. Prior to that, a Dvert device installed within the catch basin will intercept and divert low flows into the proposed flow-based proprietary biofiltration (MWS #3) for flow-based treatment. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems via the installed Dvert device within the catch basin. Flows ultimately discharge into the existing public storm drain in Grand Avenue.

Portions of the westerly frontage areas (0.25 acres total; shown in purple on WQMP Site Map) will sheet flow directly offsite without being routed through an LID BMP. These areas are mostly comprised of self-treating landscaping that does not comingle with any onsite impervious surfaces before draining offsite. Small portions of driveway approaches along Fruit Street and Grand Avenue will leave the site "untreated" due to physical constraints (ie. sloped frontage and City driveway approach standards). It is impractical to collect stormwater runoff from these locations and route them to the LID BMPs.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the Technical Guidance Document (TGD).*

Amazon.com Services LLC
c/o Amazon.com Services, Inc.
410 Terry Ave N.
Seattle, WA 98109
Subject: NA Ops DUR2
Contact: Joshua Abells, Authorized Signatory
Email: abellsj@amazon.com

No infrastructure will be transferred to public agencies. A Property Owner Association (POA) will not be formed for the long-term maintenance of the project's stormwater facilities. The owner is ultimately responsible for funding and maintenance of BMPs until the site is sold or transferred.

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the Technical Guidance Document (TGD).*

Name of Planned Community/Planning Area (if applicable)	DUR2 Santa Ana
Location/Address	511 N. Grand Avenue
	Santa Ana, CA 92701
General Plan Land Use Designation	GC (General Commercial)
Zoning	SD-21 (Specific Development)
Acreage of Project Site	16.45 Acres
Predominant Soil Type	Hydrologic Soil Group B

III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.2 in the Technical Guidance Document (TGD).*

Site Characteristics	
Precipitation Zone	0.75" (85th percentile, 24-hr storm)
Topography	Flat Previously developed and undeveloped land
Drainage Patterns/Connections	The project site is located at 511 N. Grand Avenue, City of Santa Ana, (Orange County) with the following lat/long coordinates: 33.867680, -117.901268

	Runoff from the proposed site will alter the localized discharge locations, but will continue to convey flow to the Grand Avenue storm drain as tabled per the City's Master Plan of Drainage. Runoff from the project site will be directed to the Grand Avenue storm drain system via existing and proposed connections. This will relieve runoff to the adjacent residential neighborhood as well as reduce flow to Grand Avenue compared to existing conditions. DMA 1: The truck yard north of the proposed building, the most northerly parking areas and the northwest canopy area of the building will be either hardlined into the proposed onsite storm drain or intercepted into several catch basins located in the truck and vehicle parking areas. A proposed storm drain will convey this flow westerly and connect to the relocated catch basin within Fruit Street. A diversion manhole and trench drain will divert low flows from these areas into a sump pump that is directed towards the proposed flow-based proprietary biofiltration (MWS #1) for flow-based treatment. The pump system will include a back-up pump capable of handling 100% of the flowrate in the event that the primary pump fails. The pumps will be inspected and maintained by the owner twice a year for proper operation. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems at the manhole diversion structure with a pipe set at a higher elevation. These flows ultimately discharge into the relocated catch basin within Fruit Street. DMA 2: Runoff from the proposed building, the majority of the canopy area west of the building, the easterly drive aisle and all of the southerly parking areas will be either hardlined into the proposed onsite storm drain or intercepted into several catch basins located in the parking areas. The onsite storm drain system will convey runoff southerly to the southwesterly corner of the project site and to the underground detention system. A diversion manhole (located immediately downstream of proposed hydrodynamic separator) will divert low flows into the underground detention system that is used for HCOC and 100-year storm mitigation. The underground detention system is not used as a LID BMP, however, the water quality flowrate is routed through it in order for the system to function as designed for HCOC/100-year storm mitigation. A pipe with the invert set at the bottom of the underground detention system will direct water quality flows immediately to a sump pump that is directed towards the proposed flow-based proprietary biofiltration (MWS #2) for flow-based treatment. The pump system will include a back-up pump capable of handling 100% of the flowrate in the event

	that the primary pump fails. The pumps will be inspected and maintained by the owner twice a year for proper operation. The flow-based proprietary biofiltration units utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems via two locations both set at higher elevations (one within the underground detention system and the other at the mahole diversion structure). Flows ultimately discharge into the existing public storm drain in Grand Avenue. DMA 3: Runoff from a portion of the most southerly drive aisle and driveway will surface drain to a proposed catch basin that ties into the onsite storm drain system immediately before discharging offsite into the existing Grand Avenue public storm drain. Prior to that, a Dvert device installed within the catch basin will intercept and divert low flows into the proposed flow-based proprietary biofiltration (MWS #3) for flow-based treatment. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. Treated flows will gravity feed back into the onsite storm drain. Flows greater than the design treatment flowrate will bypass the Modular Wetlands Systems via the installed Dvert device within the catch basin. Flows ultimately discharge into the existing public storm drain in Grand Avenue. Portions of the westerly frontage areas (0.25 acres total; shown in purple on WQMP Site Map) will sheet flow directly offsite without being routed through an LID BMP. These areas are mostly comprised of self-treating landscaping that does not comingle with any onsite impervious surfaces before draining offsite. Small portions of driveway approaches along Fruit Street and Grand Avenue will leave the site "untreated" due to physical constraints (ie. sloped frontage and City driveway approach standards). It is impractical to collect stormwater runoff from these locations and route them to the LID BMPs.
Soil Type, Geology, and Infiltration Properties	Hydrologic Soil Group B. Per the letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), infiltration testing results varied from 0.05 in/hr to 1.20 in/hr. This variability in the infiltration rates were due to highly layered and variable subsurface soils. Additionally, because of the highly layered stratigraphy, granular soil layers that supported infiltration during testing appear to be limited in thickness and underlain by less permeable soils. Due

	to these conditions, the Geotechnical Engineer of Record has deemed stormwater infiltration infeasible at the project site.
Hydrogeologic (Groundwater) Conditions	Per the geotechnical report in Attachment C, historical groundwater depths are mapped as shallow as 40 feet below grade, however groundwater was not encountered in current explorations performed to a maximum depth of 58 feet below ground surface.
Geotechnical Conditions (relevant to infiltration)	Per the letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), infiltration testing results varied from 0.05 in/hr to 1.20 in/hr. This variability in the infiltration rates were due to highly layered and variable subsurface soils. Additionally, because of the highly layered stratigraphy, granular soil layers that supported infiltration during testing appear to be limited in thickness and underlain by less permeable soils. Due to these conditions, the Geotechnical Engineer of Record has deemed stormwater infiltration infeasible at the project site.
Off-Site Drainage	Off-site run-on is collected via an existing 18” pipe, located at the northeast corner of the existing parking structure for the OC Register building, and routed to the relocated catch basin along Fruit Street. The offsite run-on does not comingle with any onsite impervious surfaces or runoff prior to the connection at Fruit Street.
Utility and Infrastructure Information	Existing utilities are not expected to constrain site design. Any existing utilities will be potholed for location and relocated, if necessary.

III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the Technical Guidance Document (TGD).*

Receiving Waters	Peters Canyon Channel, San Diego Creek Reach 1, Newport Bay, Upper (Ecological Reserve) and Newport Bay, Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel east end of H-J Moorings)
303(d) Listed Impairments	Peters Canyon Channel: Benthic Community Effects, DDT (Dichlorodiphenyltrichloroethane), Indicator Bacteria, Malathion, pH, Selenium, Toxaphene and Toxicity San Diego Creek Reach 1: Benthic Community Effects, DDT (Dichlorodiphenyltrichloroethane), Indicator Bacteria, Malathion, Nutrients, Sedimentation/Siltation, Selenium, Toxaphene and Toxicity Newport Bay, Upper: Chlordane, Copper, DDT (Dichlorodiphenyltrichloroethane), Indicator Bacteria, Malathion, Nutrients, PCBs (Polychlorinated biphenyls), Sedimentation/Siltation and Toxicity Newport Bay, Lower: Chlordane, Copper, DDT (Dichlorodiphenyltrichloroethane), Indicator Bacteria, Nutrients, PCBs (Polychlorinated biphenyls) and Toxicity
Applicable TMDLs	Peters Canyon Channel: None San Diego Creek Reach 1: Metals, Selenium, Nutrients, Pesticides, and Siltation Newport Bay, Upper: Metals, Nutrients, Pathogens, Pesticides/PCBs, and Siltation Newport Bay, Lower: Metals, Nutrients, Pathogens, Pesticides/Priority Organics, and Siltation
Pollutants of Concern for the Project	Nutrients, Heavy Metals, Pathogens, Pesticides, Toxic Organic Compounds, and Trash and Debris
Environmentally Sensitive and Special Biological Significant Areas	None

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- If the project has an approved WIHMP or equivalent, then any watershed specific criteria must be used and the project can evaluate participation in the approved regional or sub-regional opportunities. (Please ask your assigned planner or plan checker regarding whether your project is part of an approved WIHMP or equivalent.)
- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Determine applicable treatment control BMP performance criteria. *Refer to Section 7.II*-3.2.2 *of the Model WQMP.*
- Calculate the LID design storm capture volume for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?	YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.		

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	If a hydrologic condition of concern (HCOC) exists, priority projects shall implement on-site or regional hydromodification controls such that: • Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and • Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent. Where the Project WQMP documents that excess runoff volume from the two-year runoff event cannot feasibly be retained and where in-stream controls cannot be used to otherwise mitigate HCOCs, the project shall implement on-site regional hydromodification controls to: • Retain the excess volume from the two-year runoff event to the MEP, and Implement on-site or regional hydromodification controls such that the post-development runoff two-year peak flow rate is no greater than 110 percent of the predevelopment runoff two-year peak flow rate.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	The following performance criteria for LID implementation are stated in both permits: • Priority Projects must infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume). • A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment may be provided for the remaining design capture volume. A diversity of controls must be provided, where feasible, to achieve the greatest feasible retention of the Design Capture Volume, then if necessary, biotreatment of the remaining design capture volume.

The Design Capture Storm Depth is the 85th percentile, 24-hr storm depth that, when applied to the project site results in the design capture volume. The design capture storm depth varies across the county and is shown in TGD Appendices III. The TGD provides information for determining the applicable "design capture storm depth" to apply to a project to calculate design capture volume as well as guidance for recommended hydrologic methods.

Equivalent performances criteria have been synthesized from permit requirements with consideration of the MEP standard and analysis of local precipitation and ET patterns. The following performance criteria result in capture and retention and/or biotreatment of 80 percent of average annual stormwater runoff volume. The performance criteria for LID are stated as follows:

- LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) stormwater runoff up to 80 percent average annual capture efficiency
- LID BMPs must be designed to:
  - Retain, on-site, (infiltrate, harvest and use, or evapotranspire) stormwater runoff as feasible up to the Design Capture Volume, and
  - Recover (i.e., draw down) the storage volume as soon as possible after a storm event (see criteria for maximizing drawdown rate in the **TGD Appendix XI**), and, if necessary
  - Biotreat, on-site, additional runoff, as feasible, up to 80 percent average annual capture efficiency (cumulative, retention plus biotreatment), and, if necessary
  - NOC Permit Area only – retain or biotreat, in a regional facility, the remaining runoff up to 80 percent average annual capture efficiency (cumulative, retention plus biotreatment, on-site plus off-site), and, if necessary

Fulfill alternative compliance obligations for runoff volume not retained or biotreated up to 80 percent average annual capture efficiency using treatment controls or other alternative approaches as described in Section 7.II-3.

List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	*North County Requirements* If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate (See **Section 7.II-3.1** Water Quality Credits) and as calculated in **TGD Appendix VI**. If treatment control BMPs can treat all of the remaining unmet volume and have a medium to high effectiveness for reducing the primary POCs, the project is considered to be in compliance; a waiver application and participation in an alternative program is not required. If the cost of providing treatment control BMPs greatly outweighs the pollution control benefits they would provide, a waiver of treatment control and LID requirements can be requested and alternative compliance approaches must be used to fulfill the remaining unmet volume (See **Section 7.II-3.3**).
Calculate LID design storm capture volume for Project.	Worksheet D: Capture Efficiency Method for Flow-Based BMPs Supporting documentation provided in Attachment D of this WQMP report.

Simple Design Capture Volume Sizing Method

DMA	d (inches)	Area (acres)	imp	C	DCV (cu-ft)
1	0.75	3.00	0.78	0.7350	6,003
2	0.75	12.90	0.88	0.8100	28,447
3	0.75	0.30	0.72	0.6900	564

Flow-based BMPs

MWS #	Area (ac)	Tc (mins)	i (in/hr)	imp	C	SQDF (cfs)	Modular Wetlands			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
1	3.00	5.0	0.263	0.78	0.735	0.579	0.594	1	MWS-L-8-20-V @3.5'	0.594
2	12.90	5.0	0.263	0.88	0.810	2.743	0.577	5	MWS-L-8-20-V @3.4'	2.885
3	0.30	5.0	0.263	0.72	0.690	0.054	0.055	1	MWS-L-4-4-V @3.6'	0.055

IV.2. Site Design and Drainage

Describe site design and drainage including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP "BMP Exhibit."
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs.

Refer to Section 2.4.2 in the Technical Guidance Document (TGD).

Site Designs Utilized:

- Site Planning and Layout
  - Minimize Impervious Area: Due to the nature of this project (ie. significant redevelopment) this site design could not be utilized. However, the site plan proposes more landscaping than the typical light-industrial warehouse.
  - Maximize Natural Infiltration Capacity: Per the geotechnical letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), stormwater infiltration is not feasible at the project site.
  - Preserve Existing Drainage Patterns and Time of Concentration: Runoff from the proposed site will alter the localized discharge locations, but will continue to convey flow to the Grand Avenue storm drain as tabled per the City's Master Plan of Drainage. Time of concentration is lengthened with the inclusion of LID BMPs and detention for HCOC mitigation.
  - Disconnect Impervious Areas: The proposed BMPs will disconnect impervious areas before discharging offsite.
- Vegetative Protection, Selection Revegetation, and Soil Stockpiling
  - Protect Existing Vegetation and Sensitive Areas: Due to the nature of this project (ie. significant redevelopment) this site design concept could not be utilized. Additionally, there were little to no existing vegetation to protect.
  - Revegetate Disturbed Areas: This site design concept could not be fully utilized. The project proposes to pave most of the disturbed area. However, the site plan proposes more landscaping than the typical light-industrial warehouse.
  - Soil Stockpiling and Site Generated Organics: This site design concept will not be utilized. There will not be any soil stockpiling at the project site.
  - Firescaping: This site design concept will not be utilized. Proposed vegetation will be well maintained.
  - Xeriscape Landscaping: This site design concept will not be utilized.
- Slopes and Channel Buffers
  - Convey Runoff Safely from the Tops of Slopes: Not applicable, no slopes.

- Avoid Disturbing Steep or Unstable Slopes: Not applicable, no slopes are being disturbed.
- Avoid Disturbing Natural Channels: Not applicable, no existing channels.
- Install Permanent Stabilization BMPs on Disturbed Slopes as Quickly as Possible: Not applicable, no slopes.
- Vegetate Slopes with Native or Drought Tolerant Vegetation: Not applicable, no slopes.
- Control and Treat Flows in Landscaping and/or Other Controls Prior to Reaching Existing Natural Drainage Systems, Unless Infiltration Would Cause Geotechnical Hazards: Flows will be treated through BMPs prior to reaching the public storm drain system.
- Hydromodification Control Before Discharge to the Channel: Not applicable, hydromodification controls not required.
- Energy Dissipaters: Not applicable.
- Collecting and Conveying Runoff to Downgradient Discharge Points: Not applicable to project.
- Line On-Site Conveyance Channels Should Be Lined: Not applicable to the project.
- Other Design Principles which are Comparable and Equally Effective: Not used.

➢ Techniques to Minimize Land Disturbance

- Establish Vegetation and Soil Protection Areas: Not applicable to project, land will be disturbed and compacted where necessary.
- Use of Mulch and Load Distributing Matting: Not applicable to project, land will be disturbed and compacted only where necessary.
- Pre/Post Construction Soil and Plant Treatments: Not applicable to project, land will be disturbed and compacted only where necessary.
- Inspection Guidelines and Procedures: Not applicable to project, land will be disturbed and compacted where necessary.

➢ LID BMPs at Scales from Single Parcels to Watershed

- Not applicable to project.

➢ Integrated Water Resource Management Practices

- Not applicable to project.

Site Designed to Allow BMPs to be Incorporated to the Maximum Extent Practicable:

Per the letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), infiltration testing results varied from 0.05 in/hr to 1.20 in/hr. This variability in the infiltration rates were due to highly layered and variable subsurface soils. Additionally, because of the highly layered stratigraphy, granular soil layers that supported infiltration during testing appear to be limited in thickness and underlain by less permeable soils. Due to these conditions, the Geotechnical Engineer of Record has deemed stormwater infiltration infeasible at the project site. Instead, the project proposes to use at-grade proprietary biofiltration units (Modular Wetlands Systems) to meet the design treatment flowrate; see Worksheet D's Capture Efficiency Method for Flow-Based BMPs located in Attachment D of this WQMP report. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows.

Drainage Management Area (DMA) Characteristics and Proposed BMPs:

Each DMA (See Section IV.1) will drain to its respective BMP. All drainage will come from asphalt, roofing, or landscaping.

Design Capture Volume (DCV) for Each DMA:

See Section IV.1 and Attachment D for DCV calculations.

Flow-based BMPs

MWS #	Area (ac)	Tc (mins)	i (in/hr)	imp	C	SQDF (cfs)	Modular Wetlands			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
1	3.00	5.0	0.263	0.78	0.735	0.579	0.594	1	MWS-L-8-20-V @3.5'	0.594
2	12.90	5.0	0.263	0.88	0.810	2.743	0.577	5	MWS-L-8-20-V @3.4'	2.885
3	0.30	5.0	0.263	0.72	0.690	0.054	0.055	1	MWS-L-4-4-V @3.6'	0.055

GIS Coordinates for LID and Treatment Control BMPs:

DMA	BMP	Latitude Coordinates	Longitude Coordinates
DMA 1	MWS #1	33.752533	-117.850540
DMA 2	MWS #2	33.749510	-117.851622
DMA 3	MWS #3	33.749206	-117.851599
DMA 1	DRAIN INSERT #1	33.752788	-117.849651
DMA 1	DRAIN INSERT #2	33.752779	-117.849976
DMA 1	DRAIN INSERT #3	33.752600	-117.850465
DMA 2	DSBB #1	33.749621	-117.851134

IV.3 LID BMP Selection and Project Conformance Analysis

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. *Refer to Section 2.4.2.3 in the Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the Technical Guidance Document (TGD) for conducting conformance analysis with project performance criteria.*

IV.3.1 Hydrologic Source Controls (HSCs)

If required HSCs are included, fill out applicable check box forms. If the retention criteria are otherwise met with other LID BMPs, include a statement indicating HSCs not required.

Name	Included?
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☐
Other:	☐
Other:	☐

Residential rain barrels and green/brown/blue roofs are primarily used for residential projects and does not apply to commercial/industrial sites. Localized on-lot infiltration, impervious area dispersion, and impervious area reduction are not utilized per the letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), infiltration testing results varied from 0.05 in/hr to 1.20 in/hr. This variability in the infiltration rates were due to highly layered and variable subsurface soils. Additionally, because of the highly layered stratigraphy, granular soil layers that supported infiltration during testing appear to be limited in thickness and underlain by less permeable soils. Due to these conditions, the Geotechnical Engineer of Record has deemed stormwater infiltration infeasible at the project site.

IV.3.2 Infiltration BMPs

Identify infiltration BMPs to be used in project. If design volume cannot be met, state why.

Name	Included?
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐
Drywells	☐
Subsurface infiltration galleries	☐
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐
Other:	☐

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with infiltration BMPs. If not, document how much can be met with infiltration and document why it is not feasible to meet the full volume with infiltration BMPs.

Infiltration Infeasibility: Per the below Table 2.7, and the geotechnical engineer on record, infiltration is infeasible. No part of the design capture volume can be met with infiltration BMPs. Instead, the project proposes to use at-grade proprietary biofiltration units (Modular Wetlands Systems) to meet the design treatment flowrate; see Worksheet D's Capture Efficiency Method for Flow-Based BMPs located in Attachment D of this WQMP report. The flow-based proprietary biofiltration unit utilizes engineered media to treat/filter stormwater flows. See Section IV.3.4 of this WQMP report.

Table 2.7: Infiltration BMP Feasibility Worksheet

	Infeasibility Criteria	*Yes*	*No*
1	**Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to Appendix VII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	Would Infiltration BMPs **pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert): • The BMP can only be located less than 50 feet away from slopes steeper than 15 percent • The BMP can only be located less than eight feet from building foundations or an alternative setback. • A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
3	Would infiltration of the DCV from drainage area **violate downstream water rights**?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	***Yes***	***No***
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in Appendix VII.	X	
Provide basis: Per the letter provided by Geotechnical Professionals Inc. (GPI) dated January 11, 2021 (provided in Attachment C), infiltration testing results varied from 0.05 in/hr to 1.20 in/hr. This variability in the infiltration rates were due to highly layered and variable subsurface soils. Additionally, because of the highly layered stratigraphy, granular soil layers that supported infiltration during testing appear to be limited in thickness and underlain by less permeable soils. Due to these conditions, the Geotechnical Engineer of Record has deemed stormwater infiltration infeasible at the project site. Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X

Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.		
Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.	X
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis: Summarize findings of infeasibility screening	n/a
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis: Refer to row 5 for basis. Summarize findings of infeasibility screening	Infiltration is <u>infeasible</u>
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	n/a

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs included.

Name	Included?
All HSCs; *See Section IV.3.1*	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☐
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with evapotranspiration and/or rainwater harvesting BMPs in combination with infiltration BMPs. If not, document below how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

The minimum irrigation area demand is much more than the proposed project irrigated area available; therefore, there is not enough demand to drawdown the harvested stormwater prior to the next storm event. Rainwater harvesting is deemed infeasible.

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing			
3	Landscape irrigation		X	
4	Other:			
5	What is the design capture storm depth? (Figure III.1)	d	0.75	inches

6	What is the project size?	A	16.45	ac
7	What is the acreage of impervious area?	IA	14.26	ac
	For projects with multiple types of demand (toilet flushing, irrigation demand, and/or other demand)			
8	What is the minimum use required for partial capture? (Table X.6)	n/a		gpd
9	What is the project estimated wet season total daily use (Section X.2)?	n/a		gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)	n/a		
	For projects with only toilet flushing demand			
11	What is the minimum TUTIA for partial capture? (Table X.7)	n/a		
12	What is the project estimated TUTIA?	n/a		
13	Is partial capture potentially feasible? (Line 12 > Line 11?)	n/a		
	For projects with only irrigation demand			
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8)	12.0		ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)	2.19		ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)	No		

Provide supporting assumptions and citations for controlling demand calculation:

EIATA = LA x KL / (IE x Tributary Impervious Area)

LA = landscape area irrigated with harvested water, sq-ft = 95,210 (2.19 acres)

KL = Area-weighted landscape coefficient = 0.35

IE = irrigation efficiency (assume 0.90)

Imp area = 621,166 sq-ft (14.26 acres)

= (95,210 x 0.35) / (0.9 x 621,166)

= 0.0596

Table X.8: Minimum Irrigated Area for Potential Partial Capture Feasibility						
General Landscape Type	**Conservation Design: K_L = 0.35**			**Active Turf Areas: K_L = 0.7**		
Closest ET Station	*Irvine*	*Santa Ana*	*Laguna*	*Irvine*	*Santa Ana*	*Laguna*
Design Capture Storm Depth, inches	**Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac**					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.90	0.41	0.42	0.45
0.80	0.88	0.90	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.10	1.12	1.20	0.55	0.56	0.60

IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs included. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

Name	Included?
Bioretention with underdrains	☐
Stormwater planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Constructed wetlands	☐
Vegetated swales	☐
Vegetated filter strips	☐
Proprietary vegetated biotreatment systems	☒
Wet extended detention basin	☐
Dry extended detention basins	☐
Other:	☐
Other:	☐

Show calculations below to demonstrate if the LID Design Storm Capture Volume can be met with infiltration, evapotranspiration, rainwater harvesting and/or biotreatment BMPs. If not, document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with these BMP categories.

Due to the technical infeasibility for infiltration, as described in Section IV.3.2, biotreatment BMPs (Modular Wetlands Systems) will be utilized at the project site.

MWS #	Area (ac)	Tc (mins)	i (in/hr)	imp	C	SQDF (cfs)	Modular Wetlands			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
1	3.00	5.0	0.263	0.78	0.735	0.579	0.594	1	MWS-L-8-20-V @3.5'	0.594
2	12.90	5.0	0.263	0.88	0.810	2.743	0.577	5	MWS-L-8-20-V @3.4'	2.885
3	0.30	5.0	0.263	0.72	0.690	0.054	0.055	1	MWS-L-4-4-V @3.6'	0.055

IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 of the Technical Guidance Document (TGD).* Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

Hydromodification Control BMPs	
BMP Name	**BMP Description**
Underground detention system (NOT AN LID BMP)	A small portion of the 4,000 LF of 60″ pipes to mitigate the 2-yr,24-hr pre vs post volume. The remainder is used for mitigation of pre and post of the 100-year storm event.

IV.3.6 Regional/Sub-Regional LID BMPs

Describe regional/sub-regional LID BMPs in which the project will participate. *Refer to Section 7.II-2.4.3.2 of the Model WQMP*.

Regional/Sub-Regional LID BMPs
Not applicable.

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs. Describe treatment control BMPs including sections for selection, sizing, and infeasibility, as applicable.

Treatment Control BMPs	
BMP Name	**BMP Description**
Drain Inserts	Drain inserts protect waterways by capturing trash and debris before they can enter the storm drain system.
Hydrodynamic Separator	Hydrodynamic separators protect waterways by capturing trash and debris before they can enter the storm drain system.

IV.3.8 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Not applicable, no hazardous waste onsite.
N6	Local Industrial Permit Compliance	☐	☒	Not applicable, no fuel dispensing onsite.
N7	Spill Contingency Plan	☒	☐	
N8	Underground Storage Tank Compliance	☐	☒	Not applicable, no UST onsite.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Not applicable, no hazardous materials onsite.
N10	Uniform Fire Code Implementation	☐	☒	Not applicable, no hazardous materials onsite.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☒	☐	
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Not applicable, site is not a RGO.

IV.3.9 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

Structural Source Control BMPs				
Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	Not applicable, no outdoor storage is proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	Not applicable, no slopes or channels proposed.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	Not applicable, this project is not part of the San Diego RWQCB.
S6	Dock areas	☒	☐	
S7	Maintenance bays	☐	☒	Not applicable, maintenance bays are not proposed.
S8	Vehicle wash areas	☐	☒	Not applicable, vehicles wash areas are not proposed.
S9	Outdoor processing areas	☐	☒	Not applicable, outdoor processing areas are not proposed.
S10	Equipment wash areas	☐	☒	Not applicable, equipment wash areas are not proposed.
S11	Fueling areas	☐	☒	Not applicable, fueling areas are not proposed.
S12	Hillside landscaping	☐	☒	Not applicable, there are no hillsides onsite.
S13	Wash water control for food preparation areas	☐	☒	Not applicable, there are no food preparation areas onsite.
S14	Community car wash racks	☐	☒	Not applicable, community car wash racks are not proposed.

IV.4 Alternative Compliance Plan (If Applicable)

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the WQMP.*

IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the Technical Guidance Document (TGD) for calculation methods for applying water quality credits.*

<table>
<tr><th colspan="6">Description of Proposed Project</th></tr>
<tr><td colspan="6">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td>☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="3">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td colspan="2">☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="3">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td colspan="2">☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
</table>

Calculation of Water Quality Credits (if applicable)	Water quality credits are not utilized.

IV.4.2 Alternative Compliance Plan Information

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the Model WQMP.*

No alternate compliance plan is proposed.

Section V Inspection/Maintenance Responsibility for BMPs

Owner Information:

Amazon.com Services LLC
c/o Amazon.com Services, Inc.
410 Terry Ave N.
Seattle, WA 98109
Subject: NA Ops DUR2
Contact: Joshua Abells, Authorized Signatory
Email: abellsj@amazon.com

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

BMP Inspection/Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N1 Education for Property Owners, Tenants and Occupants	Owner	To educate employees on stormwater pollution.	Annually and within 2 weeks of being hired.
N2 Activity Restriction	Owner	There shall be no discharges of fertilizer, pesticides, or wastes to streets or storm drains. All debris shall be collected and relocated to an approved landfill.	Daily
N3 Common Area Landscape management	Owner	Clear of trash, debris, and any accumulated sediment.	Weekly

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N4 BMP Maintenance	Owner	See BMP maintenance at the end of this table.	See BMP maintenance at the end of this table.
N7 Spill Contingency Plan	Owner	Spill contingency plan shall be maintained and enforced.	Plan update per Orange County Fire Authority (OCFA) (or other regulatory agency)
N11 Common Area Litter Control	Owner	Clear of trash and debris.	Daily
N12 Employee Training	Owner	To educate employees on stormwater pollution.	Annually and within two weeks of being hired.
N13 Housekeeping of Loading Docks	Owner	Loading docks must be swept regularly for trash, debris, and sediment. Docks will not be hosed down. Absorbent will be used for cleanup of small spills. Used absorbent will be properly disposed of.	Daily
N14 Common Area Catch Basin Inspection	Owner	Clear of trash, debris, and any accumulated sediment.	Inspect monthly and vacuum as necessary.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N15 Street Sweeping Private Streets and Parking Lots	Owner	The paved parking areas shall be swept on a regular basis to remove debris.	Monthly or more often as needed to remove visible debris.
S1 Provide storm drain system stenciling and signage	Owner	Visual inspection and replace or repaint, as necessary.	Annually
S3 Trash and waste storage areas	Owner	Sweep, clean trash enclosure of trash and other debris. The trash enclosures may not be pressure washed or rinsed out unless wastewater is contained and disposed to sewer.	Weekly inspection of trash area. Remove trash as needed.
S4 Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Owner	The irrigation system will include devices to prevent low head drainage, overspray and run-off through the use of pressure regulating devices, check valves, flow sensors, proper spacing, low precipitation emission devices and ET or weather based controllers.	Inspected monthly and maintained as needed.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
S6 Dock areas	Owner	Keep all fluids indoors. Clean up chemical spills immediately and keep chemicals from entering storm drain system. Area must contain a capture system for all wash water leaks and spills. No direct discharges into the storm drain system.	Area shall be inspected weekly for proper containment and practices with spills cleaned up immediately.
TC-32: Proprietary Biofiltration Systems	Owner	Description of BMP: The Modular Wetlands will be utilized as bioretention treatment of storm water runoff from the project site. Runoff passes through the system horizontally, with planted material at the surface. Start up date: When storm drain system is complete.	Maintenance Schedule: Per manufactures specifications and units shall be inspected twice a year and maintained at least once a year (replacement of media filter), prior to October 1. The units shall be inspected and maintained by a qualified technician with proper disposal of all waste.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
MP-52: Drain inserts	Owner	Description of BMP: Catch basin inserts will need to be inspected four times a year and serviced three times a year. Debris will be removed that may cause the drain to clog. Filter medium needs to be replaced at least once a year. Start up date: When storm drain system is complete.	Maintenance Schedule: Per manufactures specifications and after September 1, shortly before the rainy season, October 1.
MP-51: Vortex Separator	Owner	Description of BMP: Vortex separators will need to be inspected semi-annually (by October 1st and February 1st) and maintain, upon reaching 25% capacity. Start up date: When storm drain system is complete.	Maintenance Schedule: Per manufactures specifications and after September 1, shortly before the rainy season, October 1.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Sump Pumps	Owner	Preventive maintenance and service to be performed by a qualified technician is recommended. Inspection and maintenance includes: • Check automatic operation of system as well as manual operation by use of float activation and selector switch, respectively. • Inspect floats for proper elevation and movement. • Check voltage and amperage for each motor. • Hose down lift station to clean walls, pumps, and floats. • Inspection of mechanical seals to be done once every two (2) years.	Maintenance Schedule: Twice (2) a year per manufacturer's recommendations

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

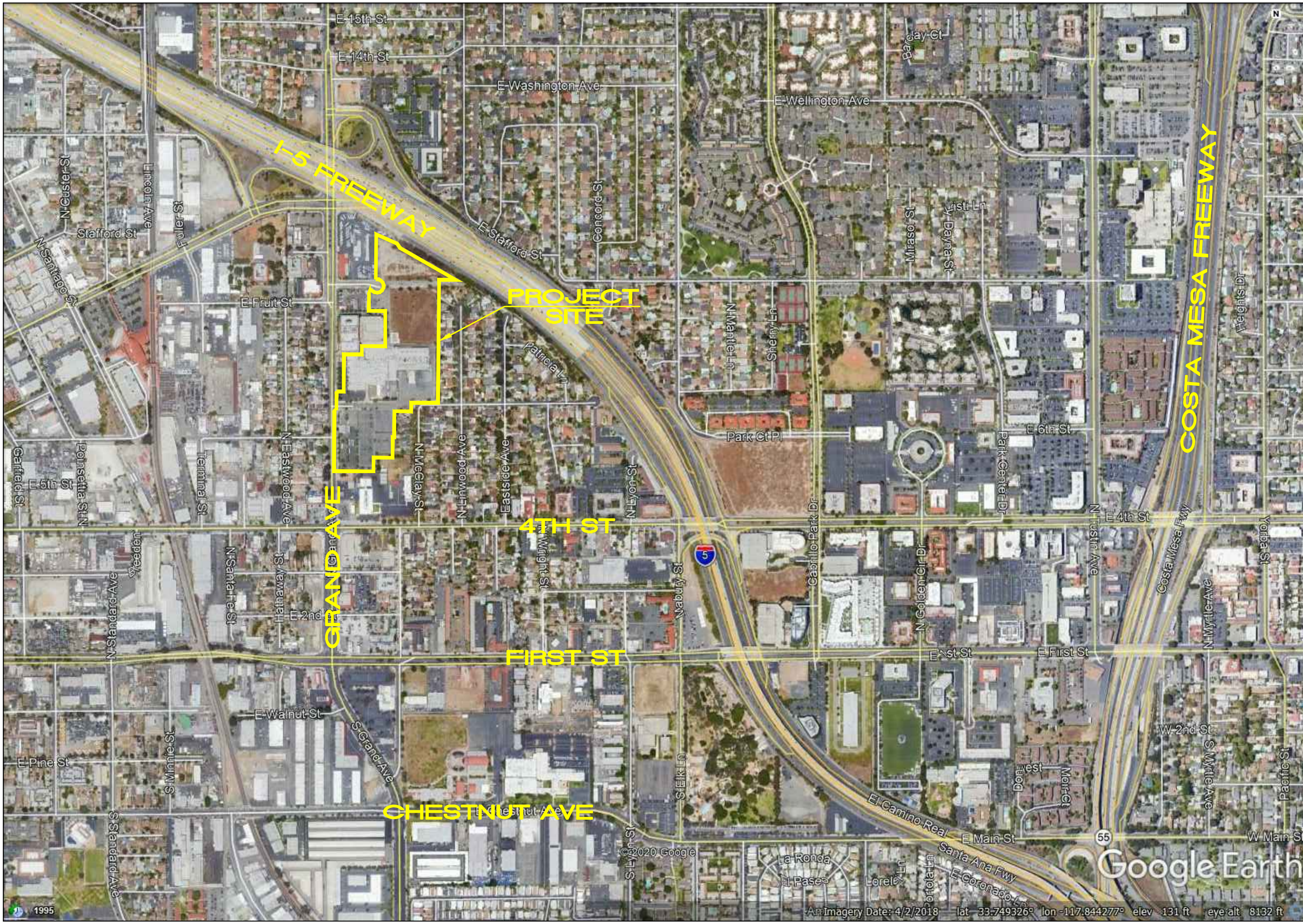
- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.



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

VICINITY MAP

FOR

625 N. GRAND AVENUE
SANTA ANA, CA

NOT TO SCALE

LEGEND

1. N13 HOUSEKEEPING OF LOADING DOCKS
2. N15 VACUUM SWEEPING PARKING LOTS
3. N14 COMMON AREA CATCH BASIN INSPECTION
4. N3 COMMON AREA LANDSCAPE MANAGEMENT
   S4 EFFICIENT IRRIGATION
5. BIO CLEAN – MODULAR WETLANDS SYSTEM
6. S1 CATCH BASIN STENCIL
   "NO DUMPING–THIS DRAINS TO RIVER"
7. SUMP PUMP
8. CB/RD DRAIN INSERT(S)
9. S3 TRASH ENCLOSURE
10. DIVERSION MANHOLE PER DETAIL
11. UNDERGROUND DETENTION SYSTEM
    UTILIZED FOR HCOC AND 100-YEAR STORM EVENTS
12. N1 EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPS
13. BIO CLEAN DEBRIS SEPARATION BAFFLE BOX (PRETREATMENT)
14. BIO CLEAN DVERT SYSTEM

BOUNDARY
DRAINAGE AREAS
FLOW LINE
RD ROOF DRAIN
SD FLOW LINE
DMA 1
DMA 2
DMA 3
AREAS DRAINING OFFSITE WITHOUT TREATMENT
LANDSCAPE

TOTAL AREA: 16.45 ACRES
IMPERVIOUS AREA: 508,867 SF
PERVIOUS AREA: 95,210 SF
BUILDING AREA: 112,485 SF

DMA	BMP	Latitude Coordinates	Longitude Coordinates
DMA 1	MWS #1	33.752533	-117.850540
DMA 2	MWS #2	33.749510	-117.851622
DMA 3	MWS #3	33.749206	-117.851599
DMA 1	DRAIN INSERT #1	33.752788	-117.849651
DMA 1	DRAIN INSERT #2	33.752779	-117.849976
DMA 1	DRAIN INSERT #3	33.752600	-117.850465
DMA 1	DRAIN INSERT #4	33.752501	-117.850400
DMA 2	DSBB #1	33.749621	-117.851134

MWS #	Area (ac)	Tc (mins)	i (in/hr)	imp	C	SQDF (cfs)	Modular Wetlands			
							Treatment Per Unit (cfs)	QTY	Model	Total Treatment (cfs)
1	3.00	5.0	0.263	0.78	0.735	0.579	0.594	1	MWS-L-8-20-V @3.5'	0.594
2	12.90	5.0	0.263	0.88	0.810	2.743	0.577	5	MWS-L-8-20-V @3.4'	2.885
3	0.30	5.0	0.263	0.72	0.690	0.054	0.055	1	MWS-L-4-4-V @3.6'	0.055

SUITABILITY / FEASIBILITY CONSTRAINTS
INFILTRATION TESTING RESULTED IN LOW INFILTRATION RATES. THIS CONSTRAINT LIMITS THE PROJECT SITE FROM USING RETENTION-BASED STORMWATER QUALITY CONTROL MEASURES TO MEET LID REQUIREMENTS. INSTEAD, THE PROJECT PROPOSES TO TREAT THE TREATMENT FLOWRATE VIA FLOW-BASED PROPRIETARY BIOFILTRATION SYSTEMS TO MEET LID REQUIREMENTS.

0 25 50 100 150
SCALE: 1"=50'

REGISTERED PROFESSIONAL ENGINEER
REINHARD STENZEL
R.C.E. NO. 56155
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

P0110396

CITY OF SANTA ANA
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP
DUR2 SANTA ANA
511 N. GRAND AVENUE
SANTA ANA, CA

DP #2020-20

PREPARED FOR:
PDC OC/IE LLC
2442 DUPONT DRIVE
IRVINE, CA 92612
PHONE: (949) 275-4202

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 5 Sheets

3892/1 OF 5 SHEETS

Last Update: 2/26/21
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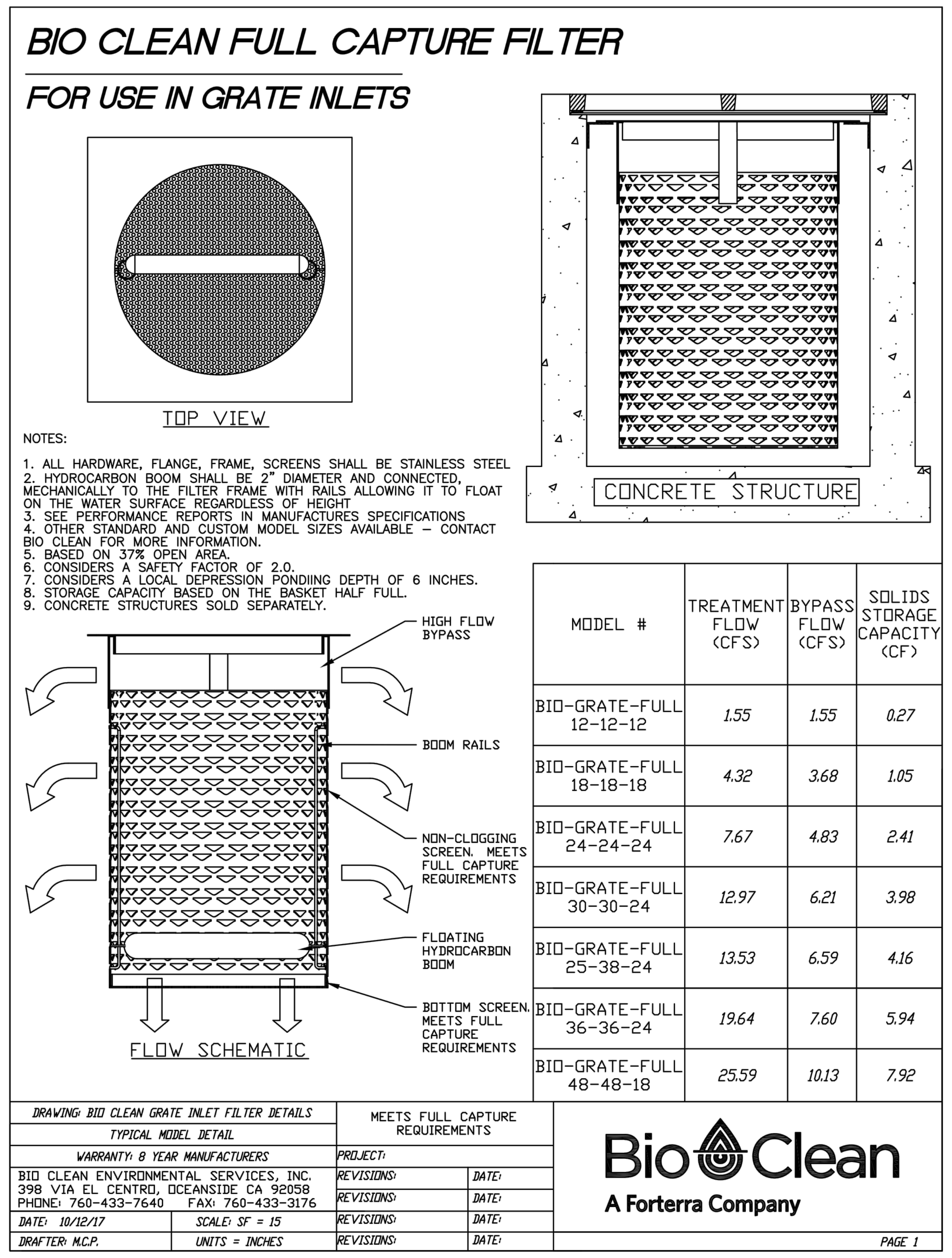
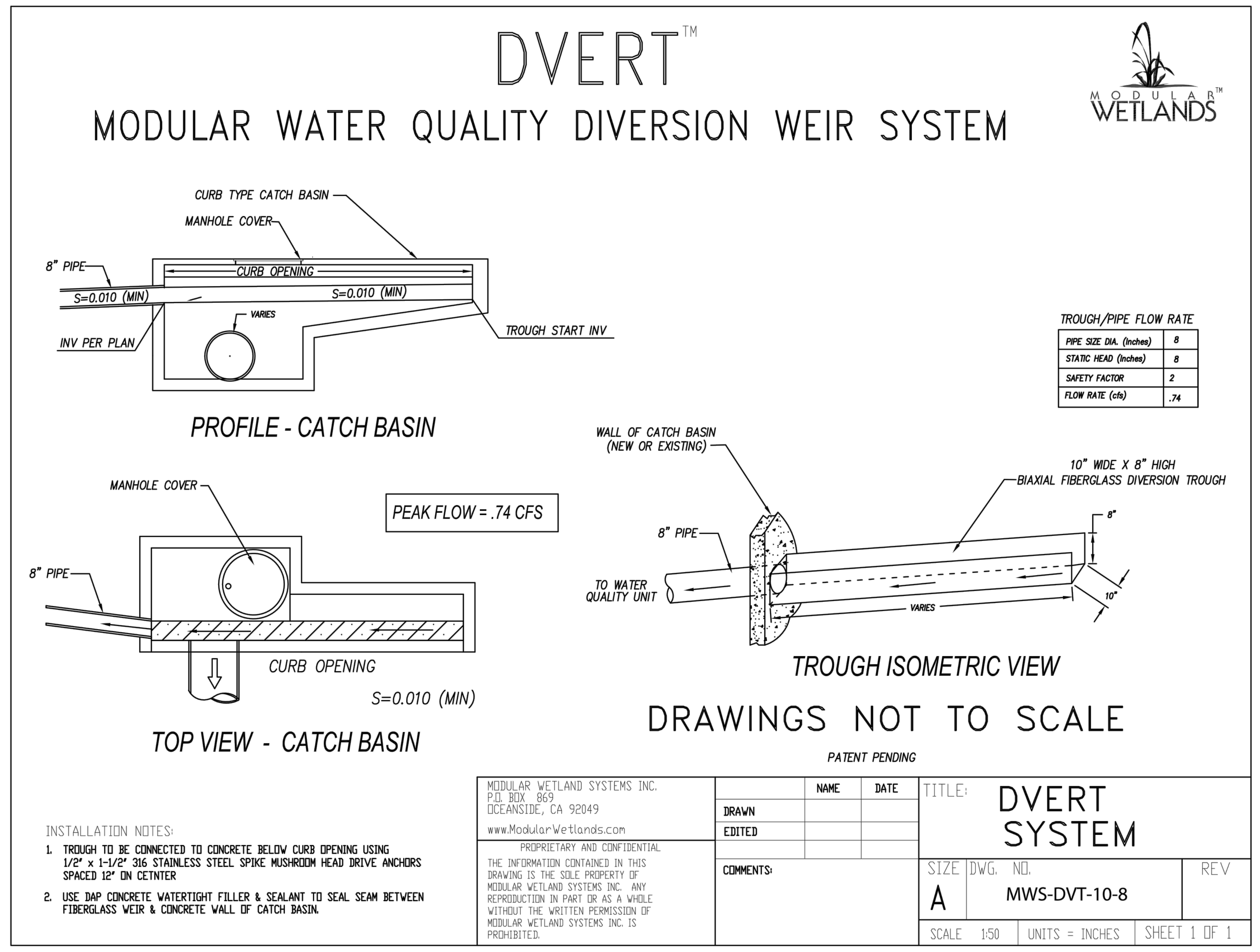
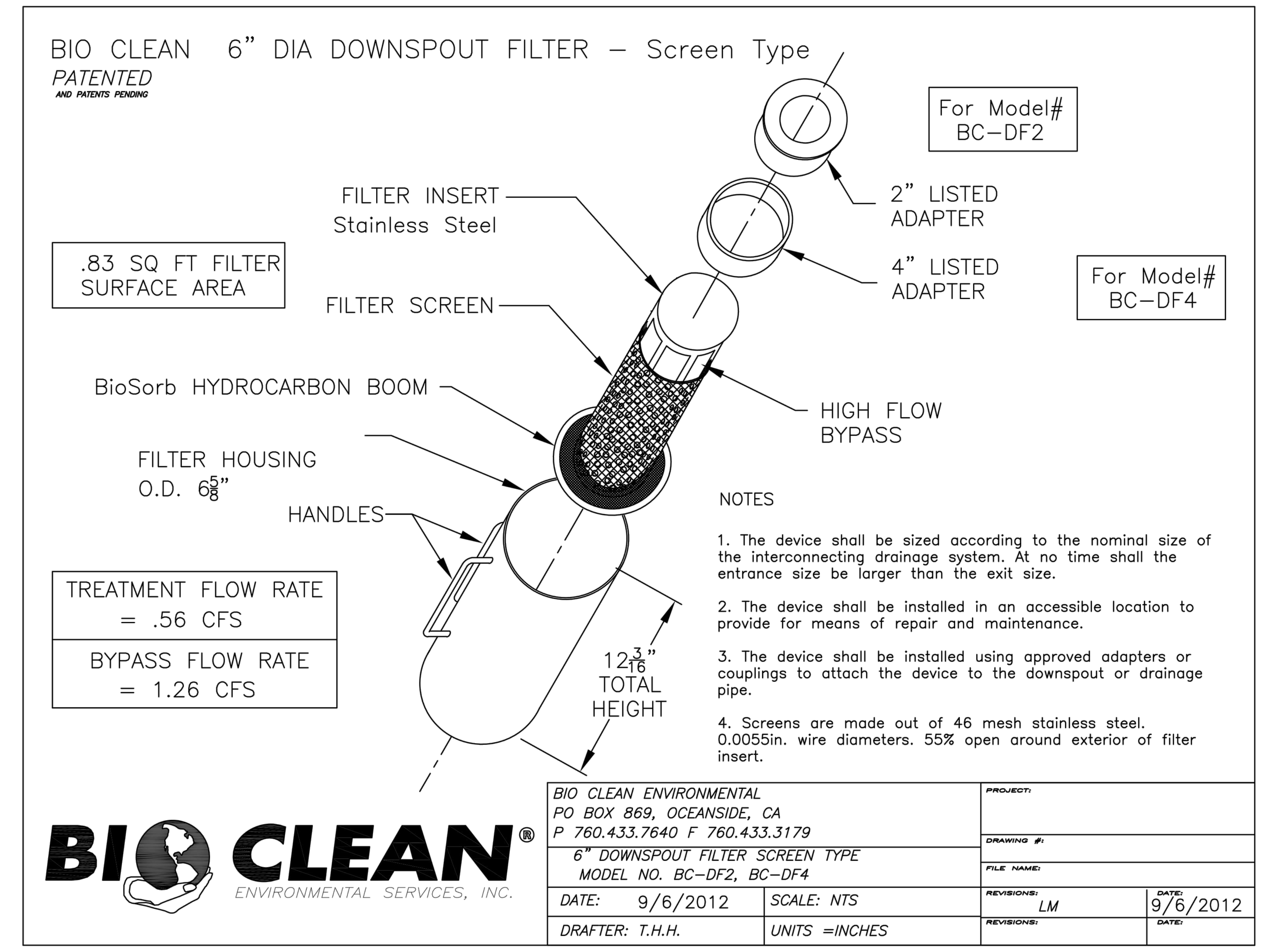


MODEL #	TREATMENT FLOW (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.55	1.55	0.27
BIO-GRATE-FULL 18-18-18	4.32	3.68	1.05
BIO-GRATE-FULL 24-24-24	7.67	4.83	2.41
BIO-GRATE-FULL 30-30-24	12.97	6.21	3.98
BIO-GRATE-FULL 25-38-24	13.53	6.59	4.16
BIO-GRATE-FULL 36-36-24	19.64	7.60	5.94
BIO-GRATE-FULL 48-48-18	25.59	10.13	7.92

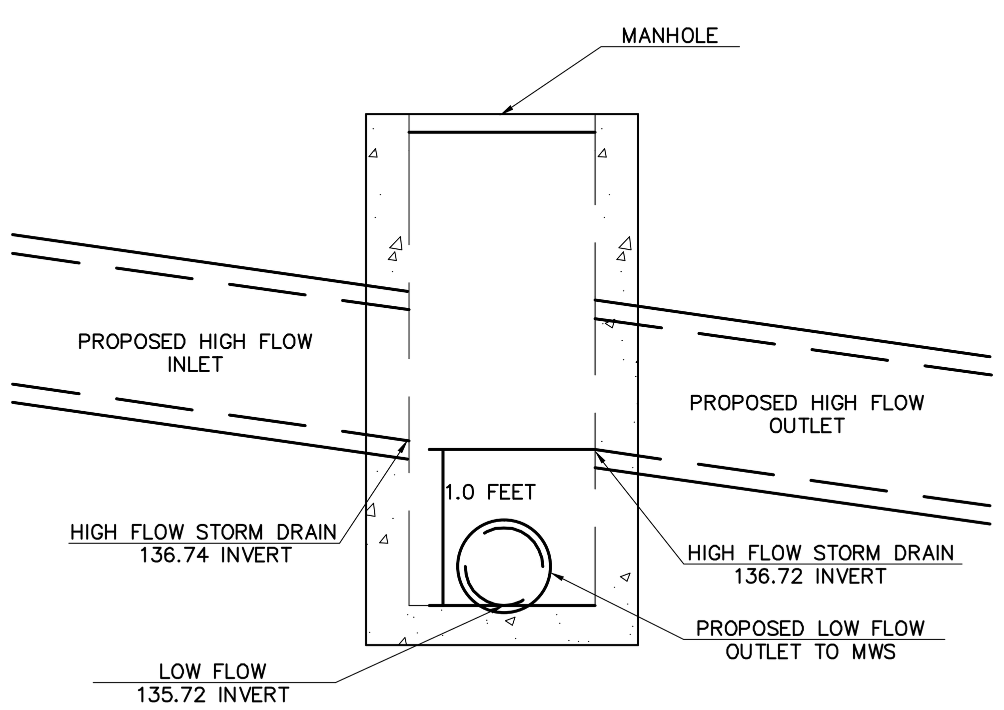
8 GRATED INLET DRAIN INSERT



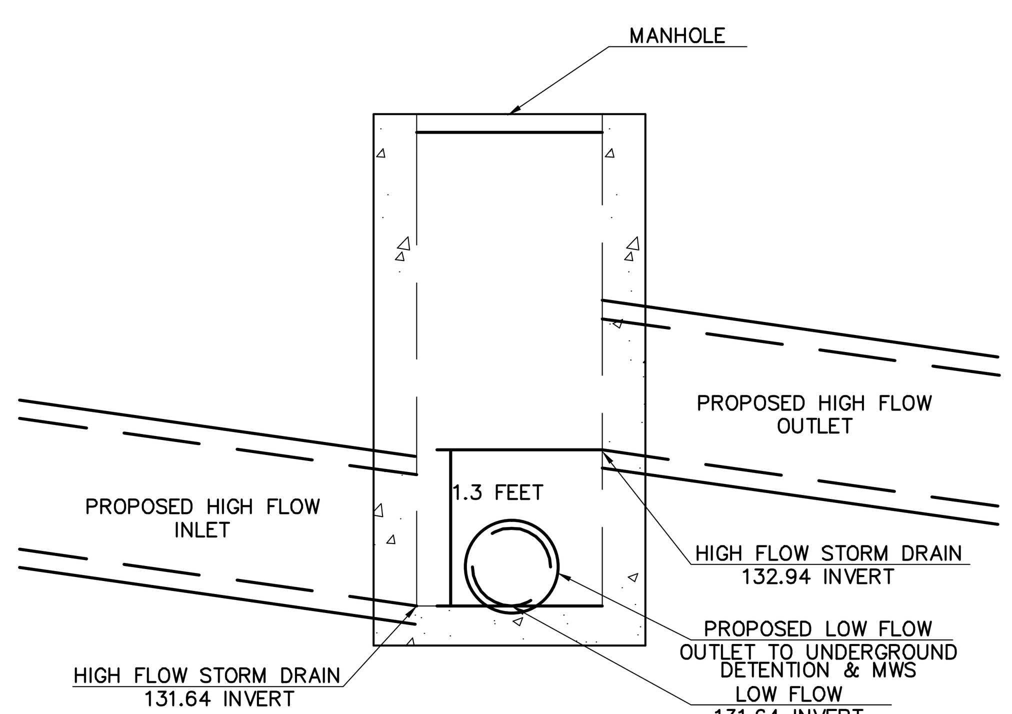
14 DVERT SYSTEM (DMA 3)



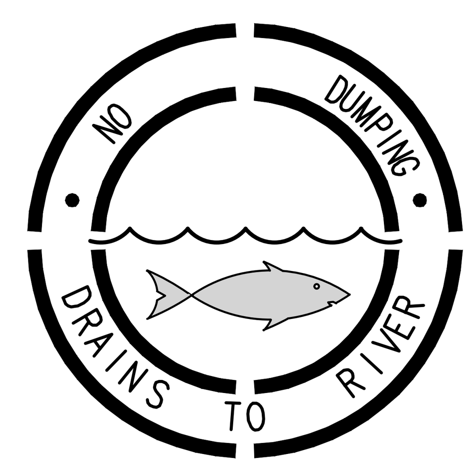
8 ROOF DRAIN INSERT



10 DIVERSION MANHOLE STRUCTURE "B" (DMA 1)



10 DIVERSION MANHOLE STRUCTURE "A" (DMA 2)



6 STORM DRAIN STENCIL
N.T.S.

P0110396

CITY OF SANTA ANA
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP
DUR2 SANTA ANA
511 N. GRAND AVENUE
SANTA ANA, CA

DP #2020-20

PREPARED FOR:
PDC OC/IE LLC
2442 DUPONT DRIVE
IRVINE, CA 92612
PHONE: (949) 275-4202

PREPARED BY:
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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 5 Sheets

3892/2 OF 5 SHEETS

Last Update: 2/26/21
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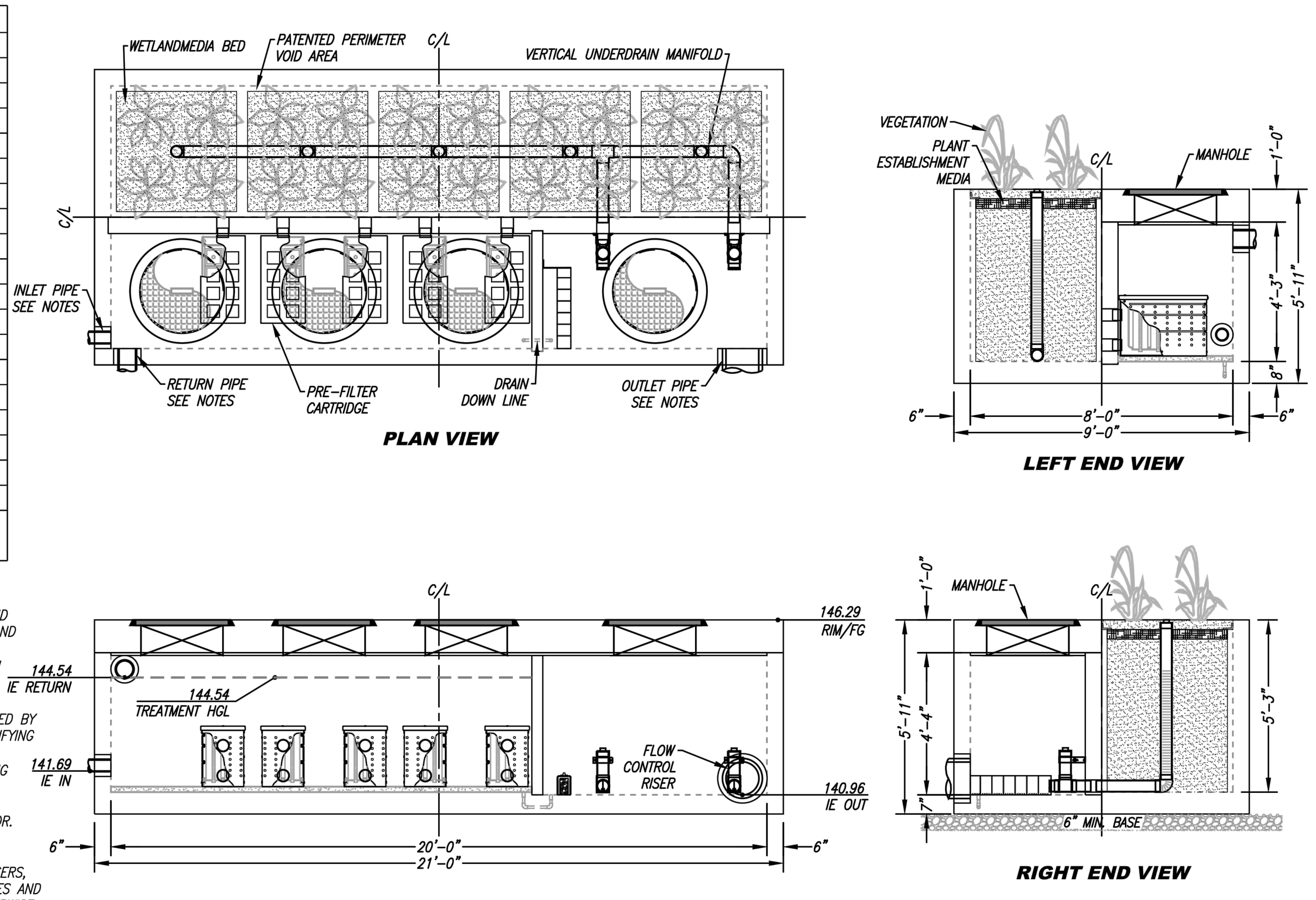
SITE SPECIFIC DATA			
PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #1	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.594	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	141.69	PVC	4"
RETURN PIPE	144.54	PVC	6"
OUTLET PIPE	140.96	HDPE	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	146.29	146.29	146.29
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø30"
WETLANDMEDIA VOLUME (CY)			13.30
ORIFICE SIZE (DIA. INCHES)			ø2.44 EA
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



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 MANUFACTURERS' 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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

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 BIO CLEAN.

LOW INFLOW PIPE DISCLOSURE:

IT IS RECOMMENDED THAT A SUFFICIENT VARIATION IN ELEVATION BETWEEN THE INLET AND OUTLET BE PROVIDED TO ALLOW FOR ACCUMULATION OF SEDIMENT IN THE PRE-TREATMENT CHAMBER. FAILURE TO DO SO MAY RESULT IN BLOCKAGE AT INFLOW POINT(S) WHICH MAY CAUSE UPSTREAM FLOODING.

TREATMENT FLOW (CFS)	0.594
OPERATING HEAD (FT)	3.5
PRETREATMENT LOADING RATE (GPM/SF)	2.1
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

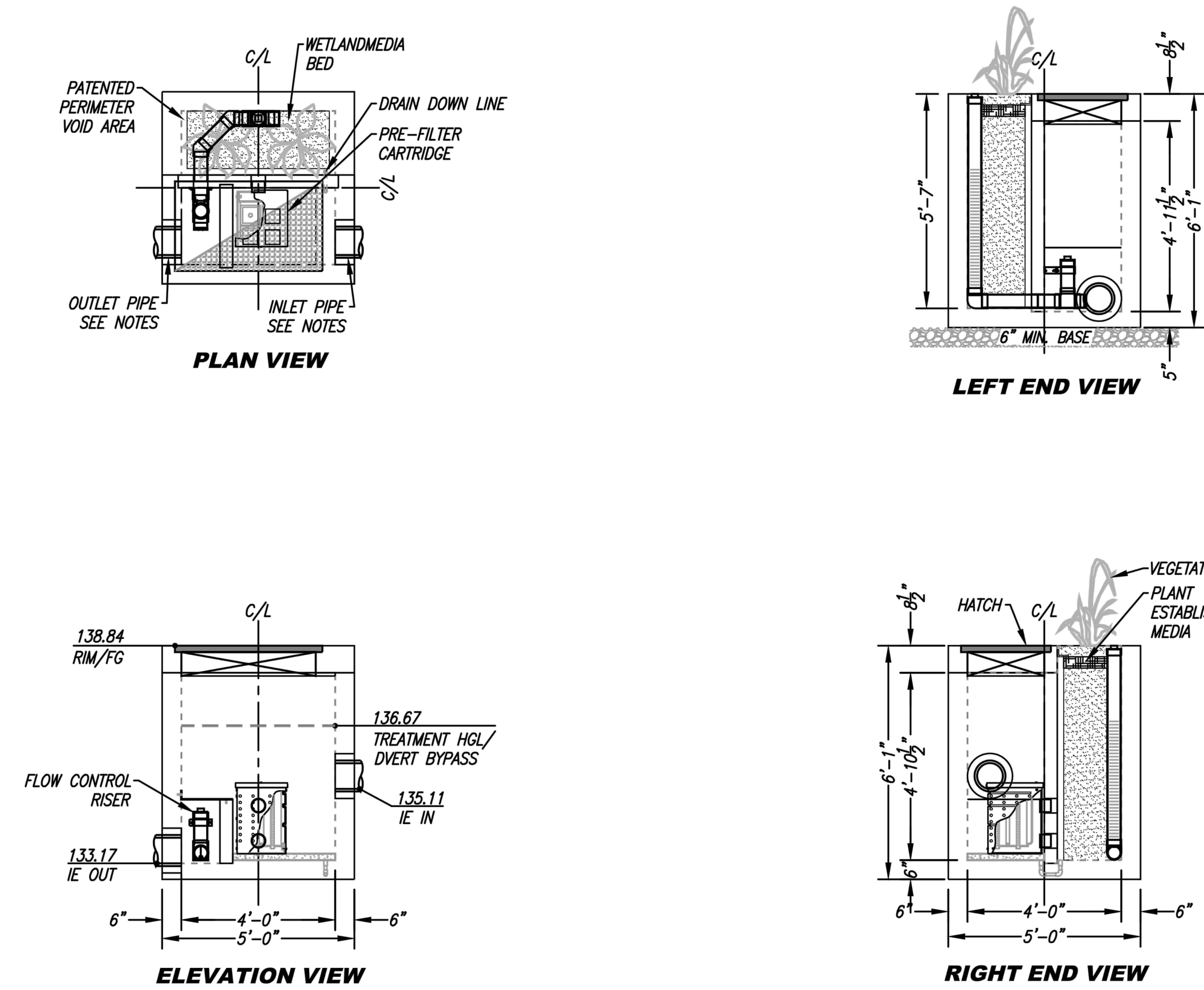
Bio Clean A Forterra Company

MWS-L-8-20-5'-3"-V-HC
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

2/25/21MWOOLERY

5 MODULAR WETLAND SYSTEM (DMA 1)

SITE SPECIFIC DATA			
PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #3	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.054	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			DVERT
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	135.11	HDPE	8"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	133.17	HDPE	8"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	138.84	138.84	138.84
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	24" X 42"	OPEN PLANTER	N/A
WETLANDMEDIA VOLUME (CY)			1.15
ORIFICE SIZE (DIA. INCHES)			ø1.04"
NOTES: PRELIMINARY NOT FOR CONSTRUCTION. DVERT INV-OUT OF CATCH BASIN MUST BE SET AT 136.00. DVERT LENGTH 5'.			



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 MANUFACTURERS' 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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

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 BIO CLEAN.

TREATMENT FLOW (CFS)	0.054
OPERATING HEAD (FT)	3.5
PRETREATMENT LOADING RATE (GPM/SF)	1.9
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

Bio Clean A Forterra Company

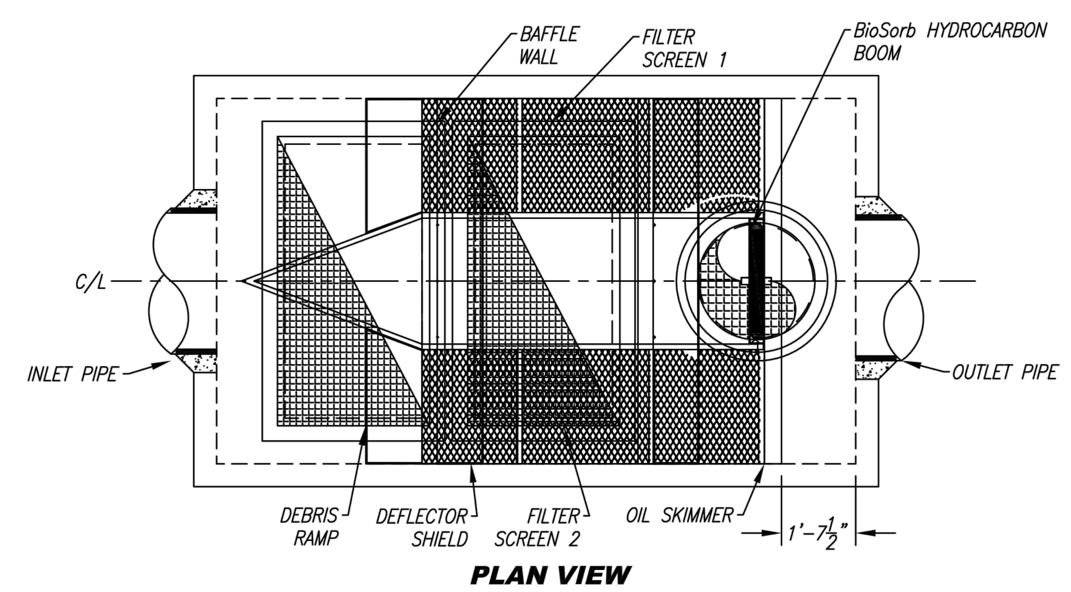
MWS-L-4-4-5'-7"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

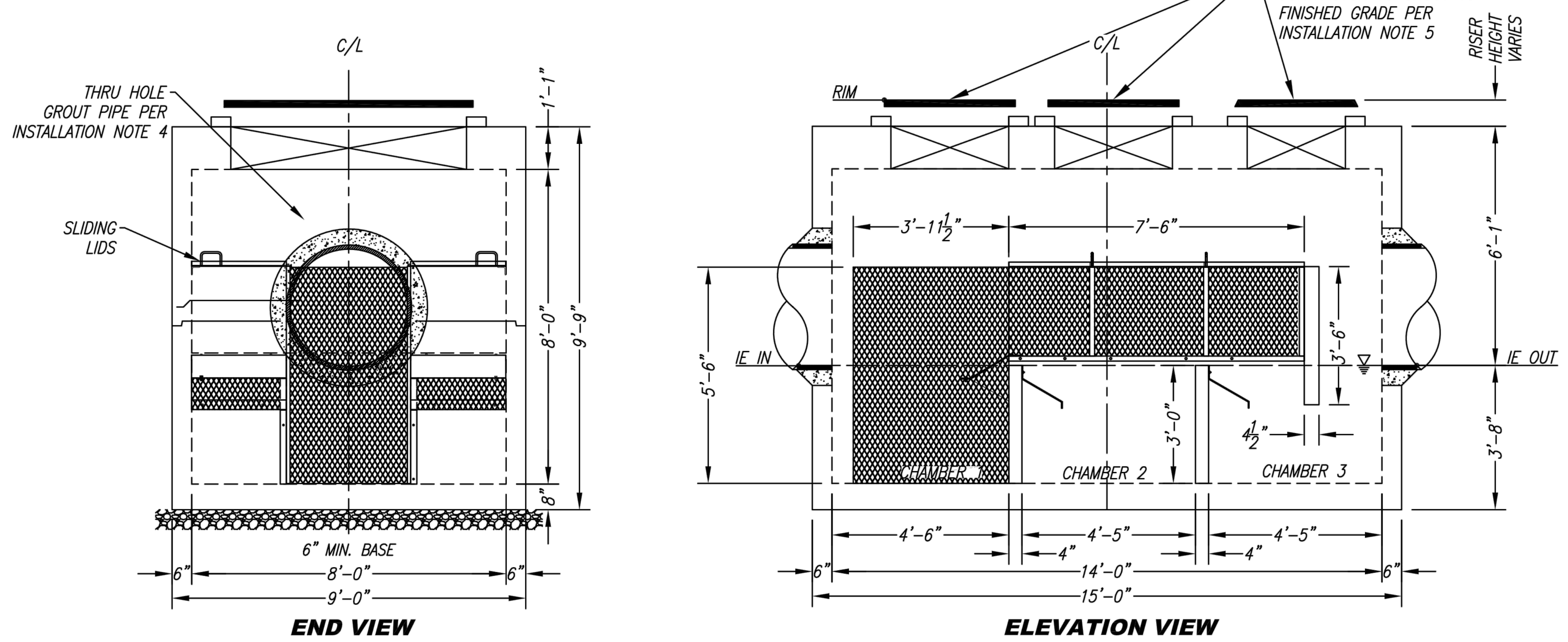
5 MODULAR WETLAND SYSTEM (DMA 3)

SITE SPECIFIC DATA			
PROJECT NUMBER	TEI 3892		
PROJECT NAME	625 N. Grand Avenue		
PROJECT LOCATION	Santa Ana, CA		
STRUCTURE ID			
TREATMENT REQUIRED			
WATER QUALITY FLOW RATE (CFS)		2.75	
PEAK FLOW RATE (CFS)		55	
PEAK STORM DURATION (YEARS)		100	
PIPE & ELEVATION DATA			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE	PER PLAN	PER PLAN	36"
OUTLET PIPE	PER PLAN	PER PLAN	36"
RIM ELEVATION	PER PLAN		
LOADING & SOIL DATA			
SURFACE LOADING		H-20	
FRAME & COVER		(1) ø30" (2) 3' X 6' HATCH	
CORROSIVE SOIL CONDITIONS		MILDLY CORROSIVE	
GROUNDWATER ELEVATION		40' + BELOW	
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.			

DSBB PERFORMANCE DATA	
TREATMENT FLOW RATE (CFS)	8.06
SETTLING AREA (SF)	96.0
LOADING RATE (GPM/SF)	####
SCREEN SYSTEM STORAGE CAPACITY (CF)	84.38
SEDIMENT STORAGE CAPACITY (CF)	324.00
80% TSS REMOVAL @ 126 MICRON	

DSBB STORAGE CAPACITIES				
CAGE SCREEN CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
SCREEN 1	7.50	2.50	2.25	42.19
SCREEN 2	7.50	2.50	2.25	42.19
SEDIMENT CHAMBER CAPACITY				
CHAMBER 1	4.50	8.00	3.00	108.00
CHAMBER 2	4.42	8.00	3.00	108.00
CHAMBER 3	4.50	8.00	3.00	108.00





GENERAL NOTES

1. BIO CLEAN 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 BIO CLEAN.
3. LIDS FOR SCREEN SYSTEM & ALTERNATIVE HATCHES AVAILABLE UPON REQUEST.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE DSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"–12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

5/3/18SSERTICH

Bio Clean A Forterra Company

DSBB-8-14-96
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

13 DEBRIS SEPARATING BAFFLE BOX (DMA 2)

P0110396

CITY OF SANTA ANA

PUBLIC WORKS DEPARTMENT

WQMP SITE MAP

DUR2 SANTA ANA
511 N. GRAND AVENUE
SANTA ANA, CA

DP #2020-20

PREPARED FOR:

PDC OC/IE LLC
2442 DUPONT DRIVE
IRVINE, CA 92612
PHONE: (949) 275-4202

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. ______

Last Update: 2/26/21
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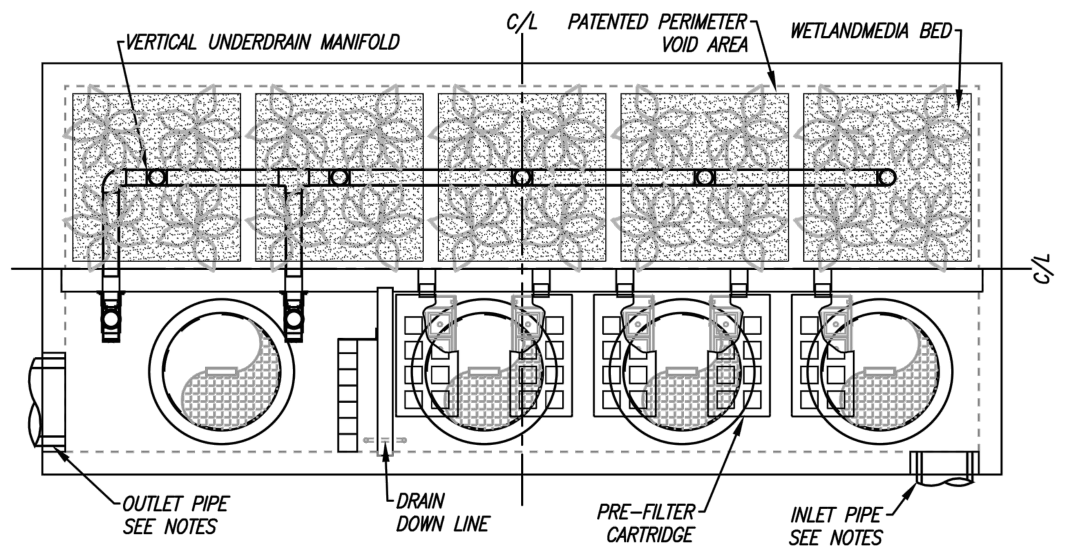
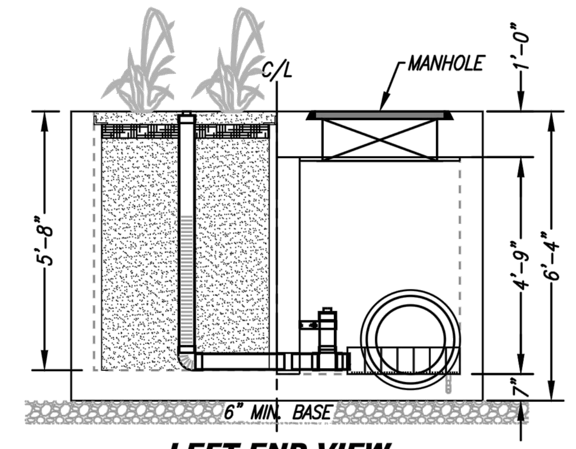
SITE SPECIFIC DATA

PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #2A	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.549	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	137.18	HDPE	12"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	136.43	HDPE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	142.18	142.18	142.18
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø30"
WETLANDMEDIA VOLUME (CY)			14.37
ORIFICE SIZE (DIA. INCHES)			ø2.40 EA

NOTES: PRELIMINARY NOT FOR CONSTRUCTION. TOTAL TREATMENT FLOW 2.743 CFS IS SPLIT EQUALLY BETWEEN FIVE MWS UNITS.



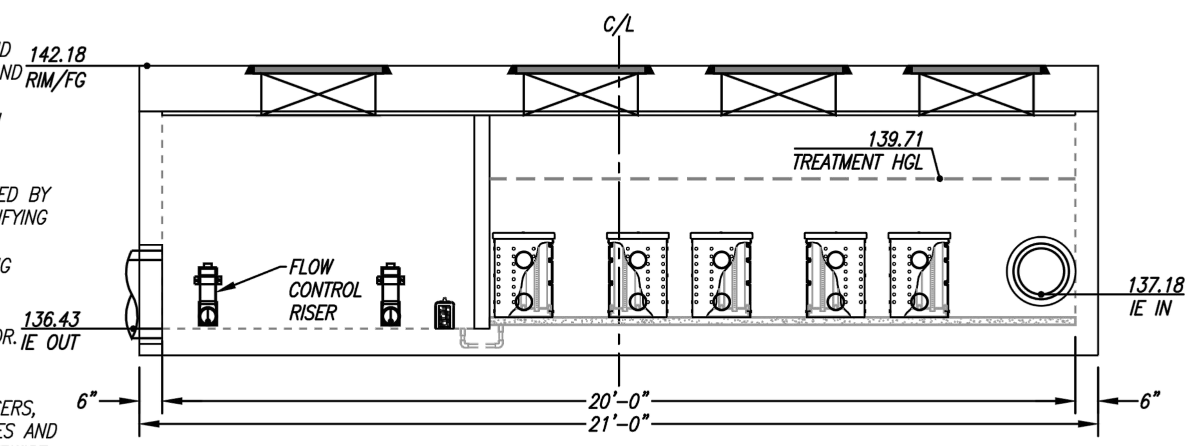
PLAN VIEW



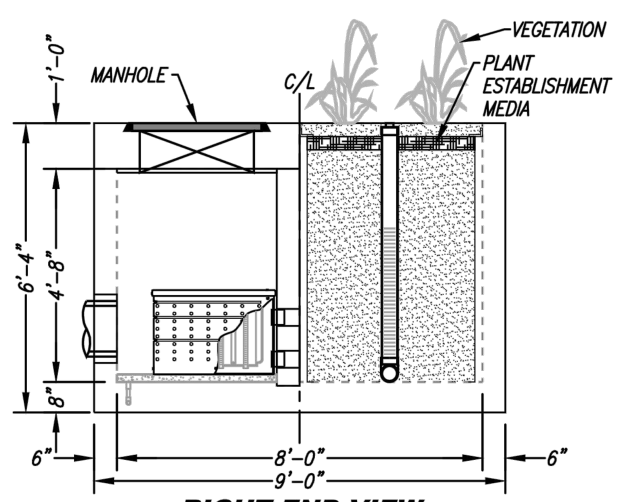
LEFT END VIEW

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 MANUFACTURERS' 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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.



ELEVATION VIEW



RIGHT END VIEW

LOW INFLOW PIPE DISCLOSURE:

IT IS RECOMMENDED THAT A SUFFICIENT VARIATION IN ELEVATION BETWEEN THE INLET AND OUTLET BE PROVIDED TO ALLOW FOR ACCUMULATION OF SEDIMENT IN THE PRE-TREATMENT CHAMBER. FAILURE TO DO SO MAY RESULT IN BLOCKAGE AT INFLOW POINT(S) WHICH MAY CAUSE UPSTREAM FLOODING.

TREATMENT FLOW (CFS)	0.549
OPERATING HEAD (FT)	3.2
PRETREATMENT LOADING RATE (GPM/SF)	1.9
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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 BIO CLEAN.

2/25/21MWOOLERY

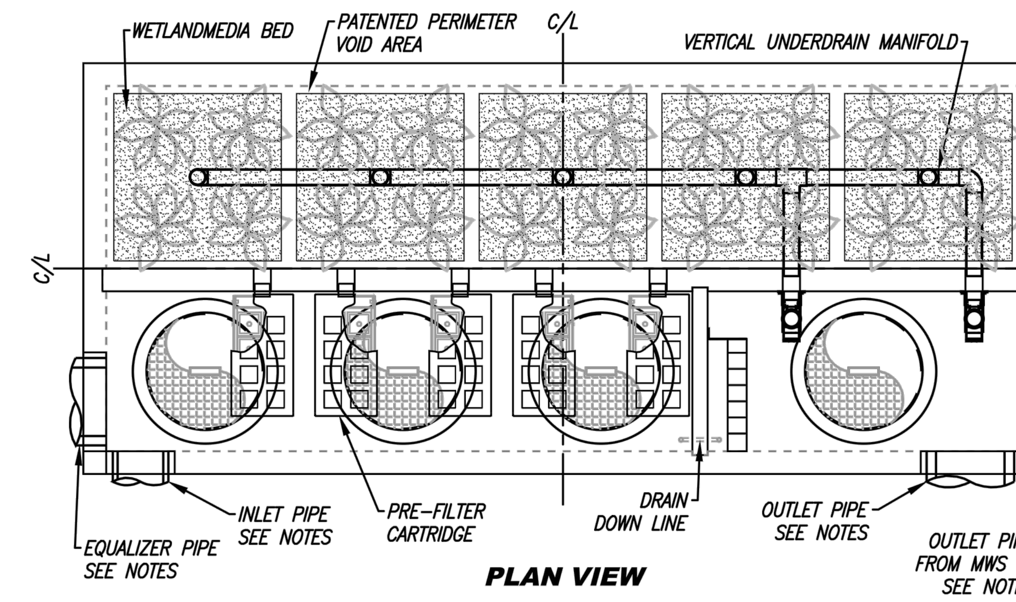
MWS-L-8-20-5'-8"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

(5) MODULAR WETLAND SYSTEM (DMA 2A)

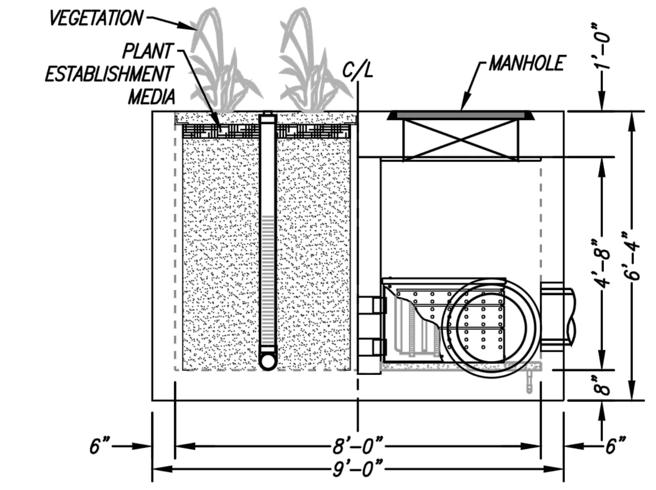
SITE SPECIFIC DATA

PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #2B	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.549	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	137.18	HDPE	12"
EQUALIZER PIPE	136.68	HDPE	18"
MWS 2A OUTLET	136.43	HDPE	18"
OUTLET PIPE	136.43	HPDE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	142.18	142.18	142.18
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø30"
WETLANDMEDIA VOLUME (CY)			14.37
ORIFICE SIZE (DIA. INCHES)			ø2.40 EA

NOTES: PRELIMINARY NOT FOR CONSTRUCTION. TOTAL TREATMENT FLOW 2.743 CFS IS SPLIT EQUALLY BETWEEN FIVE MWS UNITS.



PLAN VIEW



LEFT END VIEW

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 MANUFACTURERS' 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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
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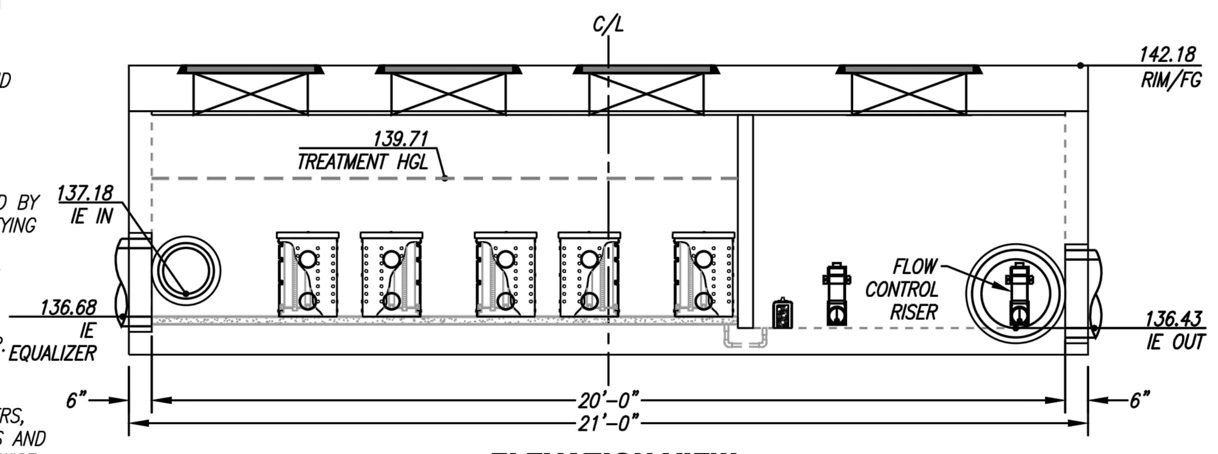
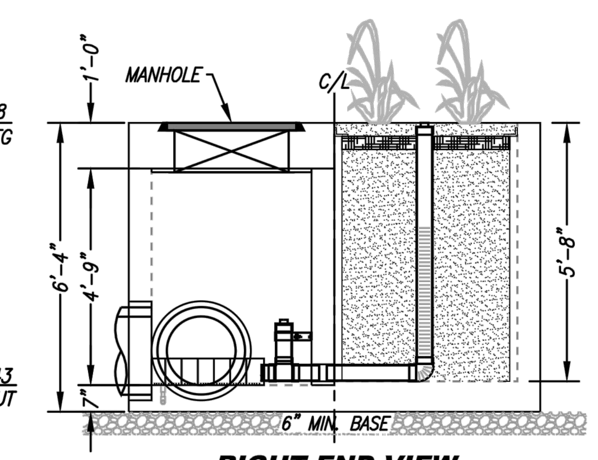


ELEVATION VIEW



RIGHT END VIEW

LOW INFLOW PIPE DISCLOSURE:

IT IS RECOMMENDED THAT A SUFFICIENT VARIATION IN ELEVATION BETWEEN THE INLET AND OUTLET BE PROVIDED TO ALLOW FOR ACCUMULATION OF SEDIMENT IN THE PRE-TREATMENT CHAMBER. FAILURE TO DO SO MAY RESULT IN BLOCKAGE AT INFLOW POINT(S) WHICH MAY CAUSE UPSTREAM FLOODING.

TREATMENT FLOW (CFS)	0.549
OPERATING HEAD (FT)	3.2
PRETREATMENT LOADING RATE (GPM/SF)	1.9
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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 BIO CLEAN.

2/25/21MWOOLERY

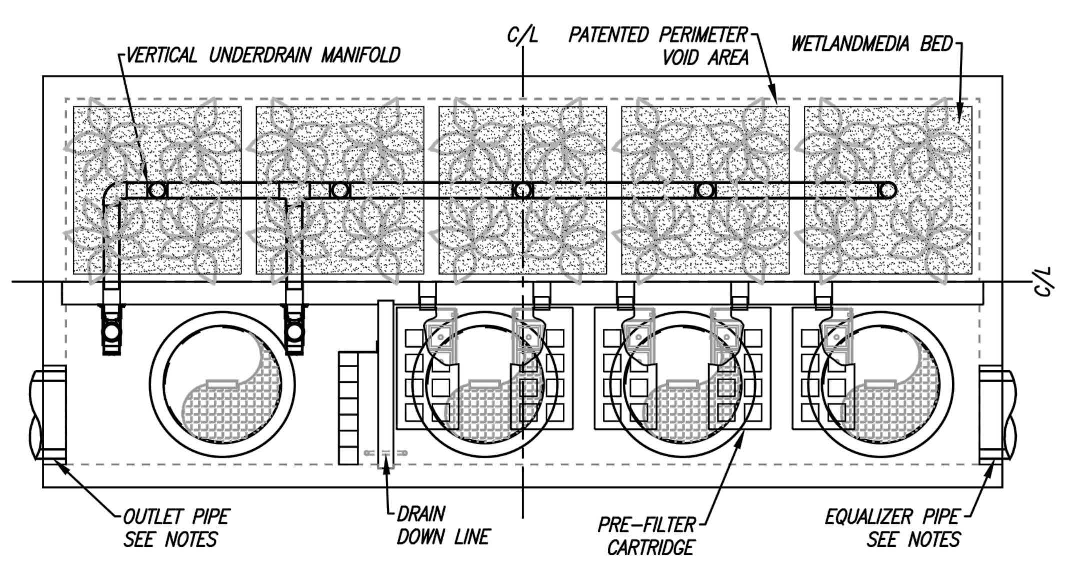
MWS-L-8-20-5'-8"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

(5) MODULAR WETLAND SYSTEM (DMA 2B)

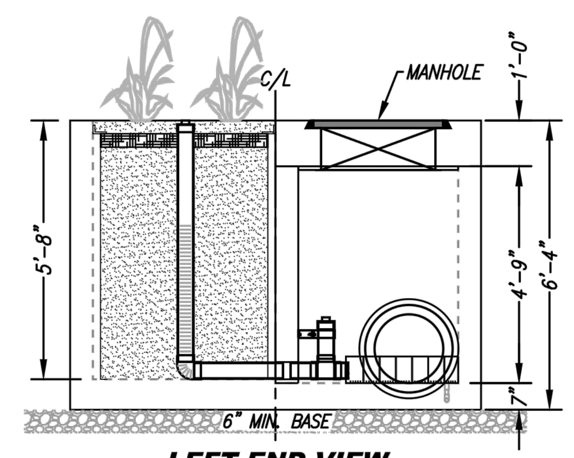
SITE SPECIFIC DATA

PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #2C	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.549	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
EQUALIZER PIPE	136.68	HDPE	18"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	136.43	HDPE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	142.18	142.18	142.18
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø30"
WETLANDMEDIA VOLUME (CY)			14.37
ORIFICE SIZE (DIA. INCHES)			ø2.40 EA

NOTES: PRELIMINARY NOT FOR CONSTRUCTION. TOTAL TREATMENT FLOW 2.743 CFS IS SPLIT EQUALLY BETWEEN FIVE MWS UNITS.



PLAN VIEW



LEFT END VIEW

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 MANUFACTURERS' 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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
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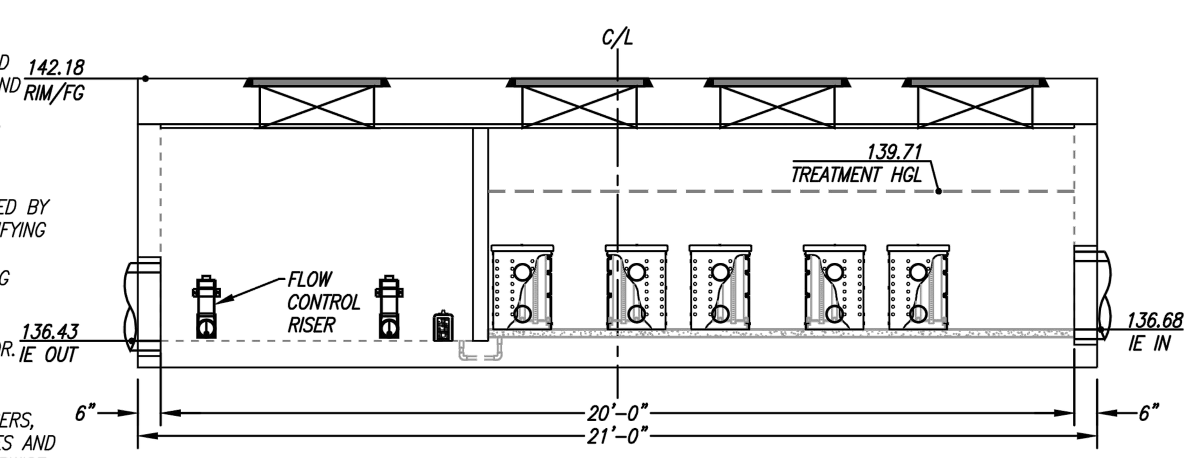
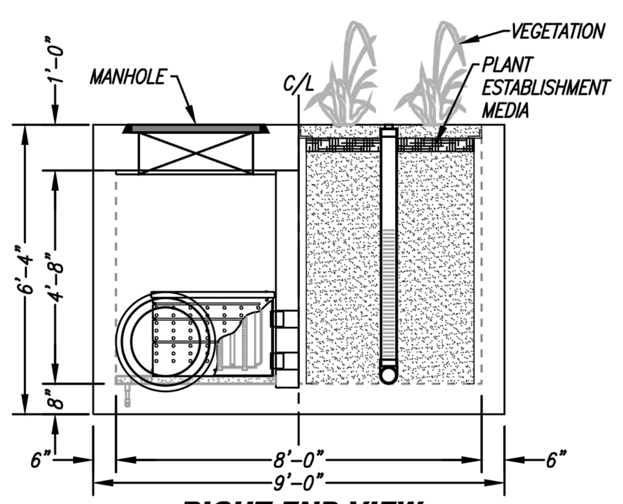


ELEVATION VIEW



RIGHT END VIEW

LOW INFLOW PIPE DISCLOSURE:

IT IS RECOMMENDED THAT A SUFFICIENT VARIATION IN ELEVATION BETWEEN THE INLET AND OUTLET BE PROVIDED TO ALLOW FOR ACCUMULATION OF SEDIMENT IN THE PRE-TREATMENT CHAMBER. FAILURE TO DO SO MAY RESULT IN BLOCKAGE AT INFLOW POINT(S) WHICH MAY CAUSE UPSTREAM FLOODING.

TREATMENT FLOW (CFS)	0.549
OPERATING HEAD (FT)	3.2
PRETREATMENT LOADING RATE (GPM/SF)	1.9
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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 BIO CLEAN.

2/25/21MWOOLERY

MWS-L-8-20-5'-8"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

(5) MODULAR WETLAND SYSTEM (DMA 2C)

P0110396

CITY OF SANTA ANA
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP
DUR2 SANTA ANA
511 N. GRAND AVENUE
SANTA ANA, CA

DP #2020-20

PREPARED FOR:

PDC OC/IE LLC
2442 DUPONT DRIVE
IRVINE, CA 92612
PHONE: (949) 275-4202

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. ______

Last Update: 2/26/21
O:\3800-3899\3892\3892BMPSITEMAP.dwg

SITE SPECIFIC DATA			
PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #2D	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.549	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	137.18	HDPE	12"
EQUALIZER PIPE	136.68	HDPE	18"
MWS 2C OUTLET	136.43	HDPE	18"
OUTLET PIPE	136.43	HPDE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	142.18	142.18	142.18
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø30"
WETLANDMEDIA VOLUME (CY)			14.37
ORIFICE SIZE (DIA. INCHES)			ø2.40 EA

NOTES: PRELIMINARY NOT FOR CONSTRUCTION. TOTAL TREATMENT FLOW 2.743 CFS IS SPLIT EQUALLY BETWEEN FIVE MWS UNITS.

INSTALLATION NOTES

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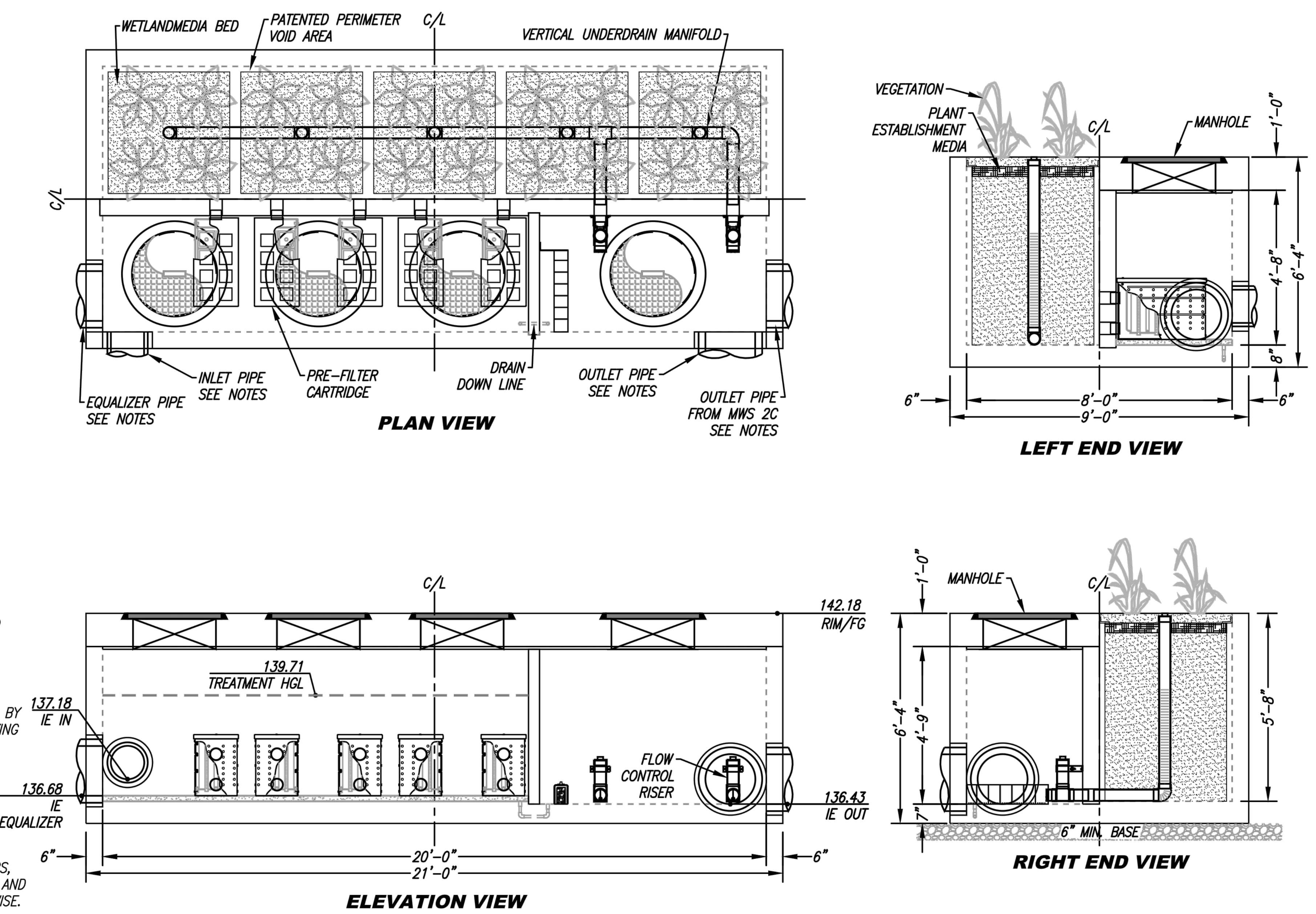
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

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 BIO CLEAN.

2/25/21MWOOLFERY



LOW INFLOW PIPE DISCLOSURE:

IT IS RECOMMENDED THAT A SUFFICIENT VARIATION IN ELEVATION BETWEEN THE INLET AND OUTLET BE PROVIDED TO ALLOW FOR ACCUMULATION OF SEDIMENT IN THE PRE-TREATMENT CHAMBER. FAILURE TO DO SO MAY RESULT IN BLOCKAGE AT INFLOW POINT(S) WHICH MAY CAUSE UPSTREAM FLOODING.

TREATMENT FLOW (CFS)	0.549
OPERATING HEAD (FT)	3.2
PRETREATMENT LOADING RATE (GPM/SF)	1.9
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:

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Bio Clean
A Forterra Company

MWS-L-8-20-5'-8"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5 **MODULAR WETLAND SYSTEM (DMA 2D)**

SITE SPECIFIC DATA			
PROJECT NUMBER		12081	
PROJECT NAME		511 N. GRAND AVE TEI 3892	
PROJECT LOCATION		SANTA ANA, CA	
STRUCTURE ID		MWS #2E	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.549	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
EQUALIZER PIPE	136.68	HDPE	18"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	136.43	HDPE	18"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	142.18	142.18	142.18
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø30"
WETLANDMEDIA VOLUME (CY)			14.37
ORIFICE SIZE (DIA. INCHES)			ø2.40 EA

NOTES: PRELIMINARY NOT FOR CONSTRUCTION. TOTAL TREATMENT FLOW 2.743 CFS IS SPLIT EQUALLY BETWEEN FIVE MWS UNITS.

INSTALLATION NOTES

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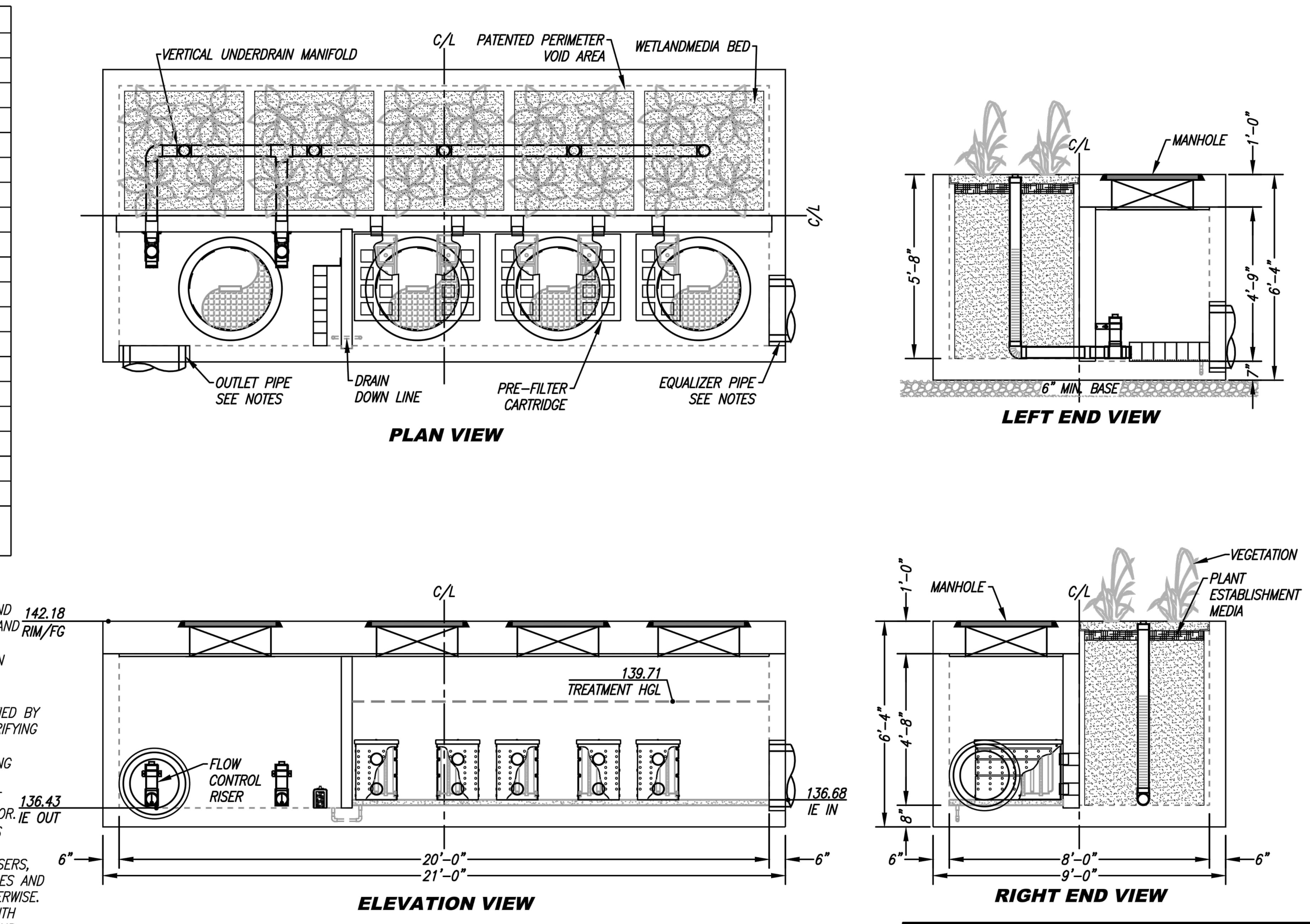
2/25/21MWOOLFERY



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OPERATING HEAD (FT)	3.2
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Bio Clean
A Forterra Company

MWS-L-8-20-5'-8"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5 **MODULAR WETLAND SYSTEM (DMA 2E)**

P0110396

CITY OF SANTA ANA
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP
DUR2 SANTA ANA
511 N. GRAND AVENUE
SANTA ANA, CA

DP #2020-20

PREPARED FOR:

PDC OC/IE LLC
2442 DUPONT DRIVE
IRVINE, CA 92612
PHONE: (949) 275-4202

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 5 of 5 Sheets

3892/5 OF 5 SHEETS

Last Update: 2/26/21
O:\3800-3899\3892\3892BMPSITEMAP.dwg

Section VII Educational Materials

Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☒
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☒
Household Tips	☐	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐	CASQA BMP Fact Sheets	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☐		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☒		☐
Tips for the Home Improvement Projects	☐		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☐		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☐		☐

ATTACHMENT A
EDUCATIONAL MATERIALS

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door

Never allow pollutants to enter the street, gutter or storm drain!

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

The Effect on the Ocean

Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

For More Information

Orange County Stormwater Program

California Environmental Protection Agency
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept.	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works	(949)	724-6315
La Habra Public Services	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality	(949)	497-0378
Laguna Hills Public Services	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev.	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works	(714)	379-9222 x204
Tustin Public Works/Engineering	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Printed on Recycled Paper

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

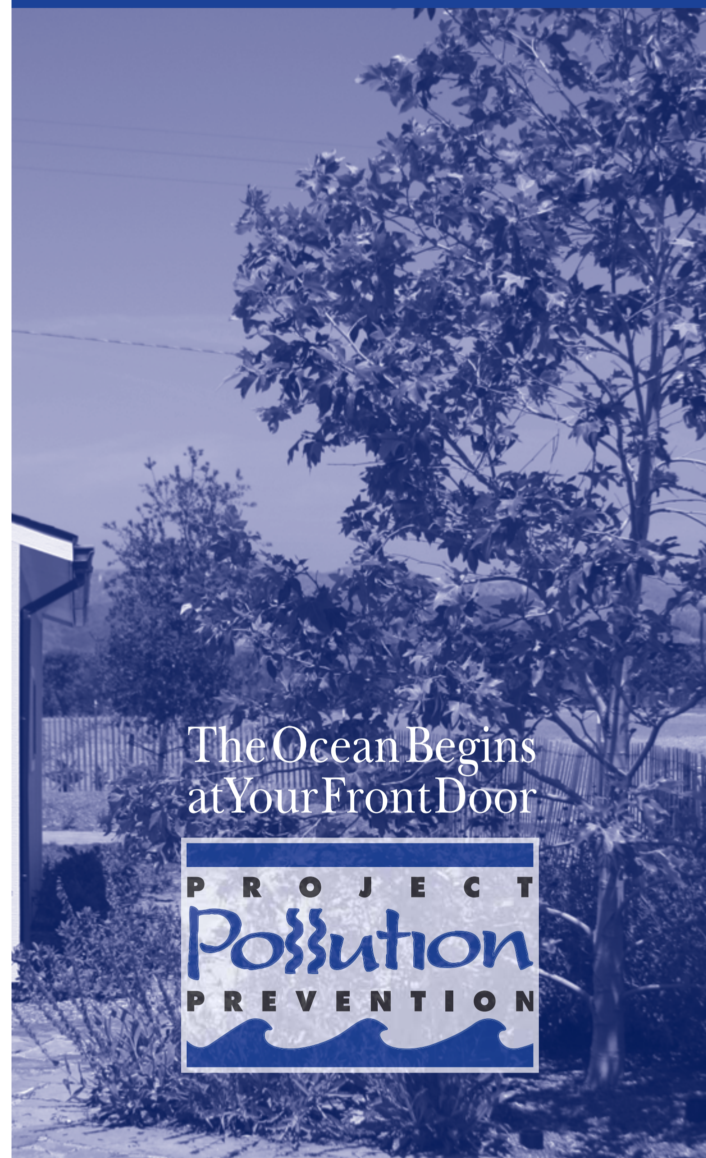
Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

Funding for this brochure has been provided in full or in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Prop. 13).

Printed on Recycled Paper

Help Prevent Ocean Pollution:

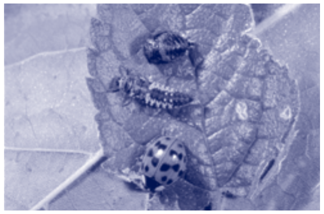
Responsible Pest Control



Tips for Pest Control

Key Steps to Follow:

Step 1: **Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.**



Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: **Determine how many pests are present and causing damage.**

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

Step 3: **If a pesticide must be used, choose the least toxic chemical.**

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: **Wear appropriate protective clothing.**

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: **Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.**

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

Step 6: **In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.**

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: **Properly store and dispose of unused pesticides.**

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste Collection Center
(714) 834-6752
www.oclandfills.com

PROJECT POLLUTION PREVENTION

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

Orange County Stormwater Program
24 Hour Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between \$500–\$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board
Santa Ana Region (951) 782-4130
San Diego Region (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than \$20,000) and/or imprisonment for not more than one year.

DTP113 Rev 4/06
printed on recycled paper

Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities

Orange County Sanitation District

Health Care Agency
Environmental Health

www.ocwatersheds.com

This brochure was designed courtesy of the Orange County Sanitation District (OCSD).
For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

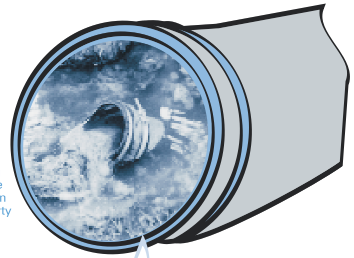
Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.



Overflowing cleanout pipe located on private property

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

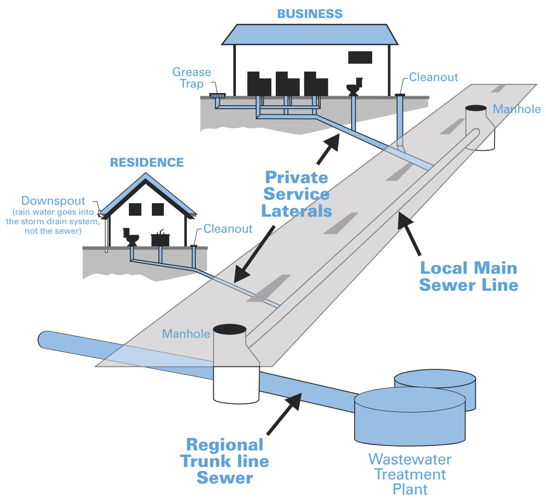
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.



How You Can Prevent Sewage Spills

1 **Never put grease down garbage disposals, drains or toilets.**

2 **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**

3 **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**

Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

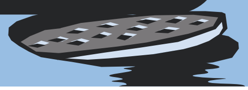
- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.



Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

UCCE Master Gardener Hotline:
(714) 708-1646

To report a spill,
call the
Orange County 24-Hour
Water Pollution Problem
Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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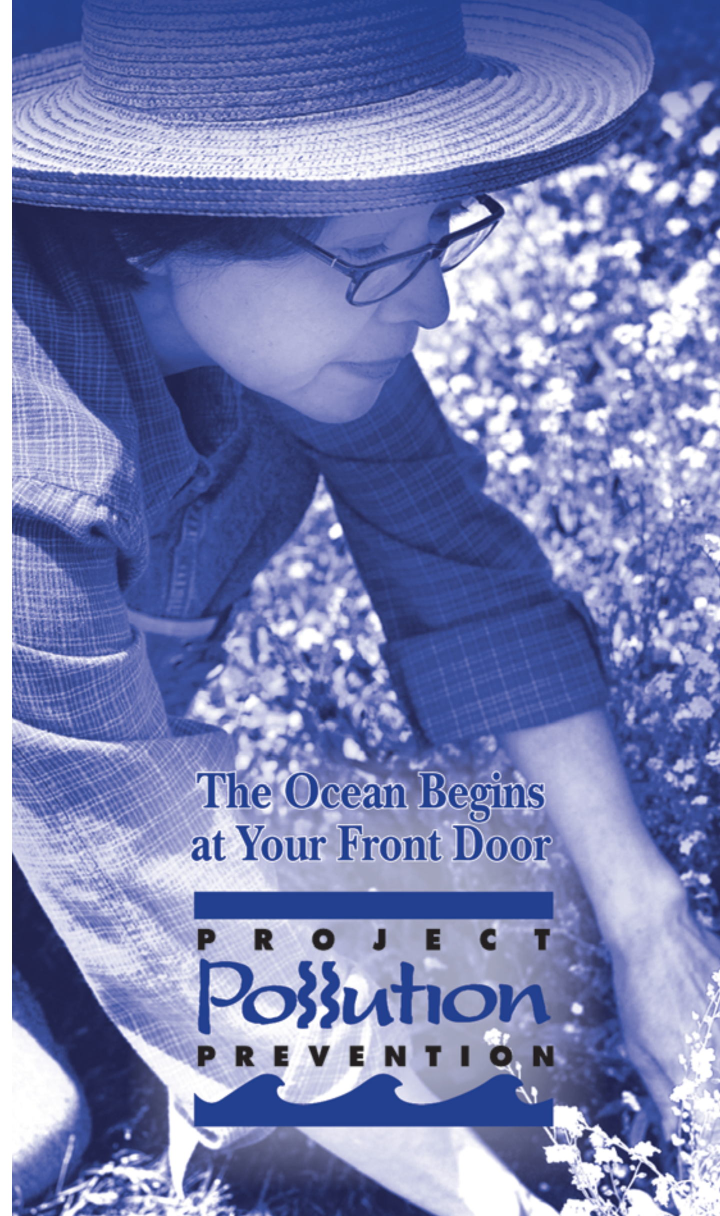
Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Materials and excess concrete or mortar can be blown or washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never throw building materials into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

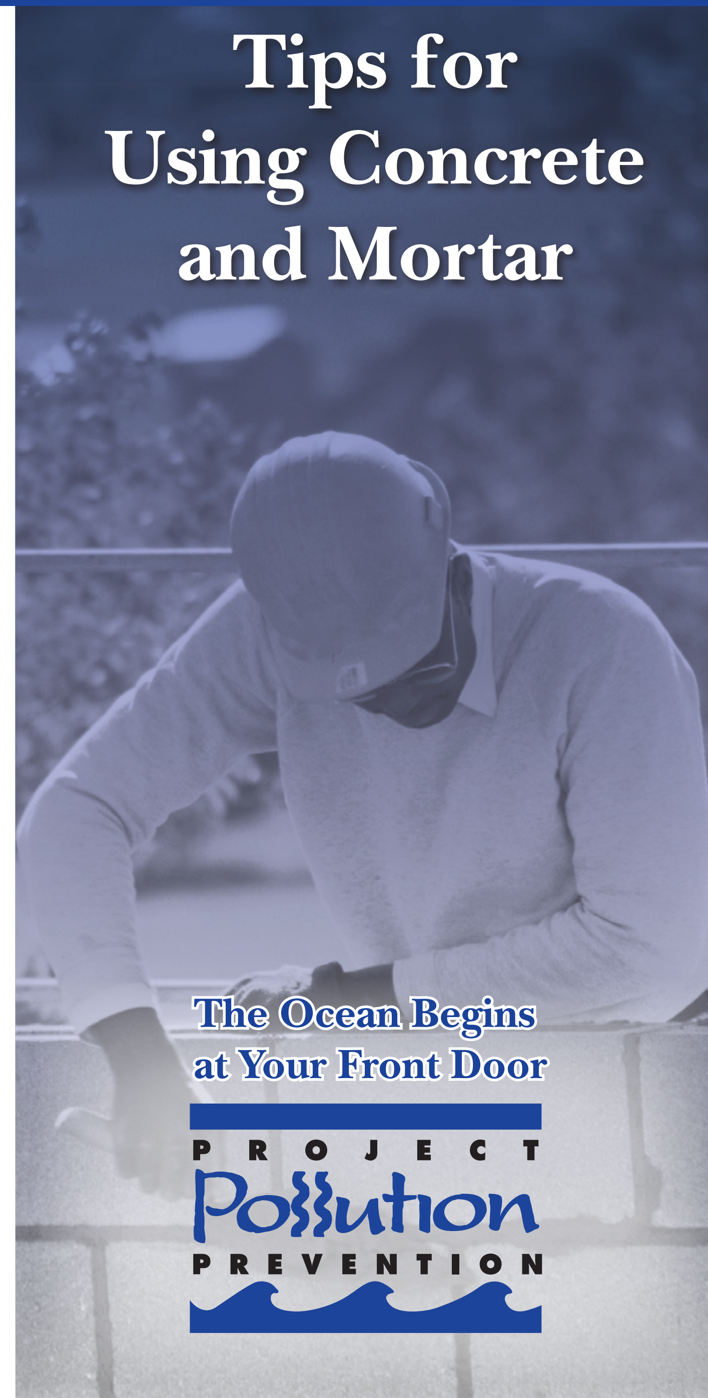
For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com.

To report a spill,
call the
Orange County 24-Hour
Water Pollution Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The Tips contained in this brochure provide useful information about how you can keep materials and washwater from entering the storm drain system. If you have other suggestions for how water and materials may be contained, please contact your city's stormwater representative or call the Orange County Stormwater Program.

Tips for Using Concrete and Mortar



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Using Concrete and Mortar

Never allow materials or washwater to enter the street or storm drain.

Before the Project

- Schedule projects for dry weather.
- Store materials under cover, with temporary roofs or plastic sheets, to eliminate or reduce the possibility that the materials can be carried from the project site to streets, storm drains or adjacent properties via rainfall, runoff or wind.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Take measures to block nearby storm drain inlets.

During the Project

- Set up and operate small mixers on tarps or heavy drop cloths.
- Do not mix more fresh concrete or cement than is needed for the job.

- When breaking up pavement, pick up all chunks and pieces and recycle them at a local construction and demolition recycling company. (See information to the right)
- When making saw cuts in pavement, protect nearby storm drain inlets during the saw-cutting operation and contain the slurry. Collect the slurry residue from the pavement or gutter and remove from the site.

Clean-Up

- Dispose of small amounts of dry concrete, grout or mortar in the trash.
- Never hose materials from exposed aggregate concrete, asphalt or similar treatments into a street, gutter, parking lot, or storm drain.
- Wash concrete mixers and equipment in designated washout areas where the water can flow into a containment area or onto dirt. Small amounts of dried material can be disposed of in the trash. Large amounts should be recycled at a local construction and demolition recycling company. (See information below)

- Recycle cement wash water by pumping it back into cement mixers for reuse.

Spills

- Never hose down pavement or impermeable surfaces where fluids have spilled. Use an absorbent material such as cat litter to soak up a spill, then sweep and dispose in the trash.
- Clean spills on dirt areas by digging up and properly disposing of contaminated dry soil in trash.
- Immediately report significant spills to the County's 24-Hour Water Pollution Problem Reporting Hotline at 714-567-6363 or log onto the County's website at www.ocwatersheds.com and fill out an incident reporting form.

For a list of construction and demolition recycling locations in your area visit www.ciwmb.ca.gov/Recycle/.

For additional information on how to control, prevent, remove, and reduce pollution refer to the Stormwater Best Management Practice Handbook, available on-line at www.cabmphandbooks.com.

Preventing water pollution at your commercial/industrial site

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit:
www.swrcb.ca.gov/stormwater/industrial.html

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE
USED OIL

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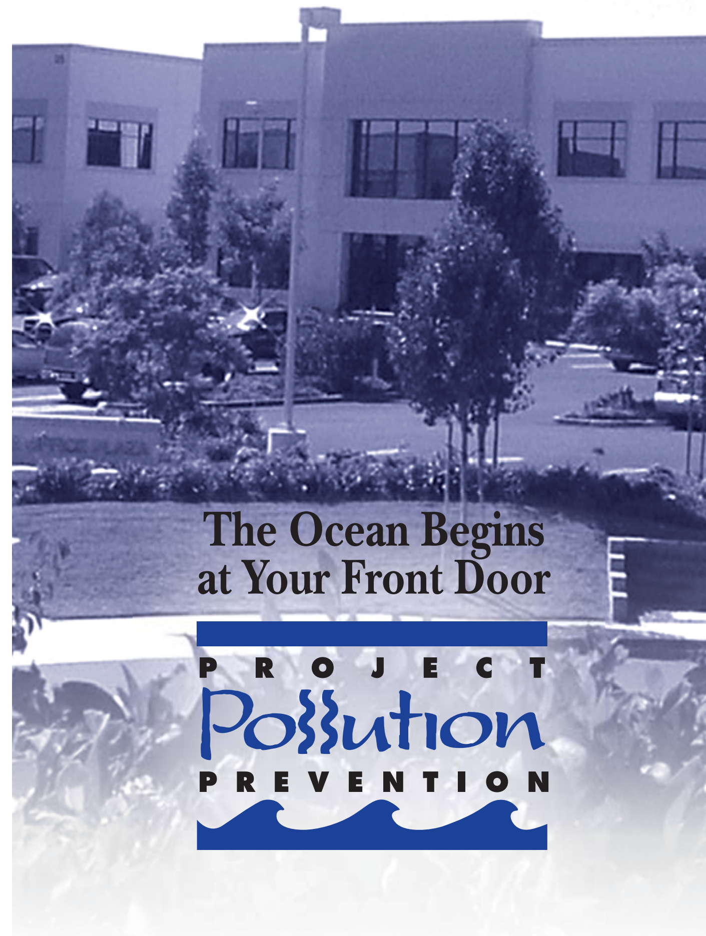
Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business



The Ocean Begins at Your Front Door

PROJECT
Pollution
PREVENTION

Proper Maintenance Practices for your Business

Landscape Maintenance

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

Building Maintenance

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.
- Call your trash hauler to replace leaking dumpsters.
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.

NEVER DISPOSE OF ANYTHING IN THE STORM DRAIN.

- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit **www.oclandfills.com**.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

PROJECT Pollution PREVENTION

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. 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: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of 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.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

Objectives

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

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger 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 the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

- Implement waste management controls described in SC-34 Waste Handling and Disposal.

- 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" or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.

- Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

- Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and

- Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

- Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:

    - ✓ Visual observations of actual discharges occurring;

- ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;

- ✓ Pools of water in low lying areas when a rain event has not occurred; and

- ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.

- ◻ If evidence of non-stormwater discharges is discovered:

  - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;

  - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and

  - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.

- ◻ Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

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 discharges to the 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.

  - ✓ 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 loading/unloading area drain inlets and floor drains in older buildings.

- Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

- If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.

- Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.

- Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.

- Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

- Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.

- Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.

- A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:

  - ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;

  - ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

- ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and

- ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.

- ◻ Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

- ◻ Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.

- ◻ Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.

- ◻ Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.

- ◻ Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.

- ◻ More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.

- ◻ Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

- ◻ Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.

- ◻ CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

- CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.

- CCTV can also be used to detect dye introduced into the sanitary sewer.

- CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can 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);
  - ✓ An anonymous tip/reporting mechanism; and
  - ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).

- 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.

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 SC-11 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.

Spill and Leak Prevention and Response

- 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.

- See SC-11 Spill Prevention Control and Cleanup.

Employee Training Program

- Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.

- Consider posting a 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. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.

- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.

- When a responsible party is identified, educate the party on the impacts of his or her actions.

Quality Assurance and Record Keeping

Performance Evaluation

- Annually review 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.

- Develop document and data management procedures.

- 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.

- Annually document and report the results of the program.

- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

- Document training activities.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Many facilities do not have accurate, up-to-date 'as-built' plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.

  - ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges

  - ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.

- Indoor floor drains may require re-plumbing if cross-connections are detected.

- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.

- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.

- Illicit connections can be difficult to locate especially if there is groundwater infiltration.

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

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;

- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;

- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

- Reduce or prevent discharges of pollutants in authorized NSWDs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability."

References and Resources

Center for Watershed Protection, 2004. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, EPA Cooperative Agreement X-82907801-0.

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Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

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Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental 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 hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. 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. An adequate supply of spill clean-up materials must be maintained onsite.

Objectives

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

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

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

Approach

General Pollution Prevention Protocols

- 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.
- Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

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- ✓ Facility map of the locations of industrial materials;
- ✓ Notification and evacuation procedures;
- ✓ Cleanup instructions;
- ✓ Identification of responsible departments; and
- ✓ 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.

Spill and Leak Prevention and Response

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 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 container 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.

Preventative 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 Response

- 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.

  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).

- 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 or local authority as location regulations dictate.

- 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 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.

- 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);

  - ✓ Clean-up procedures; and

  - ✓ Responsible parties.

Employee Training Program

- 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; and

  - ✓ 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)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- 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; and
- 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:

- Date and time the inspection was performed;
- Name of the inspector;
- Items inspected;
- Problems noted;
- Corrective action required; and
- 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; and
- 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, flanges, 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 absorbent 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 absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent 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.

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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

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 wind, 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.

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.

General Pollution Prevention Protocols

- ☐ 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.

Good Housekeeping

- ☐ Develop an operations plan that describes procedures for loading and/or unloading.
- ☐ Conduct loading and unloading in dry weather if possible.

Objectives

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

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- 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 inlets in the area.
- Grade and/or berm the loading/unloading area with drainage to sump; regularly remove materials accumulated in sump.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Material Handling and Waste Management

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.
- Perform work area clean-up and dry sweep after daily operations.

Employee Training Program

- 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.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.
- Keep accurate logs of daily clean-up operations.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended “work-arounds.”

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- Conduct regular inspections and make repairs and improvements as necessary.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area. Do not wash with water.

Supplemental Information

Loading and Unloading of Liquids

- 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

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Sacramento County Environmental Management Stormwater Program: *Best Management Practices*. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

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

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.

General Pollution Prevention Protocols

- ◻ 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; and
  - ✓ 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	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Use the entire product before disposing of the container.

- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.

- Provide containers for each waste stream at each work station. Allow time after shift to clean area.

Good Housekeeping

- 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.

- 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. Clean in a designated wash area that drains to a clarifier.

- 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.

- 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.

- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.

- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Preventative Maintenance

- 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, polypropylene or 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.
- Check waste 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 waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, 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.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Spill Response and Prevention Procedures

- Keep your spill prevention and 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; and
  - ✓ Trucks with sealed gates and spill guards for solid waste.

Material Handling and Waste Management

Litter Control

- 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. Affix labels to all waste containers.

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

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.

- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.

- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.

- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Check waste 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 waste management area regularly. 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.

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.

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

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315,* Revised. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL and 303(d) list 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

Objectives

- *Educate*
- *Reduce/Minimize*
- *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	

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

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC-20 – SC-22) and SC-41 Building and Grounds Maintenance.

Employee Training Program

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

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds"

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

✓ Minimize use of hazardous/harmful products if no alternative product is available.

Regulatory Considerations

This BMP has no regulatory requirements unless local/municipal ordinance applies. 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.

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

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. Refined 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 with low VOC content 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. Use paper products with post-consumer recycled content and implement electric had dryers.

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, http://www.dtsc.ca.gov/PollutionPrevention/GreenTechnology/Index.cfm.

CalRecycle, http://www.calrecycle.ca.gov/Business/Regulated.htm.

City of Santa Monica Office of Sustainability and Environment, http://www.smgov.net/departments/ose/.

City of Palo Alto, http:// www.city.palo-alto.ca.us/cleanbay.

City and County of San Francisco, Department of the Environment, http://www.sfenvironment.org/toxics-health/greener-business-practices.

Green Business Program, http://www.greenbiz.ca.gov/GRlocal.html .

Product Stewardship Institute, http://www.productstewardship.us/index.cfm.

Sacramento Clean Water Business Partners. http://www.sacstormwater.org/CleanWaterBusinessPartners/CleanWaterBusinessPartners.html.

USEPA. National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges From Industrial Facilities, http://cfpub.epa.gov/npdes/stormwater/indust.cfm.

USEPA Region IX Pollution Prevention Program, http://www.epa.gov/region9/waste/p2/business.html.

Western Sustainability and Pollution Prevention Network, http://wsppn.org/.

Metals (mercury, copper)
National Electrical Manufacturers Association – Environmental Stewardship, http://www.nema.org/Policy/Environmental-Stewardship/pages/default.aspx.

Sustainable Conservation, http://www.suscon.org.

Auto Recycling Project

Brake Pad Partnership

Pesticides and Chemical Fertilizers
Bio-Integral Resource Center, http://www.birc.org.

California Department of Pesticide Regulation, http://www.cdpr.ca.gov/dprprograms.htm.

University of California Statewide IPM Program, http://www.ipm.ucdavis.edu/default.html.

Dioxins
Bay Area Dioxins Project, http://www.abag.ca.gov/bayarea/dioxin/project_materials.htm.

Building & Grounds Maintenance SC-41

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.

General Pollution Prevention Protocols

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

Objectives

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

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.

Good Housekeeping

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. See also SC-40, Contaminated and Erodible Areas, for more information.

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

- 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.

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.

Spill Response and Prevention Procedures

- 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.

Material Handling and Waste 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.
- 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.

Employee Training Program

- 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 needs of individual staff.

Quality Assurance and Record Keeping

- Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

Site 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

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at:

http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at: http://www.vcstormwater.org/documents/programs_business/building.pdf.

Description

Site 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 minor construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

This fact sheet is intended to be used for minor repairs and construction. If major construction is required, the guidelines in the Construction BMP Handbook should be followed.

Approach

The BMP approach is to reduce potential for pollutant discharges 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.

General Pollution Prevention Protocols

- ◻ Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- ◻ Avoid outdoor repairs and construction during periods of wet weather.
- ◻ Use safer alternative products to the maximum extent practicable. See also SC-35 Safer Alternative Products for more information.

Objectives

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

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	✓
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Buy recycled products to the maximum extent practicable.
- 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.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Good Housekeeping

Repair & Remodeling

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep and vacuum the area regularly to remove sediments and small debris.
- Cover raw materials of particular concern that must be left outside, particularly during the rainy season. See also SC-33 Outdoor Storage of Raw Materials for more information.
- Use equipment and tools such as bag sanders to reduce accumulation of debris.
- Limit/prohibit work on windy days; implement roll-down walls or other measures to reduce wind transport of pollutants.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store liquid materials properly that are normally used in repair and remodeling such as paints and solvents. See also SC-31 Outdoor Liquid Container Storage for more information.
- Sweep out rain gutters or wash the gutter and trap the particles at the outlet of the downspout. 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.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed. See also SC-44 Drainage System Maintenance for more information.

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 percent 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 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 of 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.

Spill Response and Prevention Procedures

- Keep your spill prevention and control 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.

Material Handling and Waste Management

- 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.
- 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. Affix labels to all waste containers.
- Make sure that hazardous waste is collected, removed, and disposed of properly. See also SC-34, Waste Handling and Disposal for more information.

Sediment and Erosion Controls

- Limit disturbance to bare soils and preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.
- Stabilize loose soils by re-vegetating whenever possible. See also EC-4 Hydroseeding, in the Construction BMP Handbook.
- Utilize non-vegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:
  - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;
  - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
  - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
  - ✓ Areas where vegetation will not grow adequately within the construction time frame.

There are several non-vegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization, in the Construction BMP Handbook.

- Utilize chemical stabilization when needed. See also EC-5 Soil Binders, in the Construction BMP Handbook.

- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats, in the Construction BMP Handbook.

- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control, in the Construction BMP Handbook.

- Refer to the supplemental information provided below for projects that involve more extensive soil disturbance activities.

Employee Training Program

- Educate employees about pollution prevention measures and goals.

- Train employees how to properly implement the source control BMPs described above. Detailed information for Sediment and Erosion Control BMPs is provided in the Construction BMP Handbook.

- 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 pollutant source control responsibilities.

- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for building repair and construction, types and quantities of waste disposed of, and any improvement actions.

- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more extensive requirements for larger projects that would disturb one or more acres of surface.

  - ✓ Refer to the companion "Construction Best Management Practice Handbook" which contains specific guidance and best management practices for larger-scale projects.

- Time constraints may require some outdoor repairs and construction during wet weather.

  - ✓ Require employees to understand and follow good housekeeping and spill and leak prevention BMPs.

  - ✓ Inspect sediment and erosion control BMPs daily during periods of wet weather and repair or improve BMP implementation as necessary.

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

  - ✓ Minimize use of hazardous materials to the maximum extent practicable.

- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.

- Prices for recycled/safer alternative materials and fluids may be higher than those of conventional materials.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Limited capital investments may be required at some sites if adequate cover and containment facilities do not exist for construction materials and wastes.

- Purchase and installation of erosion and sediment controls, if needed will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.

- Minimize costs by maintaining existing vegetation and limiting construction operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.

- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

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. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

California Stormwater Quality Association, 2012. *Construction Stormwater Best Management Practice Handbook*. Available at http://www.casqa.org.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA. *Construction Site Stormwater Runoff Control*. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4.

Parking Area Maintenance SC-43

Description

Parking lots 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 areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking 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.

General Pollution Prevention Protocols

- ◻ Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.
- ◻ Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- ◻ Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.
- ◻ Post "No Littering" signs and enforce anti-litter laws.

Objectives

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

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

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.

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.
- Dispose of parking lot sweeping debris and dirt at a landfill.
- 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.
- 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.
  - ✓ Dispose of spilled materials and absorbents appropriately.

Surface Repair

- Check local ordinance for SUSMP/LID ordinance.
- 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 during sweeping 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.

Spill Response and Prevention Procedures

- 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.

Employee Training Program

- 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.
- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

- When possible, direct 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.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

California Stormwater Quality Association, 2003. *New Development and Redevelopment Stormwater Best Management Practice Handbook*. Available online at: https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Pollution from Surface Cleaning Folder, 1996, 2003. Bay Area Stormwater Management Agencies Association. Available online at: http://basmaa.org/Portals/0/documents/pdf/Pollution%20from%20Surface%20Cleaning.pdf.

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

US EPA. *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

Drainage System Maintenance SC-44

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ◻ 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.

- ◻ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- ◻ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives

- *Cover*
- *Contain*
- *Educate*
- *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
- ✓ Record locations of apparent illegal discharges/illicit connections.
- ✓ Track flows back to potential discharges 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" or similar 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 for additional information.

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); and
  - ✓ 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 for additional information.

Preventative Maintenance

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.

- 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. Prioritize storm drain inlets; 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 state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Wildlife. 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 Army Corps of Engineers and USFWS.

Spill Response and Prevention Procedures

- Keep your spill prevention control plan up-to-date.

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- 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.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- 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).

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Provided below are typical limitations and recommended "work-arounds" for drainage system maintenance:

- 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.

  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.

- 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, and liquid/sediment disposal.

  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

  - ✓ Do not dump illegal materials anywhere onsite.
  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.
  - ✓ Cleanup spills immediately and properly dispose of wastes.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.

  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.
  - ✓ Install debris excluders in areas with a trash TMDL.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .

- Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

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.
- 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.

Supplemental Information

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 re-suspension 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 if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

Knox County Tennessee *Stormwater Management Manual* Chapter 5 Drainage System Maintenance, 2008. Available online at: http://www.knoxcounty.org/stormwater/manual/Volume%201/knoxco_swmm_v1_chap5_jan2008.pdf.

US EPA. Storm Drain System Cleaning, 2012. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=102.

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.

Maintenance Bays & Docks SD-31

Design Objectives

- Maintimize 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

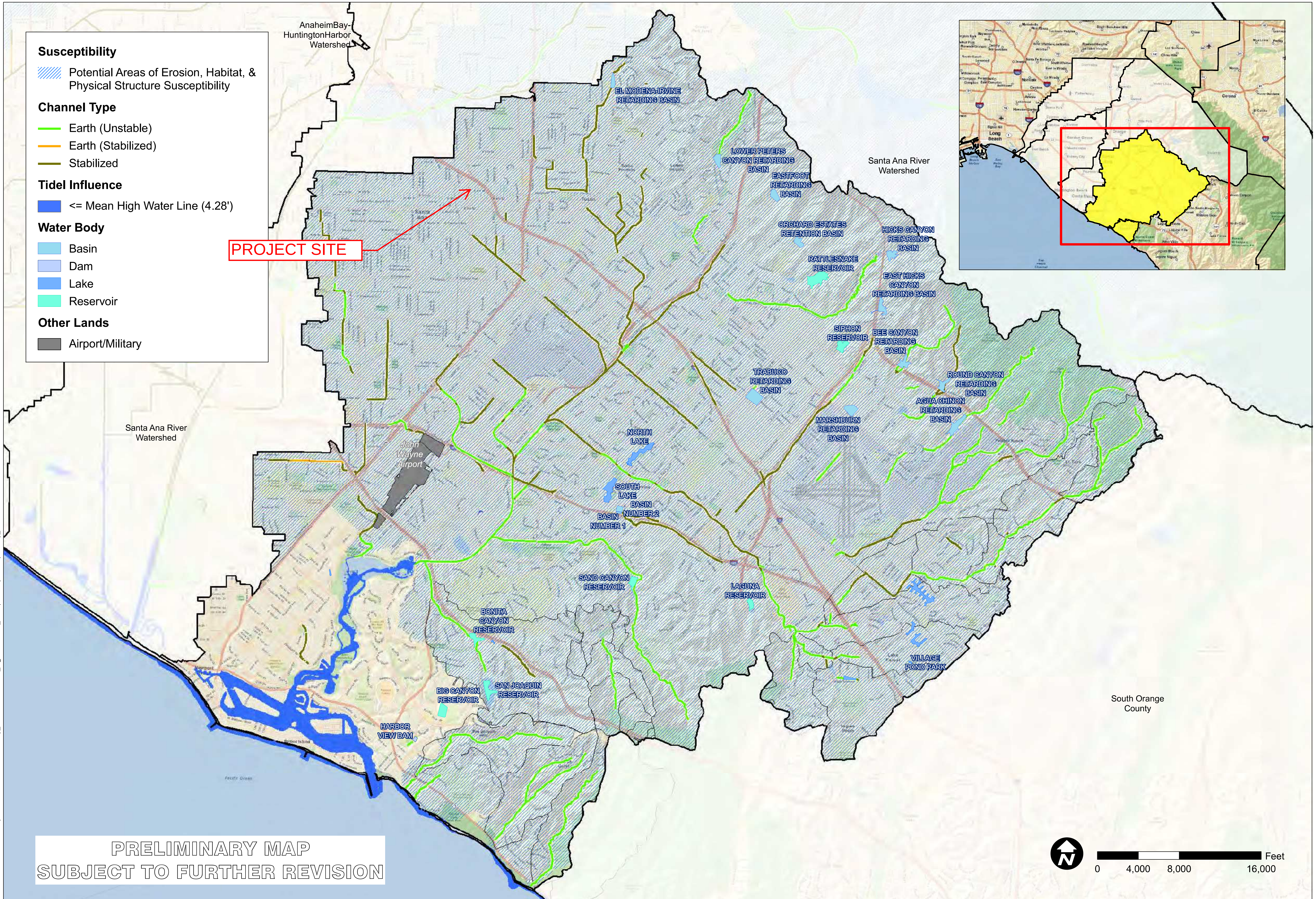
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

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.

ATTACHMENT B
HCOC MAP



P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-3d_NewportBaySusceptibility_20100430.mxd

TITLE
SUSCEPTIBILITY ANALYIS
NEWPORT BAY-
NEWPORT COASTAL STREAMS

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO. CA

SCALE	1" = 4000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-3d

```
****************************************************************************
           NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                     AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3892
  2-YEAR STORM EVENT
  EXISTING CONDITION SOIL LOSSES
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
         1          2.15      100.00       76.(AMC II)     0.300       0.023
         2          3.00      100.00       66.(AMC II)     0.300       0.000
         3         10.20        0.00       98.(AMC II)     0.300       0.890
         4          1.10      100.00       56.(AMC II)     0.300       0.000

    TOTAL AREA (Acres) =     16.45

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.114

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.445
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****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3892
  2-YEAR STORM EVENT
  EXISTING CONDITION HYDROGRAPH
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   16.45
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.114
    LOW LOSS FRACTION = 0.445
    TIME OF CONCENTRATION(MIN.) = 16.10
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.55
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.26

****************************************************************************
  TIME     VOLUME      Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)     (CFS)
----------------------------------------------------------------------------
  0.17     0.0018     0.26  Q         .         .         .         .
  0.44     0.0077     0.26  Q         .         .         .         .
  0.70     0.0136     0.27  Q         .         .         .         .
  0.97     0.0196     0.27  Q         .         .         .         .
  1.24     0.0256     0.27  Q         .         .         .         .
  1.51     0.0317     0.28  Q         .         .         .         .
  1.78     0.0379     0.28  Q         .         .         .         .
  2.05     0.0441     0.28  Q         .         .         .         .
  2.31     0.0505     0.29  Q         .         .         .         .
  2.58     0.0569     0.29  Q         .         .         .         .
  2.85     0.0633     0.29  Q         .         .         .         .
  3.12     0.0699     0.30  Q         .         .         .         .
  3.39     0.0765     0.30  Q         .         .         .         .
  3.66     0.0833     0.30  Q         .         .         .         .
  3.92     0.0901     0.31  Q         .         .         .         .
  4.19     0.0970     0.31  Q         .         .         .         .
  4.46     0.1040     0.32  Q         .         .         .         .
  4.73     0.1111     0.32  Q         .         .         .         .
  5.00     0.1184     0.33  Q         .         .         .         .
  5.27     0.1257     0.33  Q         .         .         .         .
  5.53     0.1331     0.34  Q         .         .         .         .
  5.80     0.1407     0.34  Q         .         .         .         .
  6.07     0.1484     0.35  Q         .         .         .         .
  6.34     0.1562     0.35  Q         .         .         .         .
  6.61     0.1641     0.36  Q         .         .         .         .
  6.88     0.1722     0.37  Q         .         .         .         .
  7.14     0.1804     0.38  Q         .         .         .         .
  7.41     0.1888     0.38  Q         .         .         .         .
  7.68     0.1974     0.39  Q         .         .         .         .
  7.95     0.2061     0.40  Q         .         .         .         .
  8.22     0.2150     0.41  Q         .         .         .         .
  8.49     0.2241     0.41  Q         .         .         .         .
  8.76     0.2334     0.42  Q         .         .         .         .
  9.02     0.2429     0.43  Q         .         .         .         .
  9.29     0.2526     0.45  Q         .         .         .         .
  9.56     0.2625     0.45  Q         .         .         .         .
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  9.83      0.2727      0.47  Q         .         .         .         .
 10.10      0.2832      0.48  Q         .         .         .         .
 10.36      0.2940      0.50  Q         .         .         .         .
 10.63      0.3051      0.50  .Q        .         .         .         .
 10.90      0.3165      0.53  .Q        .         .         .         .
 11.17      0.3283      0.54  .Q        .         .         .         .
 11.44      0.3405      0.56  .Q        .         .         .         .
 11.71      0.3531      0.58  .Q        .         .         .         .
 11.98      0.3662      0.61  .Q        .         .         .         .
 12.24      0.3804      0.67  .Q        .         .         .         .
 12.51      0.3967      0.80  .Q        .         .         .         .
 12.78      0.4146      0.82  .Q        .         .         .         .
 13.05      0.4333      0.87  .Q        .         .         .         .
 13.32      0.4529      0.90  .Q        .         .         .         .
 13.59      0.4735      0.96  .Q        .         .         .         .
 13.85      0.4953      1.00  . Q       .         .         .         .
 14.12      0.5186      1.10  . Q       .         .         .         .
 14.39      0.5440      1.19  . Q       .         .         .         .
 14.66      0.5719      1.33  . Q       .         .         .         .
 14.93      0.6024      1.42  . Q       .         .         .         .
 15.20      0.6368      1.67  .  Q      .         .         .         .
 15.46      0.6760      1.86  .  Q      .         .         .         .
 15.73      0.7230      2.38  .   Q     .         .         .         .
 16.00      0.7935      3.98  .      Q  .         .         .         .
 16.27      1.0079     15.35  .         .         .         Q         .
 16.54      1.1994      1.92  .  Q      .         .         .         .
 16.81      1.2377      1.53  .  Q      .         .         .         .
 17.07      1.2686      1.25  . Q       .         .         .         .
 17.34      1.2941      1.04  . Q       .         .         .         .
 17.61      1.3160      0.93  .Q        .         .         .         .
 17.88      1.3356      0.84  .Q        .         .         .         .
 18.15      1.3536      0.78  .Q        .         .         .         .
 18.42      1.3687      0.59  .Q        .         .         .         .
 18.68      1.3814      0.55  .Q        .         .         .         .
 18.95      1.3932      0.52  .Q        .         .         .         .
 19.22      1.4043      0.49  Q         .         .         .         .
 19.49      1.4148      0.46  Q         .         .         .         .
 19.76      1.4247      0.44  Q         .         .         .         .
 20.02      1.4342      0.42  Q         .         .         .         .
 20.29      1.4433      0.40  Q         .         .         .         .
 20.56      1.4520      0.39  Q         .         .         .         .
 20.83      1.4604      0.37  Q         .         .         .         .
 21.10      1.4685      0.36  Q         .         .         .         .
 21.37      1.4763      0.35  Q         .         .         .         .
 21.64      1.4839      0.34  Q         .         .         .         .
 21.90      1.4912      0.33  Q         .         .         .         .
 22.17      1.4983      0.32  Q         .         .         .         .
 22.44      1.5053      0.31  Q         .         .         .         .
 22.71      1.5120      0.30  Q         .         .         .         .
 22.98      1.5186      0.29  Q         .         .         .         .
 23.24      1.5250      0.29  Q         .         .         .         .
 23.51      1.5312      0.28  Q         .         .         .         .
 23.78      1.5373      0.27  Q         .         .         .         .
 24.05      1.5433      0.27  Q         .         .         .         .
 24.32      1.5462      0.00  Q         .         .         .         .
-----------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1449.0
10%	96.6
20%	32.2
30%	16.1
40%	16.1
50%	16.1
60%	16.1
70%	16.1
80%	16.1
90%	16.1

```
****************************************************************************
           NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                     AND LOW LOSS FRACTION ESTIMATIONS
============================================================================
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                         Analysis prepared by:

                       THIENES ENGINEERING, INC.
                          14349 FIRESTONE BLVD
                          LA MIRADA, CA 90638
                              714-521-4811

****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB 3892
  2-YEAR STORM EVENT
  PROPOSED CONDITION SOIL LOSS RATES
============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.05 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
         1        14.80        0.00       98.(AMC II)     0.300      0.890
         2         1.65      100.00       56.(AMC II)     0.300      0.000

    TOTAL AREA (Acres) =     16.45

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.030

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.200
============================================================================
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****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL

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                           Analysis prepared by:

                            THIENES ENGINEERING
                          16800 VALLEY VIEW AVENUE
                             LA MIRADA CA 90638
                   PH: (714) 521-4811 FAX: (714) 521-4173



    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   16.45
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) = 11.19
    RATIONAL METHOD PEAK FLOW RATE (DEFINED BY USER)
    IS USED FOR SMALL AREA PEAK Q
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.13
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.68

****************************************************************************
  TIME     VOLUME       Q    0.        7.5      15.0      22.5      30.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
   0.15      0.0023      0.38  Q         .         .         .         .
   0.33      0.0082      0.38  Q         .         .         .         .
   0.52      0.0141      0.38  Q         .         .         .         .
   0.71      0.0200      0.39  Q         .         .         .         .
   0.89      0.0260      0.39  Q         .         .         .         .
   1.08      0.0320      0.39  Q         .         .         .         .
   1.27      0.0381      0.40  Q         .         .         .         .
   1.45      0.0443      0.40  Q         .         .         .         .
   1.64      0.0504      0.40  Q         .         .         .         .
   1.83      0.0567      0.41  Q         .         .         .         .
   2.01      0.0629      0.41  Q         .         .         .         .
   2.20      0.0693      0.41  Q         .         .         .         .
   2.39      0.0757      0.42  Q         .         .         .         .
   2.57      0.0821      0.42  Q         .         .         .         .
   2.76      0.0886      0.42  Q         .         .         .         .
   2.94      0.0952      0.43  Q         .         .         .         .
   3.13      0.1018      0.43  Q         .         .         .         .
   3.32      0.1084      0.43  Q         .         .         .         .
   3.50      0.1152      0.44  Q         .         .         .         .
   3.69      0.1220      0.44  Q         .         .         .         .
   3.88      0.1288      0.45  Q         .         .         .         .
   4.06      0.1357      0.45  Q         .         .         .         .
   4.25      0.1427      0.46  Q         .         .         .         .
   4.44      0.1498      0.46  Q         .         .         .         .
   4.62      0.1569      0.47  Q         .         .         .         .
   4.81      0.1641      0.47  Q         .         .         .         .
   5.00      0.1714      0.48  Q         .         .         .         .
   5.18      0.1787      0.48  Q         .         .         .         .
   5.37      0.1862      0.49  Q         .         .         .         .
   5.56      0.1937      0.49  Q         .         .         .         .
   5.74      0.2013      0.50  Q         .         .         .         .
   5.93      0.2090      0.50  Q         .         .         .         .
   6.12      0.2167      0.51  Q         .         .         .         .
   6.30      0.2246      0.51  Q         .         .         .         .
   6.49      0.2325      0.52  Q         .         .         .         .
   6.67      0.2406      0.52  Q         .         .         .         .
   6.86      0.2487      0.53  Q         .         .         .         .
   7.05      0.2570      0.54  Q         .         .         .         .
```

```
  7.23      0.2654      0.55  Q         .         .         .         .
  7.42      0.2738      0.55  Q         .         .         .         .
  7.61      0.2824      0.56  Q         .         .         .         .
  7.79      0.2911      0.57  Q         .         .         .         .
  7.98      0.2999      0.58  Q         .         .         .         .
  8.17      0.3089      0.58  Q         .         .         .         .
  8.35      0.3180      0.60  Q         .         .         .         .
  8.54      0.3272      0.60  Q         .         .         .         .
  8.73      0.3365      0.61  Q         .         .         .         .
  8.91      0.3461      0.62  Q         .         .         .         .
  9.10      0.3557      0.63  Q         .         .         .         .
  9.29      0.3655      0.64  Q         .         .         .         .
  9.47      0.3755      0.66  Q         .         .         .         .
  9.66      0.3857      0.66  Q         .         .         .         .
  9.85      0.3961      0.68  Q         .         .         .         .
 10.03      0.4066      0.69  Q         .         .         .         .
 10.22      0.4174      0.71  Q         .         .         .         .
 10.40      0.4283      0.72  Q         .         .         .         .
 10.59      0.4395      0.74  Q         .         .         .         .
 10.78      0.4509      0.75  Q         .         .         .         .
 10.96      0.4626      0.77  .Q        .         .         .         .
 11.15      0.4746      0.78  .Q        .         .         .         .
 11.34      0.4868      0.81  .Q        .         .         .         .
 11.52      0.4993      0.82  .Q        .         .         .         .
 11.71      0.5122      0.85  .Q        .         .         .         .
 11.90      0.5253      0.86  .Q        .         .         .         .
 12.08      0.5392      0.93  .Q        .         .         .         .
 12.27      0.5549      1.11  .Q        .         .         .         .
 12.46      0.5723      1.15  .Q        .         .         .         .
 12.64      0.5901      1.17  .Q        .         .         .         .
 12.83      0.6085      1.22  .Q        .         .         .         .
 13.02      0.6275      1.24  .Q        .         .         .         .
 13.20      0.6471      1.30  .Q        .         .         .         .
 13.39      0.6674      1.33  .Q        .         .         .         .
 13.58      0.6885      1.40  .Q        .         .         .         .
 13.76      0.7104      1.44  .Q        .         .         .         .
 13.95      0.7332      1.53  . Q       .         .         .         .
 14.13      0.7572      1.58  . Q       .         .         .         .
 14.32      0.7829      1.75  . Q       .         .         .         .
 14.51      0.8105      1.83  . Q       .         .         .         .
 14.69      0.8402      2.03  . Q       .         .         .         .
 14.88      0.8725      2.15  . Q       .         .         .         .
 15.07      0.9080      2.46  .  Q      .         .         .         .
 15.25      0.9474      2.66  .  Q      .         .         .         .
 15.44      0.9912      3.03  .   Q     .         .         .         .
 15.63      1.0384      3.10  .   Q     .         .         .         .
 15.81      1.0984      4.68  .     Q   .         .         .         .
 16.00      1.1852      6.59  .       Q .         .         .         .
 16.19      1.4033     21.71  .         .         .        Q .         .
 16.37      1.5989      3.67  .   Q     .         .         .         .
 16.56      1.6496      2.90  .  Q      .         .         .         .
 16.75      1.6897      2.29  .  Q      .         .         .         .
 16.93      1.7222      1.92  . Q       .         .         .         .
 17.12      1.7500      1.69  . Q       .         .         .         .
 17.31      1.7745      1.48  .Q        .         .         .         .
 17.49      1.7964      1.37  .Q        .         .         .         .
 17.68      1.8167      1.27  .Q        .         .         .         .
 17.86      1.8357      1.19  .Q        .         .         .         .
 18.05      1.8536      1.13  .Q        .         .         .         .
 18.24      1.8691      0.88  .Q        .         .         .         .
 18.42      1.8823      0.83  .Q        .         .         .         .
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 18.80      1.9068      0.76  .Q        .         .         .         .
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 19.73      1.9597      0.63  Q         .         .         .         .
 19.92      1.9692      0.61  Q         .         .         .         .
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 20.29      1.9874      0.57  Q         .         .         .         .
 20.48      1.9961      0.56  Q         .         .         .         .
 20.66      2.0046      0.54  Q         .         .         .         .
 20.85      2.0128      0.53  Q         .         .         .         .
 21.04      2.0209      0.52  Q         .         .         .         .
 21.22      2.0287      0.50  Q         .         .         .         .
 21.41      2.0364      0.49  Q         .         .         .         .
 21.60      2.0439      0.48  Q         .         .         .         .
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```

```
 21.97      2.0585      0.46  Q         .         .         .         .
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 22.34      2.0725      0.44  Q         .         .         .         .
 22.53      2.0793      0.44  Q         .         .         .         .
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 22.90      2.0925      0.42  Q         .         .         .         .
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 23.27      2.1053      0.41  Q         .         .         .         .
 23.46      2.1115      0.40  Q         .         .         .         .
 23.65      2.1176      0.39  Q         .         .         .         .
 23.83      2.1237      0.39  Q         .         .         .         .
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 24.21      2.1326      0.00  Q         .         .         .         .
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1
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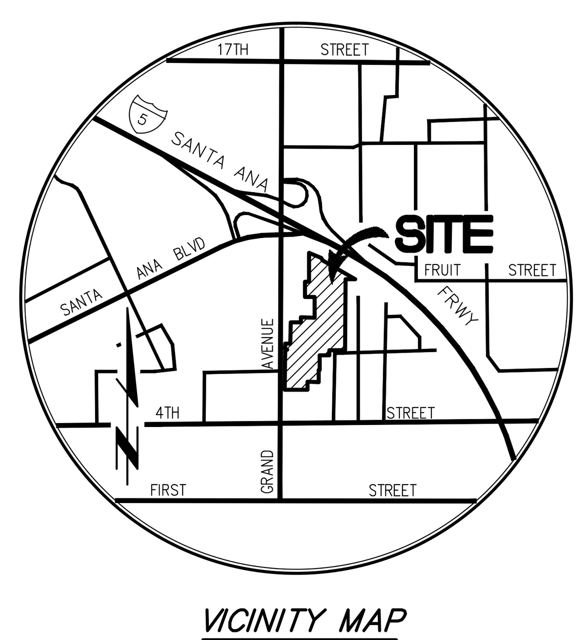


VICINITY MAP
N.T.S.

LEGEND

(heavy solid line)	PROJECT BOUNDARY
(dashed line)	SUBAREA BOUNDARY
(dash-dot line)	FLOW PATH
4.10 AC.	SUBAREA AREA
100	NODE NUMBER

ALL AREAS SOIL TYPE "B"

PREPARED FOR:

PANATTONI DEVELOPMENT COMPANY, INC
2442 DUPONT DRIVE
IRVINE CA 92612
PHONE: (949) 296-2960
FAX: (888) 793-7363

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

CITY OF SANTA ANA

PUBLIC WORKS DEPARTMENT

EXISTING CONDITION HYDROLOGY MAP FOR 625 N. GRAND AVENUE SANTA ANA, CA

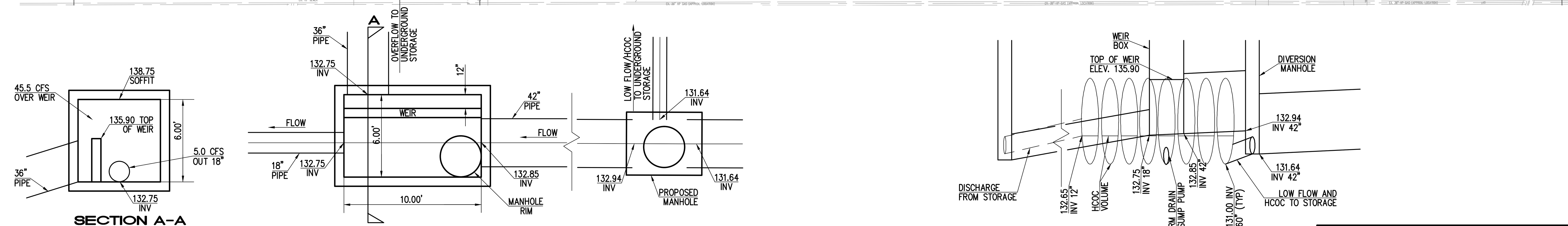
Designed by ______ Date
Checked by ______ Date
Designed by ______ Date
Checked by ______ Date

Approved by ______ Date ______

Public Works Director R.C.E. XXXXX

Sheet 1 of 1 Sheets

3892/1 OF 1 SHEET



WEIR BOX DETAIL

SCALE: 1"=5.0'

STORM DRAIN PROFILE

N.T.S.

0 30 60 120 180

SCALE: 1"=60'

Last Update:2/23/21
O:\3800-3899\3892\3892HYD.dwg

PREPARED FOR:

PANATTONI DEVELOPMENT COMPANY, INC
2442 DUPONT DRIVE
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CITY OF SANTA ANA

PUBLIC WORKS DEPARTMENT

PROPOSED CONDITION HYDROLOGY MAP

FOR

511 N. GRAND AVENUE
SANTA ANA, CA

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

Approved by Date

Public Works Director R.C.E. XXXXX

Sheet 1 of 1 Sheets

3892/1 OF 1 SHEET

ATTACHMENT C
SOIL/INFILTRATION REPORT

January 11, 2021

Amazon.com Services LLC
2442 Dupont Drive
Irvine, California 92612

Attention: Jacob LeBlanc, Partner

Subject: Clarification of Geotechnical Recommendations – Storm Water Infiltration
Proposed Amazon Distribution Facility
625 N. Grand Avenue
Santa Ana, California
GPI Project No. 2992.I

Dear Jake:

This letter is intended to provide clarification on our opinion regarding the feasibility of storm water infiltration at the subject site. We performed a geotechnical investigation for the project, including field infiltration testing, and presented the results in a report dated August 26, 2020. We also provided a supplemental letter dated November 18, 2020. The recommendations provided herein supersede the recommendations presented in our referenced report and letter where applicable.

We performed field infiltration testing in three areas identified by the Project Civil Engineer, Thienes, with two test wells in each of the three areas (six tests total). As noted in our report, the subsurface conditions across the site were highly layered and variable. This variability was evident in the field infiltration results, where infiltration rates ranged from lows of 0.05 to 0.11 inch/hour to highs of 0.54 to 1.20 inches/hour. In addition, the stratigraphy of the soils within the upper 20 feet was highly layered with relatively thin granular soil layers at the tested infiltration depths and less permeable fine-grained soils above and below the granular soils.

We presented the infiltration testing data in our report and left the determination of the feasibility of infiltration up to the Project Civil Engineer. However, based on discussions with the City reviewers during the plan check process, we understand that we, as the Geotechnical Engineer of Record, should provide our opinion regarding the feasibility of infiltration and specific soils-related infiltration recommendations. As such we have reviewed the recent project plans and our findings with respect to the feasibility of storm water infiltration. Based on our findings, it is our opinion that storm water infiltration is not feasible at the subject site. Two specific findings support our opinion.

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- The subsurface soils are highly layered and variable, which makes determination of a suitable infiltration depth infeasible. As found in our six field infiltration wells, the infiltration rates vary from about 0.1 inch/hour to about 1.0 inch/hour across relatively short distances. Also, the lowest tested infiltration rates are very low (0.05 to 0.11 inch/hour).

- Because of the highly layered stratigraphy, granular soil layers that supported infiltration during our testing appear to be limited in thickness and underlain by less permeable soils, and therefore limited in the available volume to store storm water. With this stratigraphy, the potential for long-term mounding as a result of infiltration appears to be relatively high.

We understand that there has been some discussion to implementing permeable pavement and depressed landscape planters for the project as a potential BMP because it is listed as a potential measure in the Orange County Technical Guidance Document (TGD). We do not recommend these measures for this project because of the issues outlined above, the heavy traffic loads on the pavement (usage is for a distribution center), and the adverse impact water will have on the performance of the site pavements.

We trust this information satisfies your current needs. Please do not hesitate to call if you have any questions on the contents of this response letter.

Sincerely,
Geotechnical Professionals Inc.

Patrick I.F. McGervey, P.E.
Project Engineer

Paul R. Schade, G.E.
Principal

Distribution: Addressee
Luke Rutherford, Amazon.com Services LLC
Vicky Li/Jeff Potter, Thienes Engineering, Inc.

References: Geotechnical Professionals Inc., "Report of Geotechnical Investigation, Proposed Amazon Distribution Facility, 625 N. Grand Avenue, Santa Ana, California" GPI Project No. 2992.I, report dated August 26, 2020

Geotechnical Professionals Inc., "Clarification of Geotechnical Recommendations, Proposed Amazon Distribution Facility, 625 N. Grand Avenue, Santa Ana, California" GPI Project No. 2992.I, letter dated November 18, 2020

GEOTECHNICAL
PROFESSIONALS INC.

November 18, 2020

Panattoni Development Company, Inc.
2442 Dupont Drive
Irvine, California 92612

Attention: Jacob LeBlanc, Partner

Subject: Clarification of Geotechnical Recommendations
Proposed Amazon Distribution Facility
625 N. Grand Avenue
Santa Ana, California
GPI Project No. 2992.I

Dear Jake:

As requested by Thienes Engineering, this letter is intended to provide clarification on the drainage and stormwater infiltration sections of our referenced report based on the City's comments provided by Vicky Li of Thienes Engineering. The comments address the report dated August 26, 2020 prepared by Geotechnical Professionals, Inc. (GPI). The recommendations provided herein supersede the recommendations presented in our referenced report where applicable.

Section 4.9 Drainage in our referenced report states "long-term ponding of surface water should not be allowed on pavements or adjacent to buildings." Questions regarding the definition of "long-term ponding" and the amount of surface ponding have been raised by the city reviewer. Our recommendations regarding surface ponding are intended for finished surfaces such as pavements, hardscape, and planters. In other words, the finished surfaces should be designed and constructed to provide proper drainage away from improvements while avoiding long-term <u>surface</u> ponding. With respect to stormwater systems for the project, we understand that surface ponding design is temporary/short term and will pass shortly after the peak of a 100-year storm event, and we take no exception to that design approach.

We discussed the feasibility of stormwater infiltration at the site based on our field testing in section 4.10 of the referenced report. We have revised that section of our report (see below) to remove the statements on infiltration feasibility, as the Project Civil Engineer should determine the feasibility of stormwater infiltration based on our test results.

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4.10 INFILTRATION TESTING

Test wells P-1 through P-6 were installed in boreholes drilled using truck-mounted hollow-stem auger drill equipment at preliminary infiltration basin locations provided by Thienes Engineering. The locations of the test wells are shown on Figures 2 and 3. The wells consisted of 2-inch diameter PVC casing installed in an 8-inch diameter borehole. The casing was perforated in the lower 2 feet of the wells. Packing material around the slotted sections of the well casing consisted of #3 sand. The test wells were constructed to depths of approximately 8 to 10 feet below existing grade in order to test the soils near the bottom of the proposed infiltration basins being considered at the time our field work was conducted. The infiltration testing was performed in general accordance with the Orange County guidelines for borehole infiltration tests.

The test wells were filled with water the day before testing and presoaked at least 15 hours. Prior to running the tests, we conducted the screening test to determine test method by filling the test holes as described in the guidelines and taking measurements of the water levels. The non-sandy soil criterion was achieved in each by showing that 6 inches of water did not completely seep away in less than 25 minutes in two 25 minute measurements.

The percolation testing was conducted as outlined in the guidelines for non-sandy soils for at least 12 consecutive 30-minute readings. The tests were performed in each well, measuring the drop in water level over the designated time increment, as appropriate for each location. The initial water levels prior to each reading was at least 2 feet above the bottom of the wells, being refilled in between tests. After completion of the infiltration testing, the well casings were removed, and the holes were backfilled with the on-site soils. Details of the percolation tests are presented in the attached Tables 1 to 6, Borehole Infiltration Test Results.

The measured infiltration rates were calculated using the drop in water level over the test increment time and corrected for one-dimensional flow using the Porchet Method. The final observed rates for each well, corrected as indicated above, are presented in the following table and should be used by the Project Civil Engineer with an appropriate factor of safety (Worksheet 3 from OC TGD, 2013).

Infiltration Test Results Summary

TEST WELL	APPROXIMATE DEPTH OF TEST WELL (feet)	CORRECTED INFILTRATION RATE (inch/hour)
P-1	10.6	1.03
P-2	8.5	0.11
P-3	9.1	0.54
P-4	9.2	0.07
P-5	8.3	0.05
P-6	9.1	1.20

*Per Orange County guidelines (OC TGD, 2013)

The Civil Engineer should evaluate the feasibility of surface infiltration using the rates provided above. Further infiltration testing may be required depending on the final design (location and depths) of the stormwater systems.

It should also be noted that the infiltration rates are for clean water and do not include effects of sediment, fines, dissolved solids or other debris, as these materials will significantly reduce the infiltration rates of the subsurface soils. Prior to infiltration, water should be cleaned of sediment or other deleterious materials to help reduce the potential for clogging and reduced percolation rates. Should fines or suspended solids be permitted to enter the basin, reduced infiltration rates will result."

We trust this information satisfies your current needs. Please do not hesitate to call if you have any questions on the contents of this response letter.

Sincerely,
Geotechnical Professionals Inc.

Patrick I.F. McGervey, P.E.
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
PATRICK I.F. MCGERVEY
No. C 90770
CIVIL
STATE OF CALIFORNIA

Paul R. Schade, G.E.
Principal

REGISTERED PROFESSIONAL ENGINEER
PAUL R. SCHADE
No. 2371
GEOTECHNICAL
STATE OF CALIFORNIA

Distribution: Addressee
Michael Sizemore, Panattoni Development Company, Inc.
Brian Thienes/Vicky Li, Thienes Engineering, Inc.

References: Geotechnical Professionals Inc., "Report of Geotechnical Investigation, Proposed Amazon Distribution Facility, 625 N. Grand Avenue, Santa Ana, California" GPI Project No. 2992.I, report dated August 26, 2020.

Orange County Public Works, "Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs)," Exhibit 7.III, December 20, 2013

GEOTECHNICAL
PROFESSIONALS INC.

GEOTECHNICAL INVESTIGATION
PROPOSED AMAZON DISTRIBUTION FACILITY
625 N. GRAND AVENUE
SANTA ANA, CALIFORNIA

Prepared for:
Panattoni Development Company, Inc.
2442 Dupont Drive
Irvine, California 92612

Prepared by:
Geotechnical Professionals Inc.
5736 Corporate Avenue
Cypress, California 90630
(714) 220-2211

Project No. 2992.I

August 26, 2020

GEOTECHNICAL
PROFESSIONALS INC.

August 26, 2020

Panattoni Development Company
2442 Dupont Drive
Irvine, California 92612

Attention: Jacob LeBlanc, Partner

Subject: Report of Geotechnical Investigation
Proposed Amazon Distribution Facility
625 N. Grand Avenue
Santa Ana, California
GPI Project No. 2992.I

Dear Jacob:

Transmitted herewith is an electronic copy of our geotechnical investigation report for the subject project. The report presents our evaluation of the foundation conditions at the site and recommendations for design and construction.

This report reflects comments issued by the Project Team to our July 15, 2020 draft report, as well as comments provided in a peer review letter dated August 20, 2020 by Amazon's consultant. We have incorporated our response to the comments provided directly into the report. Although not required by the City of Santa for this project site, we have incorporated the geologic input requested by Amazon's consultant and the report has been reviewed and signed by our Certified Engineering Geologist.

We appreciate the opportunity of offering our services on this project and look forward to seeing the project through its successful completion. Feel free to call us if you have questions regarding our report or need further assistance.

Very truly yours,
Geotechnical Professionals Inc.

Paul R. Schade, G.E.
Principal

cc: Michael Sizemore, Panattoni Development Company
Brian Thienes, P.E./Michelle Garcia/Paul McClellan, Thienes Engineering, Inc.
Rafik Gerges, S.E., HSA & Associates

2992-I-01L.doc (08/20)

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of a geotechnical investigation performed by Geotechnical Professionals Inc. (GPI) for the proposed Amazon distribution facility (Medium Delivery Station) at the subject site in Santa Ana, California. The site location is shown on the Site Location Map, Figure 1.

We have been provided with the Design Criteria and Outline Specifications for the Development of AMZN Build-To-Suite (BTS) Delivery Stations, Version 1.5, dated May 6, 2020.

1.2 PROJECT DESCRIPTION

The proposed project will consist of an approximately 112,000-square foot distribution building with a loading dock and extensive surface parking/drives. The site is approximately 3.26 acres in size. The building will be one story and of concrete tilt-up construction. Floor slabs will be supported on-grade. The site will include pavements, site walls, and subsurface storm water infiltration chambers. The Project Civil Engineer, Thienes Engineering, provided the planned infiltration locations and indicated that infiltration depths will be about 8 to 10 feet below the existing grades.

Project-specific finish elevations and structural loads were not known at the time this report was prepared. We have assumed that proposed grades for the building will be within the existing grades to up to 4 feet above existing grades for the dock-high portion of the building. The grades in the proposed truck area to the north of the building will likely be cut up to 4 feet below existing grades and the grades to the west and south of the building are anticipated to be at about the existing grade. Based on similar past projects, the Project Structural Engineer, HSA, has indicated maximum column and wall loads will be on the order of 75 kips and 8.5 to 9.7 kips per lineal foot, respectively (dead plus live loads).

Our recommendations are based upon the above structural and finish grade information. We should be notified if the actual loads and/or grades differ or change during the project design to either confirm or modify our recommendations. Also, when the project grading and foundation plans become available, we should be provided with copies for review and comment.

1.3 PURPOSE OF INVESTIGATION

The primary purpose of this investigation and report is to provide an evaluation of the existing geotechnical conditions at the site as they relate to the design and construction of the proposed development. More specifically, this investigation was aimed at providing geotechnical recommendations for earthwork, and design of foundations and pavements.

2.0 SCOPE OF WORK

Our scope of work included subsurface exploration, field infiltration testing, laboratory testing, engineering analysis and the preparation of this report

Our subsurface exploration consisted of 10 cone penetration tests (CPTs), seven hollow stem auger borings, and six infiltration test wells. The CPTs were planned to be performed to depths of 100 feet below existing grades but reached refusal on the dense subsurface soils at depths of approximately 50 to 58 feet. The borings were performed to depths of approximately 10 to 21 feet below existing grade, and the percolation wells were installed at depths of 8 to 10 feet below existing grades. A description of field procedures and logs of the explorations are presented in the attached Appendices A and B. The procedures and results of the infiltration tests are discussed in this report. The approximate locations of the subsurface explorations are shown on the Existing Site Plan and Proposed Site Plan, Figures 2 and 3.

Laboratory soil tests were performed on selected representative samples as an aid in soil classification and to evaluate the engineering properties of the soils. The geotechnical laboratory testing program included determinations of moisture content and dry density, grain size analyses, shear strength, consolidation, corrosivity, expansion, R-value and maximum density. Corrosivity and R-value testing was performed by HDR and Geo-Logic, respectively, under subcontract to GPI. Their test results are presented Appendix C.

Infiltration testing was performed in the field to determine infiltration rates for the proposed stormwater infiltration system. Testing was performed at six locations (P-1 to P-6). Testing procedures and results are summarized in the “Infiltration Testing” section of this report.

Engineering evaluations were performed to provide earthwork criteria, foundation design parameters, and assessments of seismic hazards. The results of our evaluations are presented in the remainder of the report.

3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The site is bound by the I-5 Freeway to the north, a residential neighborhood to the east, Grand Avenue and the existing 5-story OC Register office building and parking structure to the west, and a retail development and residential neighborhood to the south.

The existing site conditions include a distribution building surrounded by pavement to the east and south, a 2-story office/retail building fronting Grand Avenue, a parking lot paved with crushed aggregate base used for distribution traffic and parking, and an abandoned lot used predominately for larger truck storage to the north of Fruit Street. Above ground power lines extend along the western limits of the site along Grand Avenue.

In general, the site slopes gently downward from north to the south, with a change in ground surface elevation from about Elevation +141 feet to +133 feet across the site.

The existing asphalt pavement sections at the boring locations within the parking lot to the east and south of the existing distribution building consisted of 3 to 7-inches of asphalt concrete over 0 to 6-inches of aggregate base.

3.2 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

Our field investigation disclosed a subsurface profile consisting of fill soils overlying natural alluvial soils. Detailed descriptions of the conditions encountered are shown on the Logs of CPTs and Borings in Appendices A and B, respectively. The regional geologic conditions are shown on Figure 4, Regional Geologic Map.

We encountered undocumented fill soils to depths of approximately 2 to 5 feet below existing grade in the explorations, with an average depth of about 3½ feet. The fill soils consisted of loose to medium dense, dry to slightly moist silty sands with trace amounts of gravel.

The natural alluvial soils below consisted of predominately well stratified silty sands, sandy silts, and silts to a depth of approximately 20 feet. The upper natural soils had localized trace gravel and cobbles. In general, the native granular soils were loose to medium dense and the cohesive soils were firm to stiff. The sandy soils are, in general, slightly moist to moist, and the finer grained silts and sandy silts are moist to wet. The moisture content within the upper 8 feet in the proposed building area are variable, ranging from 1.5 to 17.4 percent, with an average moisture content of 7.5 percent. The natural soils have moderate strength and low to medium compressibility characteristics. Our laboratory tests indicate the upper sandy soils have a very low potential for expansion (EI of 1). A subsurface soil profile is shown on the Subsurface Geologic Section, Figure 5.

Historical groundwater depths are mapped as shallow as 40 feet below grade, however groundwater was not encountered in our current explorations performed to a maximum depth of 58 feet below ground surface.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 OVERVIEW

Based on the results of our investigation, it is our opinion that from a geotechnical viewpoint it is feasible to develop the site as proposed, provided the geotechnical constraints discussed below are mitigated. The most significant geotechnical issues that will affect the design and construction of the proposed project are as follows:

- Undocumented fills were reported to depths of up to 5 feet below existing grade at the site. The fill soils are not considered to be suitable for direct support of foundations or floor slabs without remedial earthwork. For the proposed improvements, we recommend removal and recompaction of the fill and a portion of the upper low-density natural soils to provide uniform support for the planned foundations and floor slab. Shallow removals are also recommended for proposed pavement areas.

- Current moisture contents of the soils within the upper 8 feet are variable with average moisture contents at or slightly below optimum, but localized samples exhibiting moisture contents of up to about 6 percent above optimum moisture contents. Earthwork may encounter localized wet soils requiring additional removals or stabilization prior to placing fill and drying/mixing of the on-site soils before replacing as properly compacted fill. If stabilization is required to properly compact the overlying fill soils, the crushed miscellaneous base, concrete, or asphalt generated from clearing the existing structures and pavements may be used.

- The upper sandy soils are considered to be susceptible to caving in open cuts and excavations. Care should be taken to maintain support of the soils and structures left in-place adjacent to planned excavations.

- The variable layering of granular and fine-grained soils within the depths of the planned storm water infiltration resulted in variable field infiltration testing results, ranging from “not supported” to “marginal” according to the County guidelines.

Our recommendations related to the geotechnical aspects of the development of the site are presented in the subsequent sections of this report.

4.2 SEISMIC DESIGN

4.2.1 General

The site is in a seismically active area of Southern California and is likely to be subjected to strong ground shaking due to earthquakes on nearby faults.

We assume the seismic design of the proposed development will be in accordance with the 2019 California Building Code (CBC) criteria. For the 2019 CBC, a Site Class D may be used. Using the Site Class, which is dependent on geotechnical issues, and the appropriate internet website (https://seismicmaps.org/), the corresponding seismic design parameters from the CBC are as follows:

2019 CBC:

$S_S = 1.29g$	$S_{MS} = F_a * S_S = 1.54$ g	$S_{DS} = 2/3 * S_{MS} = 1.03g$
$S_1 = 0.46g$	$S_{M1} = F_V * S_1 = 0.78g$	$S_{D1} = 2/3 * S_{M1} = 0.52g$

In accordance with the 2019 CBC, site-specific response spectra are required for structures located in a Site Class D (with S_1 greater than or equal to 0.2) unless, per the exceptions detailed in Section 11.4 8 of ASCE 7-16, the structure is designed using seismic response coefficient (Cs) determined by either:

- Equation 12.8-2 for values of $T \leq 1.5\ T_{S,}$
- 1.5 times the value computed by Equation 12.8-3 for values of $T_L \geq T > 1.5\ T_S$, or
- 1.5 times the value computed by Equation 12.8-4 for values of $T > T_L$.

If this exception is not taken and the structure will still be designed in accordance with the 2019 CBC, GPI should be notified that site-specific response spectra is requested.

4.2.2 Strong Ground Motion Potential

Based on published information (geohazards.usgs.gov), the most significant fault in the proximity of the site is the San Joaquin Hills Fault, which is located about 6 miles from the site. Other significant faults in the area include the Newport-Inglewood, Compton, and Whittier Faults which are located about 10, 11, and 10 miles from the site respectively.

During the life of the project, the site will likely be subject to strong ground motions due to earthquakes on nearby faults. Based on the USGS website (earthquake.usgs.gov), we computed that the site could be subjected to a peak ground acceleration (PGA_M) of 0.65g for a mean magnitude 7.7 earthquake. This acceleration has been computed using the mapped Maximum Considered Geometric Mean peak ground acceleration from the ASCE 7-16 (for 2019 CBC) and a site coefficient (F_{PGA}) based on Site Class. The predominant earthquake magnitude was determined using a 2-percent probability of exceedance in a 50-year period, or an average return period of 2,475 years. The structural design will need to incorporate measures to mitigate the effects of strong ground motion.

4.2.3 Potential for Ground Rupture

There are no known active faults crossing or projecting through the site. The site is not located in an Alquist-Priolo Earthquake Fault Zone. Therefore, ground rupture at this site due to faulting is considered unlikely.

4.2.4 Liquefaction and Seismic Settlement

Soil liquefaction is a phenomenon in which saturated cohesionless soils undergo a temporary loss of strength during severe ground shaking and acquire a degree of mobility sufficient to permit ground deformation. In extreme cases, the soil particles can become suspended in groundwater, resulting in the soil deposit becoming mobile and fluid-like. Liquefaction is generally considered to occur primarily in loose to medium dense deposits of saturated soils. Thus, three conditions are required for liquefaction to occur: (1) a cohesionless soil of loose to medium density; (2) a saturated condition; and (3) rapid large strain, cyclic loading, normally provided by earthquake motions.

The site is not located within a zone identified as having a potential for liquefaction by the State. Although the site is not within a liquefaction hazard zone, we evaluated the potential for liquefaction using methods presented in NCEER, 1998 and modifications provided in Special Publication 117A. We used the historical high groundwater of 40 feet. Based on our evaluation of the CPT data using computer software CLIQ (GeoLogismiki, 2007), should a design earthquake occur causing liquefaction the soils exhibit a potential for liquefaction induced seismic settlement between the depths of approximately 43 to 47 feet. In general, the potentially liquefiable layers consist of medium dense silty sands. Total liquefaction-induced settlement is estimated to be on the order of ¼-inch. The depths and thicknesses of the liquefiable soils layers make foundation bearing failure unlikely in the event of liquefaction. The results from our analysis are presented in Appendix D.

Seismic ground subsidence, not related to liquefaction, occurs when loose, granular soils above the groundwater are densified during strong earthquake shaking. The 2019 California Building Code (CBC) and ASCE 7-16 (ASCE, 2019) require that the ground motion used to evaluate liquefaction and seismic settlement be based on the Peak Ground Acceleration (PGA_M) adjusted for site class effects. This value is computed using the mapped Maximum Considered Geometric Mean (MCE_G) peak ground acceleration for Site Class D and a site coefficient, F_{PGA}. Accordingly, we considered a ground acceleration of 0.65g for a magnitude 7.7 earthquake (mean deaggregated). Based on our analyses, we estimate a potential dry seismic settlement of ¼ -inch.

The potential total seismic settlement (liquefaction-induced plus dry seismic settelement) is expected to be on the order of ½ inch, with the differential seismic settlement less than ¼-inch across a span of 60 feet.

4.3 EARTHWORK

The earthwork for the planned improvements is anticipated to consist of clearing and excavation of undocumented fill and upper natural soils, subgrade preparation, and the placement and compaction of fill.

4.3.1 Clearing

Prior to grading, performing excavations or constructing the proposed improvements, the areas to be developed should be cleared of existing structures, debris, and pavements. Buried obstructions, such as footings, abandoned utilities, and tree roots should be removed from areas to be developed. Deleterious material generated during the clearing operation, including organic topsoil, should be removed from the site. If approved by the owner and regulatory agency, inert demolition debris, such as concrete and asphalt may be crushed for reuse in engineered fills in accordance with the criteria presented in the "Materials for Fill" section of this report.

If cesspools or septic systems are encountered during grading, they should be removed in their entirety. The resulting excavation should be backfilled as recommended in the "Subgrade Preparation" and "Placement and Compaction of Fill" sections of this report. As an alternative, cesspools can be backfilled with lean sand-cement slurry containing 1½ sacks cement per yard. At the conclusion of the clearing operations, a representative of GPI should observe and accept the site prior to further grading.

4.3.2 Excavations

Excavations at this site will include removals of undocumented fill and disturbed low-density natural soils, footing excavations, and trenching for proposed utility lines.

To provide uniform support for the planned building, prior to placement of fills or construction of the building, the existing fill and a portion of the upper natural soils within the proposed building pad should be removed and replaced as properly compacted fill. For planning purposes, removals for the building pad should extend to a depth of 6 feet below existing grades or 3 feet below the base of foundations, whichever is deeper. Localized deeper removals may be required where deeper undocumented fills are encountered or where loose wet subgrade soils at the bottom of removals is observed. The actual depths of removals should be determined in the field during grading by GPI. The soils exposed at the base of the overexcavations should be processed in-place as described in the “Subgrade Preparation” section of this report.

Removals below minor structures, such as free-standing walls and trash enclosures, should extend to a depth of 3 feet below existing grade or 1 foot below the base of the foundation, whichever is deeper. For new pavements and hardscape, removals should extend to a depth of at least 1 foot below existing grades or proposed finished subgrade, whichever is deeper.

The Project Surveyor should accurately stake the corners of the areas to be overexcavated in the field. Where space is available, the base of the excavations should extend laterally at least 5 feet beyond the building line or edge of foundations, or a minimum distance equal to the depth of overexcavation/compaction below finish grade (i.e., a 1:1 projection below the top outside edge of footings), whichever is greater. Building lines include the footprint of the building and other foundation supported improvements, such as canopies and attached site walls.

Where space is not available to perform the lateral extent of the recommended overexcavation, such as for perimeter site walls along property lines, we recommend using a reduced allowable bearing capacity as discussed in the “Foundations” section of this report.

Excavation of the soils at the site should be readily achieved using conventional methods. The contractor should determine the best method for removal based on the subsurface conditions outlined herein.

Where not removed by the aforementioned excavations, existing utility trench backfill should be removed and replaced as properly compacted fill within the building pad. This is especially important for deeper fills associated with existing sewers and storm drains. For planning purposes, removals over the utilities should extend to within 1-foot of the top of the pipe. For utilities that are 5 feet or shallower, the removal should extend laterally 1-foot beyond both sides of the pipe. For deeper utilities, the removals should include a zone defined by a 1:1 projection upward (and away from the pipe) from each side of the pipe. The actual limits of removal will be confirmed in the field. We recommend that known utilities be shown on the grading plan. Wet utilities left in-place outside building areas should be capped to reduce the potential for water to infiltrate into the building pad.

The dry to slightly moist sandy soils at the site are expected to have a moderate to severe caving potential when exposed in open cuts. Temporary construction excavations may be made vertically into the undisturbed natural soils without shoring to a depth of 3 feet below adjacent grade (up to 4 feet in properly compacted fills). For cuts up to 10 feet deep, the slopes should be properly shored or sloped back to at least 1:1 or flatter. For deeper cuts, the slopes should be properly shored or sloped back to at least 1½:1 (horizontal to vertical) or flatter. The allowable slope inclinations are measured from the toe to the top of the cut. Even at these inclinations, some raveling should be anticipated. The exposed slope face should be kept moist (but not saturated) during construction to reduce local sloughing.

Surcharge loads should not be permitted within a horizontal distance equal to the height of cut from the top of the excavation or 5 feet from the top of the slopes, whichever is greater, unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of adjacent existing site facilities should be properly shored to maintain support of adjacent elements. Excavations and shoring systems should meet the minimum requirements given in the State of California Occupational Safety and Health Standards.

Deeper removals along property lines and adjacent to existing improvements will require shoring or slot cuts. Recommendations for shoring are provided in the “Retaining Structures” section of the report. Removals that will undermine existing adjacent pavements or hardscape may utilize “ABC” slot cuts to depths not greater than 8 feet. Unsurcharged slots up to 8 feet in height should not be wider than 7 feet and should be backfilled to finished grade prior to excavation of the adjacent four slots (two on each side of the excavated slot). A test slot should be performed prior to production slots to confirm the stability of the planned cuts.

4.3.3 Subgrade Preparation

After the recommended cuts and removals are performed and prior to placing fills or construction of the proposed improvements, the subgrade soils should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90 percent of the maximum dry density, determined in accordance with ASTM D1557.

Localized samples obtained at depths of approximately 5 to 8-feet below existing grades were very moist with moisture contents of up to about 18 percent. Therefore, localized subgrade soils to be exposed at the base of excavations may exhibit well over-optimum moisture conditions. Subjecting these materials to heavy rubber-tired equipment may induce pumping/rutting possibly requiring stabilization. If wet/pumping subgrade conditions are encountered, such that there is inadequate support for compaction of overlying soils, we recommend that the yielding soils be removed to expose underlying stable soils or stabilized with 12 inches of crushed base (such as the crushed miscellaneous base, concrete, or asphalt generated from clearing the existing structures and pavements). In that case, processing of the subgrade soils should be omitted to reduce the potential for excessive subgrade disturbance.

4.3.4 Material for Fill

The on-site soils are, in general, suitable for use as compacted fill with some moisture conditioning being required. Imported fill material should be predominately granular (contain no more than 40 percent fines-portion passing No. 200 sieve), and relatively non-expansive (an Expansion Index of less than 20). GPI should be provided with a sample (at least 50 pounds) and notified at least 72 hours in advance of the location of soils proposed for import. Each proposed import source should be sampled, tested and accepted for use prior to delivery of the soils to the site. Soils imported prior to acceptance by GPI may be rejected if not suitable.

Both imported and existing on-site soils to be used as fill should be free of debris and pieces larger than 8 inches in greatest dimension. If approved by the client and regulatory agencies, the on-site asphalt concrete can be pulverized and mixed with the on-site soils prior to performing the overexcavation. The pavement should be crushed so that the resulting particle size is less than 3 inches in diameter and mixed with the on-site soils.

4.3.5 Placement and Compaction of Fills

Fill soils should be placed in horizontal lifts, moisture-conditioned, and mechanically compacted to densities equal to at least 90 percent of the maximum dry density, determined in accordance with ASTM D1557. Soils within 1-foot of the subgrade for building floor slabs and pavement areas, and aggregate base material should be compacted to a relative compaction of at least 95 percent. The optimum lift thickness will depend on the compaction equipment used and can best be determined in the field.

The following uncompacted lift thickness can be used as preliminary guidelines.

Plate compactors	4-6 inches
Small vibratory or static rollers (5-ton±) or track equipment	6-9 inches
Heavy loaders and large vibratory rollers	9-12 inches

The maximum lift thickness should not be greater than 12 inches and each lift should be thoroughly compacted and accepted prior to subsequent lifts.

Fills should be placed at moisture contents of 1 to 2 percent over the optimum moisture content in order to readily achieve the required compaction. Current moisture contents of the upper soils are variable so that moisture conditioning (wetting, drying, and mixing) will be required. Compacted fills should not be allowed to dry out prior to covering. If the fills are allowed to dry out, moisture conditioning, and potentially processing, will be required.

4.3.6 Shrinkage and Subsidence

Shrinkage is the loss of soil volume caused by compaction of fills to a higher density than before grading. Subsidence is the settlement of in-place subgrade soils caused by loads generated by large earthmoving equipment. For earthwork volume estimating purposes, an average shrinkage value of 15 to 20 percent may be assumed for the surficial soils. Subsidence is expected to be less than 0.1 feet. These values are estimates only and exclude losses due to removal of vegetation or debris. Actual shrinkage and subsidence will depend on the types of earthmoving equipment used and should be determined during grading.

4.3.7 Trench/Wall Backfill

Utility trench backfill consisting of the on-site materials or imported soil, or wall backfill consisting of granular material should be mechanically compacted in lifts. Lift thickness should not exceed those values given in the "Placement and Compaction of Fills" section of this report. Moisture conditioning of the on-site soils will be required prior to re-use as backfill. Jetting or flooding of backfill materials should not be permitted. A representative of GPI should observe and test trench and wall backfill as they are placed.

In backfill areas where mechanical compaction of soil backfill is impractical due to space constraints, sand-cement slurry may be substituted for compacted backfill. The slurry should contain 1½ sacks of cement per cubic yard and have a maximum slump of 5 inches.

If open-graded gravel is placed as fill, such as within the storm water chambers, the gravel should be angular (crushed rock), placed in lifts, and densified using mechanical compaction. Open-graded gravel should be wrapped in a suitable filter fabric, such as Mirafi 140N or equivalent, to reduce the potential for migration of the adjacent soil into the voids within the gravel.

4.3.8 Observation and Testing

A representative of GPI should observe excavations, subgrade preparation, and fill placement activities. Sufficient in-place field density tests should be performed during fill placement and in-place compaction to evaluate the overall compaction of the soils. Soils that do not meet minimum compaction requirements should be reworked and tested prior to placement of additional fill.

4.4 FOUNDATIONS

4.4.1 Foundation Type

As discussed previously, the proposed structures can be supported on conventional spread footings founded in the properly compacted fill.

4.4.2 Allowable Bearing Pressures

Based on the shear strength and elastic settlement characteristics of the natural and recompacted on-site soils, a static allowable net bearing pressure of up to 3,500 pounds per square foot (psf) may be used for both continuous footings and isolated column footings for the building. These bearing pressures are for dead-plus-live-loads, and may be increased one-third for short-term, transient, wind and seismic loading. The actual bearing pressure used may be less than the value presented above and can be based on economics and structural loads to determine the minimum width for footings as discussed below. The maximum edge pressures induced by eccentric loading or overturning moments should not be allowed to exceed these recommended values.

For minor structures, such as perimeter site walls along property lines, where reduced excavation limits are required, we recommend a maximum allowable bearing capacity of 1,500 pounds per square foot be used with minimum footing widths and depths of 18 inches.

4.4.3 Minimum Footing Width and Embedment

The following minimum footing widths and embedments are recommended for the corresponding allowable bearing pressure.

STATIC BEARING PRESSURE (psf)	MINIMUM FOOTING WIDTH (inches)	MINIMUM FOOTING* EMBEDMENT (inches)
3,500	48	24
3,000	36	24
2,500	24	24
2,000	24	18
1,500	18	18

* Refers to minimum depth below lowest adjacent grade at the time of foundation construction.

A minimum footing width of 18 inches should be used even if the actual bearing pressure is less than 1,500 psf.

4.4.4 Estimated Settlements

Total static settlement of isolated pad or continuous wall footings (up to 80 kips for columns and 10 kips per lineal foot for walls) is expected to be on the order of ¾-inch. Differential static settlement between similarly loaded column footings or along a 60-foot span of a continuous footing is expected to be on the order of ½-inch or less. The majority of the settlement will occur immediately upon load application.

The potential for seismic settlement was addressed in a previous section of this report and should be referred to in evaluating the potential total settlements.
The above estimates are based on the assumption that the recommended earthwork will be performed and that the footings will be sized in accordance with our recommendations.

4.4.5 Lateral Load Resistance

Soil resistance to lateral loads will be provided by a combination of frictional resistance between the bottom of footings or thrust restraints and underlying soils and by passive soil pressures acting against the embedded sides of the footings. For frictional resistance of the footings, a coefficient of friction of 0.30 may be used for design. In addition, an allowable lateral bearing pressure equal to an equivalent fluid weight of 275 pounds per cubic foot may be used, provided the footings are poured tight against compacted fill. These values may be used in combination without reduction. For frictional resistance of the thrust restraints, a coefficient of friction of 0.25 may be used for design.

4.4.6 Foundation Inspection

Prior to placement of concrete and reinforcing steel, a representative of GPI should observe and approve foundation excavations.

4.4.7 Foundation Concrete

Laboratory testing by HDR (Appendix C) indicates that the near surface soils exhibit a soluble sulfate content of 33 mg/kg. For the 2019 CBC, foundation concrete should conform to the requirements outlined in ACI 318, Section 4.3 for negligible levels of soluble sulfate exposure from the on-site soils, (Category S0). Chloride levels in the on-site soils are found to be low (5.1 ppm). For concrete exposed to soil moisture, such as footings and floor slabs, we recommend a chloride Category C1.

4.5 BUILDING FLOOR SLABS

Slab-on-grade floors should be supported on granular, non-expansive (EI $\leq$ 20), compacted soils as discussed in the "Placement and Compaction of Fills" section. The upper on-site soils consist predominantly of soils that meet this criterion. There is not a geotechnical requirement for slab reinforcing based on the non-expansive characteristics of the on-site soils.

For elastic design of slabs-on-grade supporting sustained concentrated loads, a modulus of subgrade reaction (k) of 250 pounds per cubic inch (pounds per square inch per inch of deflection) may be used for on-site soils. The structural design should consider both long-term loads related to building operations and short-term construction loads.

Although not anticipated under most of the building, a vapor/moisture retarder should be placed under slabs that are to be covered with moisture-sensitive floor coverings (parquet, vinyl tile, etc.). Currently, common practice is to use a 15-mil polyolefin product such as Stego Wrap for this purpose. Whether to place the concrete slab directly on the vapor barrier or place a clean sand layer between the slab and vapor barrier is a decision for the Project Architect, as it is not a geotechnical issue. If covered by sand, the sand layer should be about 2 inches thick and contain less than 5 percent by weight passing the No. 200 sieve. Based on our explorations and laboratory testing, the soils at the site are not suitable for this purpose. The function of the sand layer is to protect the vapor retarder during construction and to aid in the uniform curing of the concrete. This layer should be nominally compacted using light equipment. The sand placed over the vapor retarder should only be slightly moist. If the sand gets wet (for example as a result of rainfall or excessive moistening) it must be allowed to dry prior to placing concrete. Care should be taken to avoid infiltration of water into the sand layer after placement of the concrete slab, such as at slab cut-outs and other exposures. A sand layer is not required beneath the vapor retarder, but we take no exception if one is provided.

It should be noted that the material used as a vapor retarder is only one of several factors affecting the prevention of moisture accumulation under floor coverings. Other factors include maintaining a low water to cement ratio for the concrete used for the floor slab, effective sealing of joints and edges (particularly at pipe penetrations), as well as excess moisture in the concrete. The manufacturer of the floor coverings should be consulted for establishing acceptable criteria for the condition of floor surface prior to placing moisture-sensitive floor coverings.

During construction of a concrete tilt-up building during the rainy season, there is a potential for storm water run-off across the building pad or floor slab prior to construction of the roof. Such run-off can cause erosion at the edges of the building pad, undermining the recently placed floor slab. We recommend the Contractor take measures to protect the soils beneath the edge of the dock-high slab from erosion during the rainy season. If undermined, the slab support will need to be evaluated by GPI, and backfill with sand-cement slurry will likely be required to restore the support for the floor slab.

4.6 RETAINING STRUCTURES

The following recommendations are provided for retaining walls or shoring less than 8 feet in height. We recommend that walls be backfilled with granular soils (less than 40 percent passing the No. 200 sieve), which are readily available on site.

Active earth pressures can be used for designing cantilevered walls or shoring that can yield laterally at least ½-percent of the wall height under the imposed loads. For level, drained backfill, derived from granular, non-expansive soils, a lateral pressure of an equivalent fluid weighing of 40 pounds per cubic foot may be used. This value can also be used for design of temporary cantilevered shoring.

At-rest pressures should be used for restrained walls that remain rigid enough to be essentially non-yielding. For select, non-expansive, level, drained backfill, a lateral pressure of an equivalent fluid weighing 60 pounds per cubic foot can be used.

As outlined in the California Building Code, site retaining walls 6 feet or taller should be designed to resist seismic lateral earth pressures. A lateral pressure equivalent to a fluid with a unit weight of 20 pounds per cubic foot may be used. This pressure should be combined with the active earth pressure presented above. If the retaining walls are designed using the at-rest pressure provided above, only the difference between the active plus seismic pressures and the at-rest pressure needs to be included as the seismic pressure.

The recommended pressures are based on the assumption that the supported earth will be fully drained, preventing the build-up of hydrostatic pressures. For traditional backfilled retaining walls, a drain consisting of perforated pipe and 1 cubic foot of gravel per lineal foot, wrapped in filter fabric should be used. The fabric (non-woven filter fabric, Mirafi 140N or equivalent) should be lapped at the top.

Walls subject to surcharge loads should be designed for an additional uniform lateral pressure equal to one-third and one-half the anticipated surcharge pressure for unrestrained and restrained walls, respectively.

The Structural Engineer should specify the use of select, granular wall backfill on the plans. Wall footings should be designed as discussed in the “Foundations” section.

4.7 PAVEMENTS

A test on the upper soils resulted in an R-value of 39. The California Division of Highways Design Method was used for design of the recommended asphalt pavement sections. We anticipate the truck drives and loading area north of the building to have significantly higher loading and traffic index than the remainder of the site. For this area we assumed a traffic index of 7 for a 15-year service life based on information provided in the design criteria. Based on the test results and soil conditions encountered in our explorations, we recommend the following preliminary pavement sections be used for design.

PAVEMENT AREA	TRAFFIC INDEX	SECTION THICKNESS (inches)	
		ASPHALT CONCRETE	AGGREGATE BASE COURSE
Asphalt Concrete			
Auto Parking	4	3	4
Circulation Drives/ Light Truck and Van	5.5	3	6
Heavy Truck Drives	7	4	8
Portland Cement Concrete		**PCC**	
Auto Parking	4	5.0	---
Circulation Drives/Light Truck and Van	5.5	6.0	---
Heavy Truck Drives/Truck Court	7	7.0	---

The pavement subgrade and base course material should be compacted to at least 95 percent of the maximum dry density (ASTM D1557).

The concrete used for paving should have a compressive strength of at least 4,000 psi at the time the pavement is subjected to truck traffic. The pavement base course should be compacted to at least 95 percent of maximum dry density (ASTM D-1557). Aggregate base should conform to the requirements of Section 26 of the California Department of Transportation Standard Specifications for Class II aggregate base (three-quarter inch maximum) or Section 200-2 of the Standard Specifications for Public Works Construction (Green Book) for untreated base materials (except processed miscellaneous base).

The above recommendations are based on the assumption that the base course and compacted subgrade will be properly drained. The design of paved areas should incorporate measures to prevent moisture build-up within the base course, which can otherwise lead to premature pavement failure. For example, curbing adjacent to landscaped areas should be deep enough to act as a barrier to infiltration of irrigation water into the adjacent base course.

We have assumed that the existing pavement will be replaced for this project. If it is desired to re-use or overlay portions of the existing pavements, we can evaluate those options and provide recommendations in a separate report.

4.8 CORROSION

Resistivity testing of a representative sample of the on-site soils indicates that they are mildly corrosive to buried ferrous metals. Soil corrosion with regards to foundation concrete was addressed in a prior section of this report. GPI does not practice corrosion protection engineering. If corrosion protection recommendations are required, a corrosion engineer such as HDR should be consulted to provide recommendations to protect these elements from corrosion.

4.9 DRAINAGE

Positive surface gradients should be provided adjacent to structures so as to direct surface water run-off and roof drainage away from foundations and slabs toward suitable discharge facilities. Long-term ponding of surface water should not be allowed on pavements or adjacent to buildings.

4.10 INFILTRATION TESTING

Test wells P-1 through P-6 were installed in boreholes drilled using truck-mounted hollow-stem auger drill equipment at preliminary infiltration basin locations provided by Thienes Engineering. The locations of the test wells are shown on Figures 2 and 3. The wells consisted of 2-inch diameter PVC casing installed in an 8-inch diameter borehole. The casing was perforated in the lower 2 feet of the wells. Packing material around the slotted sections of the well casing consisted of #3 sand. The test wells were constructed to depths of approximately 8 to 10 feet below existing grade in order to test the soils near the bottom of the proposed infiltration basins being considered at the time our field work was conducted. The infiltration testing was performed in general accordance with the Orange County guidelines for borehole infiltration tests.

The test wells were filled with water the day before testing and presoaked at least 15 hours. Prior to running the tests, we conducted the screening test to determine test method by filling the test holes as described in the guidelines and taking measurements of the water levels. The non-sandy soil criterion was achieved in each by showing that 6 inches of water did not completely seep away in less than 25 minutes in two consecutive 25 minute measurements.

The percolation testing was conducted as outlined in the guidelines for non-sandy soils for at least 12 consecutive 30-minute readings. The tests were performed in each well, measuring the drop in water level over the designated time increment, as appropriate for each location. The initial water levels prior to each reading was at least 2 feet above the bottom of the wells, being refilled in between tests. After completion of the infiltration testing, the well casings were removed, and the holes were backfilled with the on-site soils. Details of the percolation tests are presented in the attached Tables 1 to 6, Borehole Infiltration Test Results.

The measured infiltration rates were calculated using the drop in water level over the test increment time and corrected for one-dimensional flow using the Porchet Method. The final observed rates for each well, corrected as indicated above, are presented in the following table and should be used by the Project Civil Engineer with an appropriate factor of safety (Worksheet 3 from OC TGD, 2017).

Infiltration Test Results Summary

TEST WELL	APPROXIMATE DEPTH OF TEST WELL (feet)	CORRECTED INFILTRATION RATE (inch/hour)	INFILTRATION FEASABILITY*
P-1	10.6	1.03	Marginal
P-2	8.5	0.11	Partial
P-3	9.1	0.54	Partial
P-4	9.2	0.07	Not Supported
P-5	8.3	0.05	Not Supported
P-6	9.1	1.20	Marginal

*Per Orange County guidelines (OC TGD, 2017)

The Civil Engineer should evaluate the feasibility of surface infiltration using the rates provided above. Based on the results of the tests, storm water disposal by infiltration into the shallow subsurface soils is anticipated to be feasible; however, the variable layering of granular and fine-grain soils results in variable infiltration rates. Further infiltration testing may be required depending on the final design (location and depths) of the storm water systems.

It should also be noted that the infiltration rates are for clean water and do not include effects of sediment, fines, dissolved solids or other debris, as these materials will significantly reduce the infiltration rates of the subsurface soils. Prior to infiltration, water should be cleaned of sediment or other deleterious materials to help reduce the potential for clogging and reduced percolation rates. Should fines or suspended solids be permitted to enter the basin, reduced infiltration rates will result.

4.11 GEOTECHNICAL OBSERVATION AND TESTING

We recommend that a representative of GPI observe earthwork during construction to confirm that the recommendations provided in our report are applicable during construction. The earthwork activities include grading, compaction of fills, subgrade preparation, pavement construction and foundation excavations. If conditions are different than expected, we should be afforded the opportunity to provide an alternate recommendation based on the actual conditions encountered.

5.0 LIMITATIONS

This report, exploration logs, and other materials resulting from GPI's efforts were prepared exclusively for Panattoni Development Company, Inc. and their consultants in designing the proposed development. The report is not intended to be suitable for reuse on extensions or modifications of the project or for use on projects other than the currently proposed development, as it may not contain sufficient or appropriate information for such uses. If this report or portions of this report are provided to contractors or included in specifications, it should be understood that they are provided for information only. This report cannot be utilized by another entity without the express written permission of GPI.

Soil deposits may vary in type, strength, and many other important properties between points of exploration due to non-uniformity of the geologic formations or to man-made cut and fill operations. While we cannot evaluate the consistency of the properties of materials in areas not explored, the conclusions drawn in this report are based on the assumption that the data obtained in the field and laboratory are reasonably representative of field conditions and are conducive to interpolation and extrapolation.

Furthermore, our recommendations were developed with the assumption that a proper level of field observation and construction review will be provided by GPI during grading, excavation, and foundation construction. If field conditions during construction appear to be different than is indicated in this report, we should be notified immediately so that we may assess the impact of such conditions on our recommendations. If others perform the construction phase services, they must accept full responsibility for all geotechnical aspects of the project, including this report.

Our investigation and evaluations were performed using generally accepted engineering approaches and principles available at this time and the degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers practicing in this area. No other representation, either expressed or implied, is included or intended in our report.

Respectfully submitted,
Geotechnical Professionals Inc.

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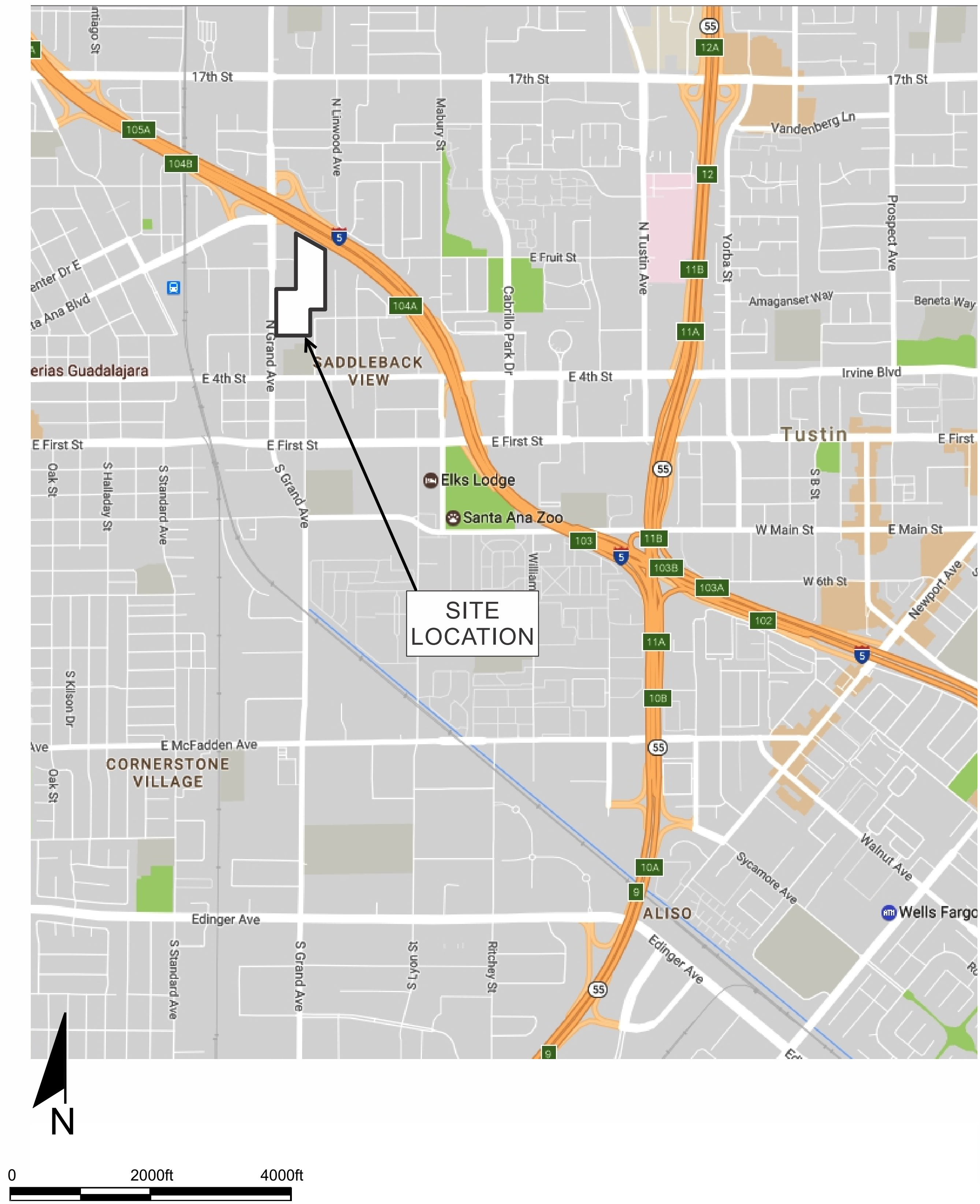
GeoLogismiki, 2007, "CLiq – CPT Liquefaction Software," Version 2.0.6.82



BASE MAP REPRODUCED FROM © GOOGLE MAPS

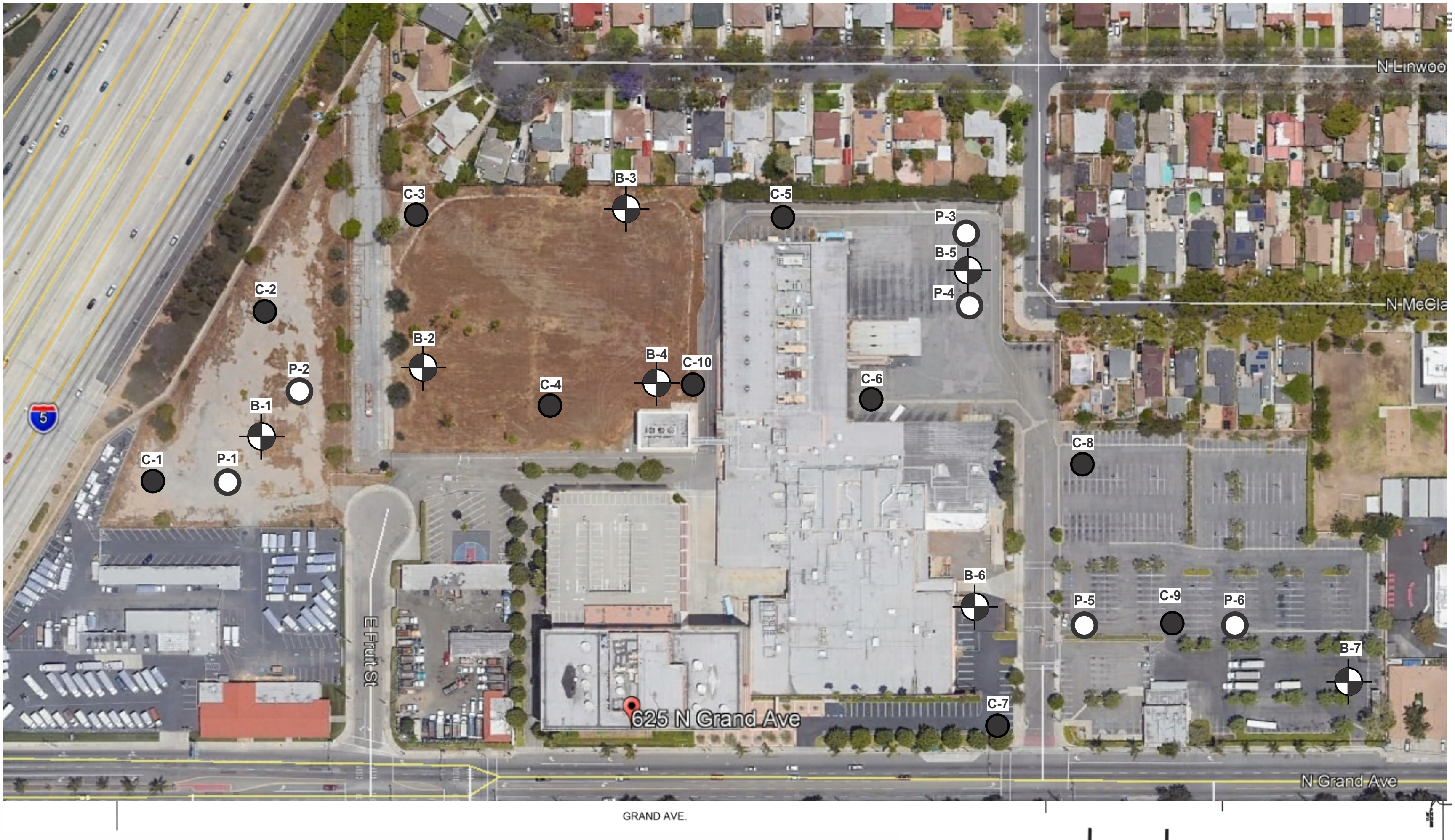
GEOTECHNICAL PROFESSIONALS, INC.

PANATTONI - SANTA ANA

GPI PROJECT NO. 2992.I	SCALE: 1" = 2000 FEET

SITE LOCATION

FIGURE 1



EXPLANATION

B-8 APPROXIMATE LOCATION AND NUMBER OF EXPLORATORY BORING

C-8 APPROXIMATE LOCATION AND NUMBER OF CONE PENETRATION TEST

P-6 APPROXIMATE LOCATION AND NUMBER OF INFILTRATION TEST

N

0 200 400 FEET

BASE MAP REPRODUCED FROM SITE PLAN PROVIDED BY ARCHITECTS ORANGE: DATED 05-24-2020

GPI GEOTECHNICAL PROFESSIONALS, INC.

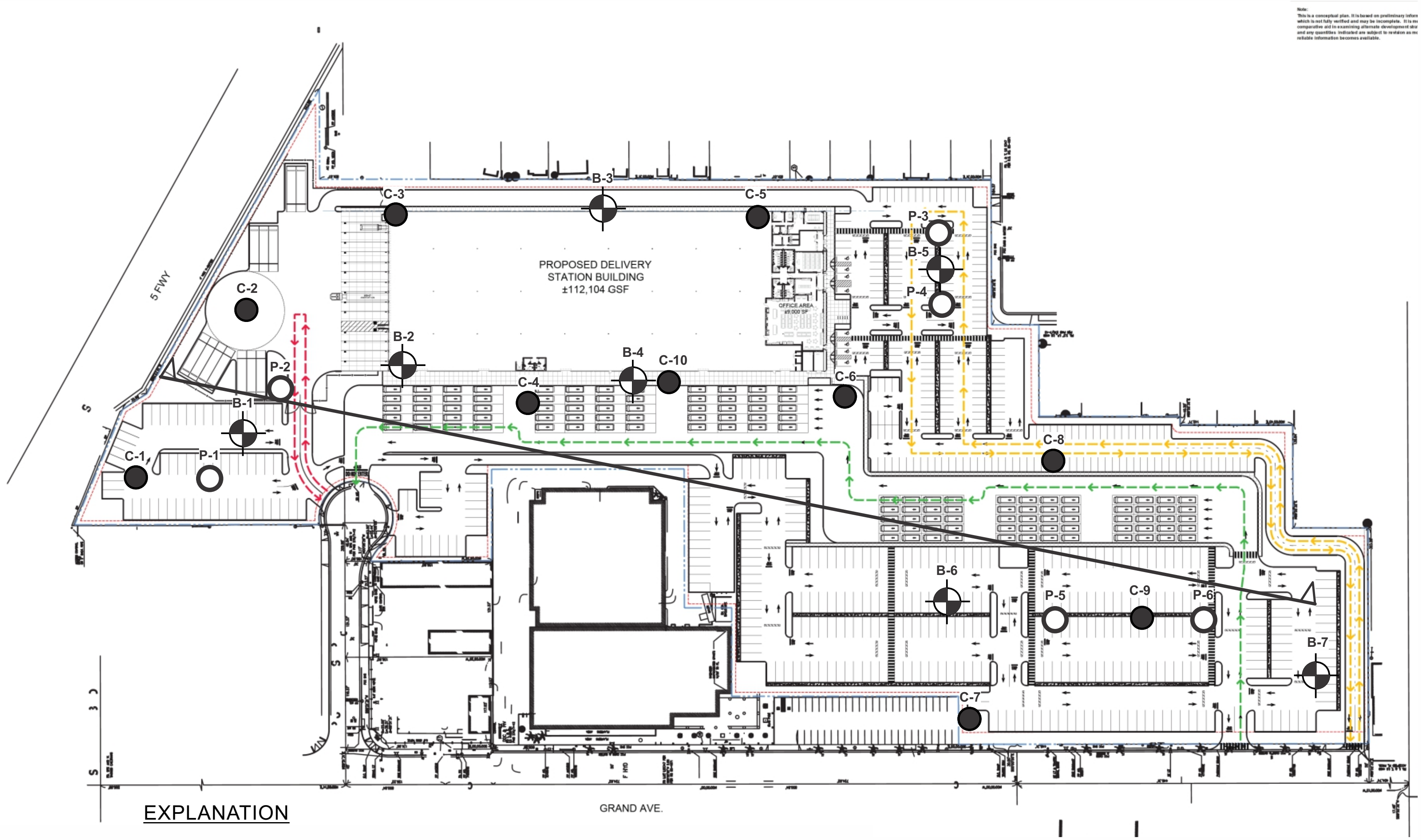
PANATTONI - SANTA ANA

GPI PROJECT NO.: 2992.I

SCALE: 1" = 200'

EXPLORATION LOCATION PLAN (EXISTING CONDITIONS)

FIGURE 2



EXPLANATION

B-8 APPROXIMATE LOCATION AND NUMBER OF EXPLORATORY BORING

C-8 APPROXIMATE LOCATION AND NUMBER OF CONE PENETRATION TEST

P-6 APPROXIMATE LOCATION AND NUMBER OF INFILTRATION TEST

APPROXIMATE LOCATION OF GEOLOGIC CROSS SECTION (FIGURE 5)

BASE MAP REPRODUCED FROM SITE PLAN PROVIDED BY ARCHITECTS ORANGE: DATED 05-24-2020

GEOTECHNICAL PROFESSIONALS, INC.

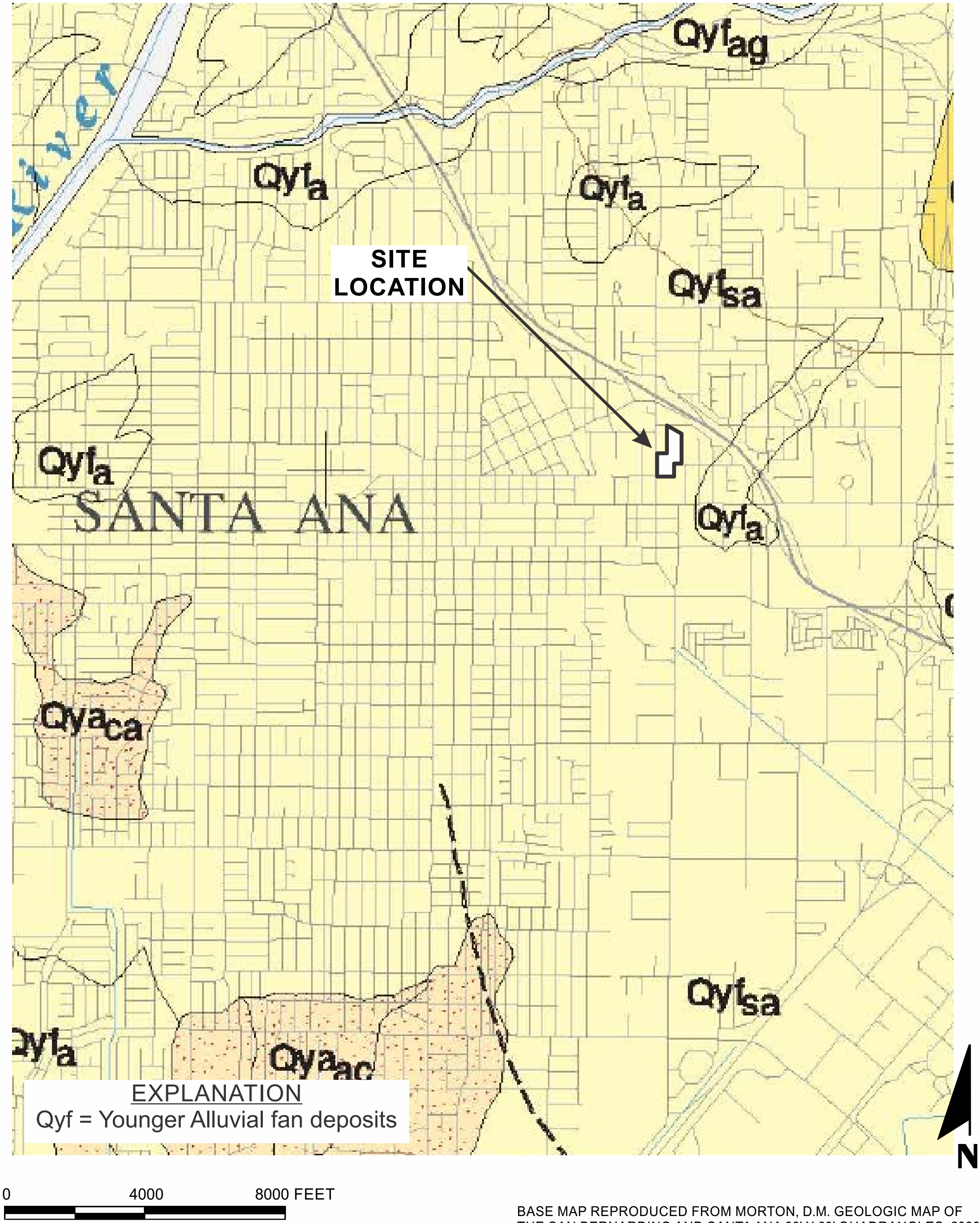
PANATTONI - SANTA ANA

GPI PROJECT NO.: 2992.I

SCALE: 1" = 200'

EXPLORATION LOCATION PLAN (PROPOSED BUILDING LAYOUT)

FIGURE 3



BASE MAP REPRODUCED FROM MORTON, D.M. GEOLOGIC MAP OF THE SAN BERNARDINO AND SANTA ANA 30' X 60' QUADRANGLES, 2006

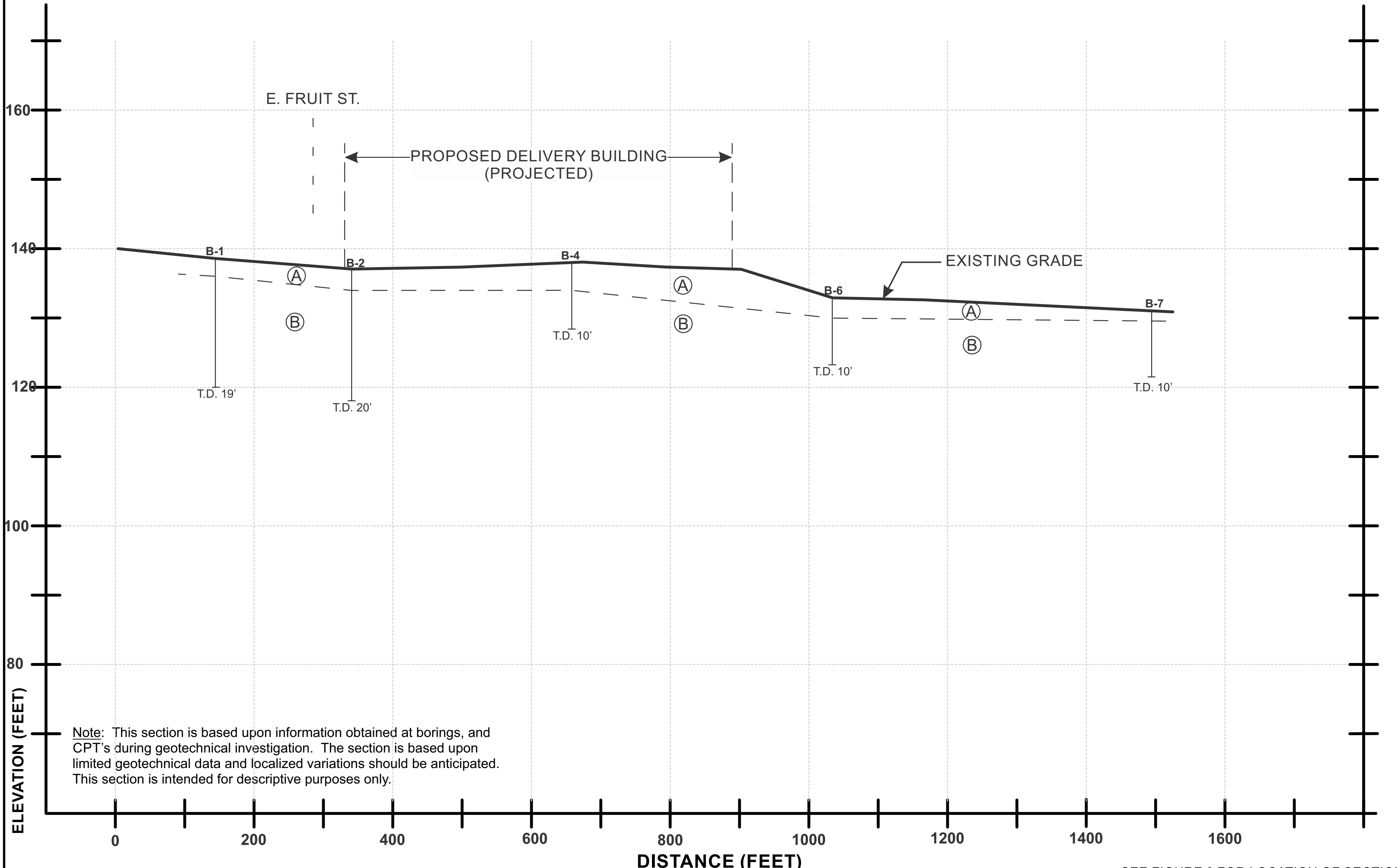
GPI GEOTECHNICAL PROFESSIONALS, INC.

PANATTONI SANTA ANA

GPI PROJECT NO. 2992.I | SCALE: 1" = 4000'

REGIONAL GEOLOGIC MAP

FIGURE 4



SEE FIGURE 3 FOR LOCATION OF SECTION

SOIL UNITS

- Ⓐ UNDOCUMENTED FILL
- Ⓑ YOUNGER ALLUVIUM

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PANATTONI - SANTA ANA

GPI PROJECT NO.: 2992.I | SCALE: HOR 1" = 200' VER 1" = 20'

SUBSURFACE GEOLOGIC SECTION

FIGURE 5

TABLE 1

BOREHOLE INFILTRATION TEST RESULTS (corrected with Porchet Method)

Orange County Method-TGD, 2011

Project No. 2992.I Project Name: Panattoni-Santa Ana Date: 7/14/2020

Test Date 6/27/2020 NOTE: Slowest rate from percolation testing used to calculate infiltration rate

Test Well	Test Duration (min) Δt	Water Depth Initial (ft) D_o	Water Depth Final (ft) D_f	Total Depth of Test Hole (ft) D_T	Hole Diameter (inches)	Initial Water Height (ft) H_o	Final Water Height (ft) H_f	Change in Height of Water (ft) $\Delta H = \Delta D$	Average Height of Water (ft) H_{avg}	Infiltration Rate (in/hr) I_t
P-1	30	7.60	8.14	10.60	8	3.00	2.46	0.54	2.73	0.75
P-1	30	7.91	8.66	10.60	8	2.69	1.94	0.75	2.32	1.21
P-1	30	7.50	8.12	10.60	8	3.10	2.49	0.615	2.79	0.83
P-1	30	7.83	8.59	10.60	8	2.77	2.02	0.755	2.39	1.18
P-1	30	8.08	8.75	10.60	8	2.52	1.86	0.665	2.19	1.13
P-1	30	8.06	8.74	10.60	8	2.54	1.87	0.675	2.20	1.14
P-1	30	7.90	8.64	10.60	8	2.70	1.96	0.74	2.33	1.19
P-1	30	8.06	8.74	10.60	8	2.54	1.86	0.68	2.20	1.15
P-1	30	8.23	8.86	10.60	8	2.37	1.75	0.625	2.06	1.12
P-1	30	8.30	8.93	10.60	8	2.30	1.67	0.63	1.99	1.17
P-1	30	8.16	8.79	10.60	8	2.44	1.81	0.63	2.13	1.10
P-1	30	8.02	8.65	10.60	8	2.58	1.96	0.625	2.27	1.03

Test Date 6/27/2020 NOTE: Slowest rate from percolation testing used to calculate infiltration rate

Test Well	Test Duration (min) Δt	Water Depth Initial (ft) D_o	Water Depth Final (ft) D_f	Total Depth of Test Hole (ft) D_T	Hole Diameter (inches)	Initial Water Height (ft) H_o	Final Water Height (ft) H_f	Change in Height of Water (ft) $\Delta H = \Delta D$	Average Height of Water (ft) H_{avg}	Infiltration Rate (in/hr) I_t
P-2	30	6.38	6.54	8.47	8	2.09	1.94	0.155	2.01	0.28
P-2	30	6.47	6.55	8.47	8	2.00	1.93	0.075	1.96	0.14
P-2	30	6.24	6.38	8.47	8	2.23	2.10	0.135	2.16	0.23
P-2	30	6.47	6.51	8.47	8	2.00	1.96	0.04	1.98	0.07
P-2	30	6.45	6.52	8.47	8	2.02	1.95	0.07	1.99	0.13
P-2	30	6.43	6.49	8.47	8	2.04	1.99	0.055	2.01	0.10
P-2	30	6.40	6.48	8.47	8	2.07	2.00	0.075	2.03	0.14
P-2	30	6.44	6.50	8.47	8	2.03	1.97	0.06	2.00	0.11
P-2	30	6.39	6.46	8.47	8	2.08	2.01	0.07	2.05	0.13
P-2	30	6.43	6.50	8.47	8	2.04	1.98	0.065	2.01	0.12
P-2	30	6.45	6.53	8.47	8	2.02	1.95	0.075	1.98	0.14
P-2	30	6.40	6.47	8.47	8	2.07	2.01	0.065	2.04	0.12
P-2	30	6.45	6.52	8.47	8	2.02	1.96	0.065	1.99	0.12

TABLE 1 (cont.)

Test Date 9/16/2016 NOTE: Slowest rate from percolation testing used to calculate infiltration rate

Test Well	Test Duration (min)	Water Depth Initial (ft)	Water Depth Final (ft)	Total Depth of Test Hole (ft)	Hole Diameter (inches)	Initial Water Height (ft)	Final Water Height (ft)	Change in Height of Water (ft)	Average Height of Water (ft)	Infiltration Rate (in/hr)
	Δt	D_o	D_f	D_T		H_o	H_f	ΔH=ΔD	H_{avg}	I_t
P-3	30	6.71	7.03	9.05	8	2.34	2.02	0.32	2.18	0.55
P-3	30	6.93	7.25	9.05	8	2.12	1.80	0.32	1.96	0.60
P-3	30	6.92	7.25	9.05	8	2.13	1.81	0.325	1.97	0.61
P-3	30	6.93	7.27	9.05	8	2.12	1.79	0.335	1.95	0.63
P-3	30	6.91	7.24	9.05	8	2.14	1.82	0.325	1.98	0.61
P-3	30	6.91	7.23	9.05	8	2.14	1.83	0.315	1.98	0.59
P-3	30	6.92	7.25	9.05	8	2.13	1.81	0.325	1.97	0.61
P-3	30	6.91	7.24	9.05	8	2.14	1.82	0.325	1.98	0.61
P-3	30	6.93	7.26	9.05	8	2.12	1.79	0.33	1.96	0.62
P-3	30	6.93	7.26	9.05	8	2.12	1.79	0.33	1.96	0.62
P-3	30	6.91	7.23	9.05	8	2.14	1.82	0.32	1.98	0.60
P-3	30	6.90	7.23	9.05	8	2.15	1.82	0.33	1.99	0.61
P-3	30	6.86	7.16	9.05	8	2.19	1.89	0.3	2.04	0.54

Test Date 9/16/2016 NOTE: Slowest rate from percolation testing used to calculate infiltration rate

Test Well	Test Duration (min)	Water Depth Initial (ft)	Water Depth Final (ft)	Total Depth of Test Hole (ft)	Hole Diameter (inches)	Initial Water Height (ft)	Final Water Height (ft)	Change in Height of Water (ft)	Average Height of Water (ft)	Infiltration Rate (in/hr)
	Δt	D_o	D_f	D_T		H_o	H_f	ΔH=ΔD	H_{avg}	I_t
P-4	30	7.28	7.38	9.17	8	1.89	1.80	0.095	1.84	0.19
P-4	30	7.17	7.24	9.17	8	2.00	1.94	0.065	1.97	0.12
P-4	30	7.16	7.23	9.17	8	2.01	1.95	0.065	1.98	0.12
P-4	30	7.19	7.27	9.17	8	1.98	1.91	0.075	1.94	0.14
P-4	30	7.17	7.22	9.17	8	2.00	1.95	0.05	1.98	0.09
P-4	30	7.22	7.31	9.17	8	1.95	1.86	0.09	1.91	0.17
P-4	30	7.23	7.33	9.17	8	1.94	1.84	0.1	1.89	0.19
P-4	30	7.18	7.23	9.17	8	1.99	1.94	0.05	1.97	0.09
P-4	30	7.19	7.24	9.17	8	1.98	1.93	0.05	1.96	0.09
P-4	30	7.18	7.22	9.17	8	1.99	1.95	0.04	1.97	0.07
P-4	30	7.19	7.24	9.17	8	1.98	1.93	0.05	1.96	0.09
P-4	30	7.19	7.24	9.17	8	1.98	1.93	0.05	1.96	0.09

TABLE 1 (cont.)

Test Date 9/16/2016 NOTE: Slowest rate from percolation testing used to calculate infiltration rate

Test Well	Test Duration (min) Δt	Water Depth Initial (ft) D_o	Water Depth Final (ft) D_f	Total Depth of Test Hole (ft) D_T	Hole Diameter (inches)	Initial Water Height (ft) H_o	Final Water Height (ft) H_f	Change in Height of Water (ft) ΔH=ΔD	Average Height of Water (ft) H_{avg}	Infiltration Rate (in/hr) I_t
P-5	30	6.33	6.40	8.32	8	1.99	1.93	0.065	1.96	0.12
P-5	30	6.29	6.32	8.32	8	2.03	2.00	0.03	2.02	0.06
P-5	30	6.30	6.31	8.32	8	2.02	2.02	0.005	2.02	0.01
P-5	30	6.31	6.33	8.32	8	2.01	2.00	0.015	2.00	0.03
P-5	30	6.32	6.35	8.32	8	2.00	1.98	0.025	1.99	0.05
P-5	30	6.31	6.35	8.32	8	2.01	1.98	0.035	1.99	0.06
P-5	30	6.33	6.37	8.32	8	1.99	1.96	0.035	1.97	0.07
P-5	30	6.30	6.33	8.32	8	2.02	2.00	0.025	2.01	0.05
P-5	30	6.33	6.36	8.32	8	1.99	1.96	0.03	1.98	0.06
P-5	30	6.34	6.38	8.32	8	1.98	1.95	0.035	1.96	0.07
P-5	30	6.33	6.36	8.32	8	1.99	1.96	0.03	1.98	0.06
P-5	30	6.31	6.35	8.32	8	2.01	1.98	0.035	1.99	0.06
P-5	30	6.32	6.35	8.32	8	2.00	1.97	0.03	1.99	0.06

Test Date 9/16/2016 NOTE: Slowest rate from percolation testing used to calculate infiltration rate

Test Well	Test Duration (min) Δt	Water Depth Initial (ft) D_o	Water Depth Final (ft) D_f	Total Depth of Test Hole (ft) D_T	Hole Diameter (inches)	Initial Water Height (ft) H_o	Final Water Height (ft) H_f	Change in Height of Water (ft) ΔH=ΔD	Average Height of Water (ft) H_{avg}	Infiltration Rate (in/hr) I_t
P-6	30	7.12	7.77	9.12	8	2.00	1.35	0.65	1.68	1.41
P-6	30	7.27	7.84	9.12	8	1.85	1.29	0.565	1.57	1.30
P-6	30	7.36	7.88	9.12	8	1.76	1.25	0.515	1.50	1.23
P-6	30	7.21	7.79	9.12	8	1.91	1.34	0.575	1.62	1.29
P-6	30	7.17	7.76	9.12	8	1.95	1.36	0.59	1.66	1.30
P-6	30	7.23	7.80	9.12	8	1.89	1.33	0.565	1.61	1.27
P-6	30	7.16	7.75	9.12	8	1.96	1.38	0.585	1.67	1.28
P-6	30	7.02	7.62	9.12	8	2.10	1.50	0.6	1.80	1.22
P-6	30	7.19	7.77	9.12	8	1.93	1.35	0.58	1.64	1.28
P-6	30	7.09	7.69	9.12	8	2.03	1.43	0.6	1.73	1.27
P-6	30	7.20	7.78	9.12	8	1.92	1.34	0.58	1.63	1.29
P-6	30	7.05	7.64	9.12	8	2.07	1.49	0.585	1.78	1.20

APPENDIX A

APPENDIX A

CONE PENETRATION TESTS

The subsurface conditions were investigated by performing 10 Cone Penetration Tests (CPTs) at the site. The soundings were planned to depths of up to 100 feet below existing grades. However, the CPT's were ultimately advanced to maximum depths ranging from approximately 50 to 58 feet below existing grades after refusing on the very dense subsurface soils. The locations of the CPTs are shown on the Existing and Proposed Site Plans, Figures 2 and 3, respectively.

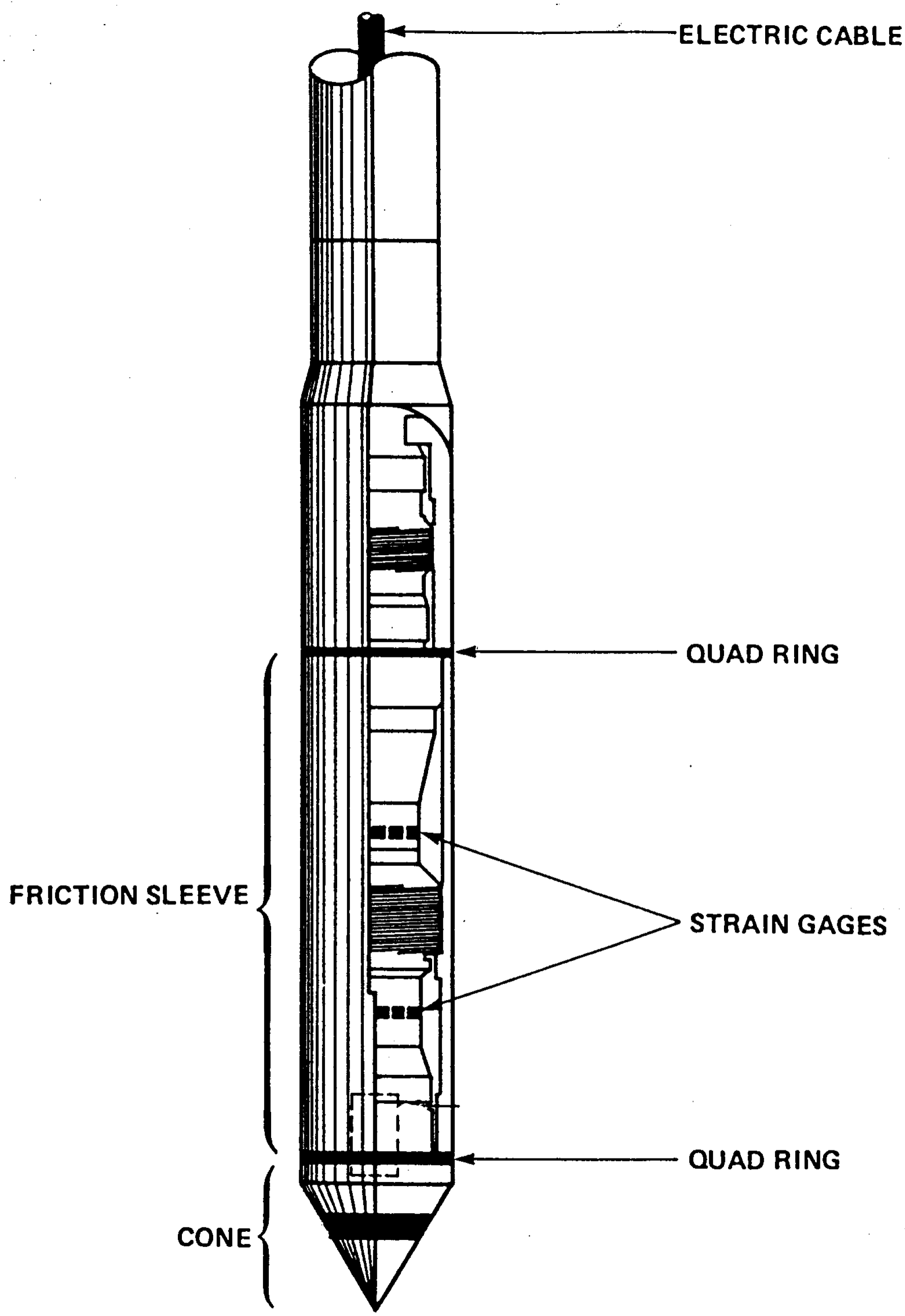
The Cone Penetration Test consists of pushing a cone-tipped probed into the soil deposit while simultaneously recording the cone tip resistance and side friction resistance of the soil to penetration (refer to Figure A-1). The CPTs described in this report were conducted in general accordance with ASTM specifications (ASTM D5778) using an electric cone penetrometer.

The CPT equipment consists of a cone assembly mounted at the end of a series of hollow sounding rods. A set of hydraulic rams is used to push the cone and rods into the soil while a continuous record of cone and friction resistance versus depth is obtained in both analog and digital form at the ground surface. A specially designed truck is used to transport and house the test equipment and to provide a 30-ton reaction to the thrust of the hydraulic rams.

Standard data obtained during a CPT consists of continuous stratigraphic information with close vertical resolution. Stratigraphic interpretation is based on relationships between cone tip resistance and friction resistance. The calculated friction ratio (CPT friction sleeve resistance divided by cone tip resistance) is used as an indicator of soil type. Granular soils typically have low friction ratios and high cone resistance, while cohesive or organic soils have high friction ratios and low cone resistance. These stratigraphic material categories form the basis for all subsequent calculations which utilize the CPT data.

Computer plots of the reduced CPT data acquired for this investigation is presented in Figures A-2 to A-11 of this appendix. The field testing and computer processing was performed by Kehoe Testing and Engineering under subcontract to Geotechnical Professionals Inc. (GPI). The interpreted soils descriptions were prepared by GPI.

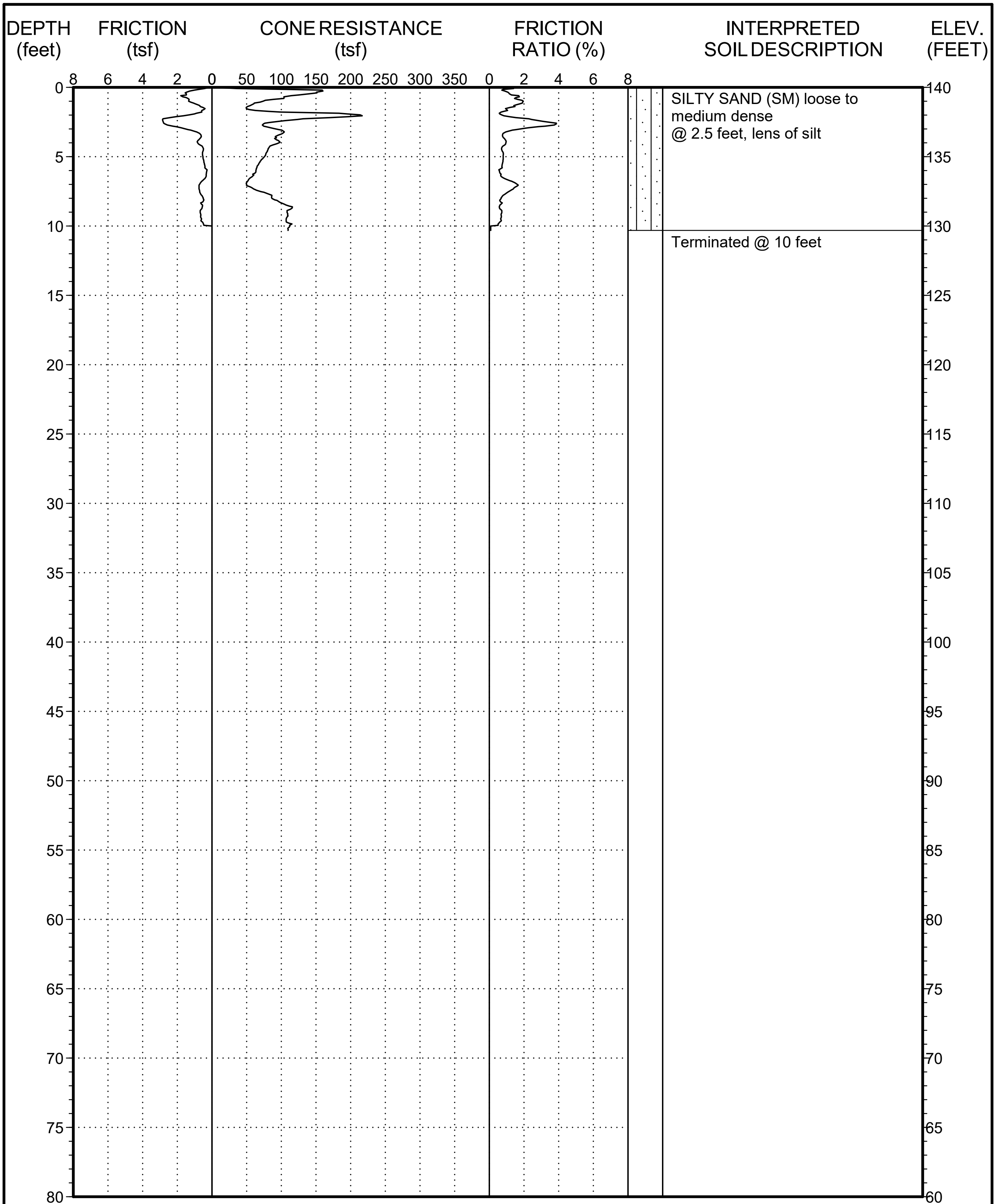
The CPT locations were laid out in the field by measuring from existing site features. Upon completion, the un-caved portions of the CPT holes were backfilled with bentonite chips. Ground surface elevations at the exploration locations were estimated from internet sources and should be considered very approximate.



GEOTECHNICAL PROFESSIONALS, INC.

CONE PENETROMETER

FIGURE A-1



Date performed:6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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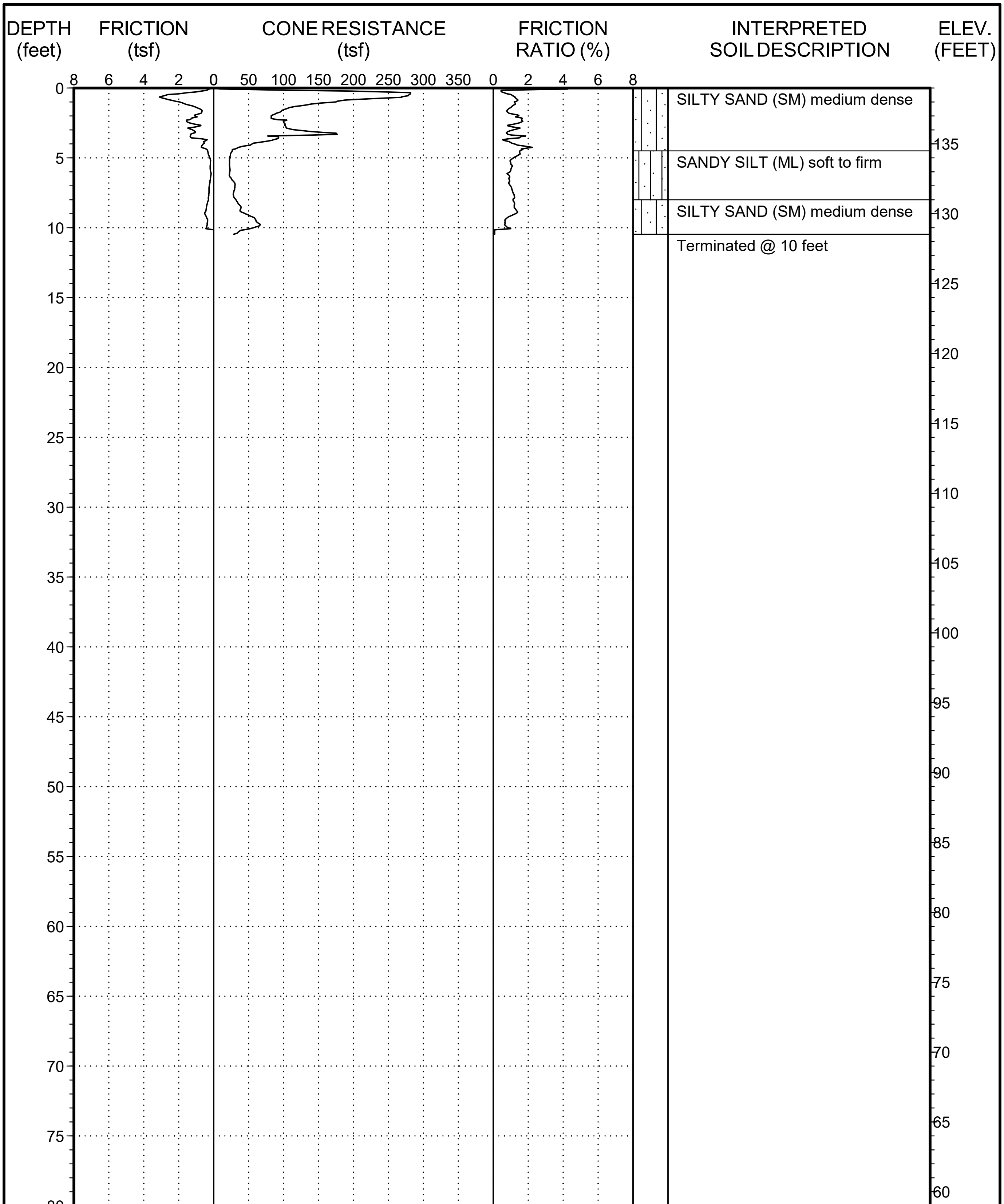
PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-1

FIGURE A-2



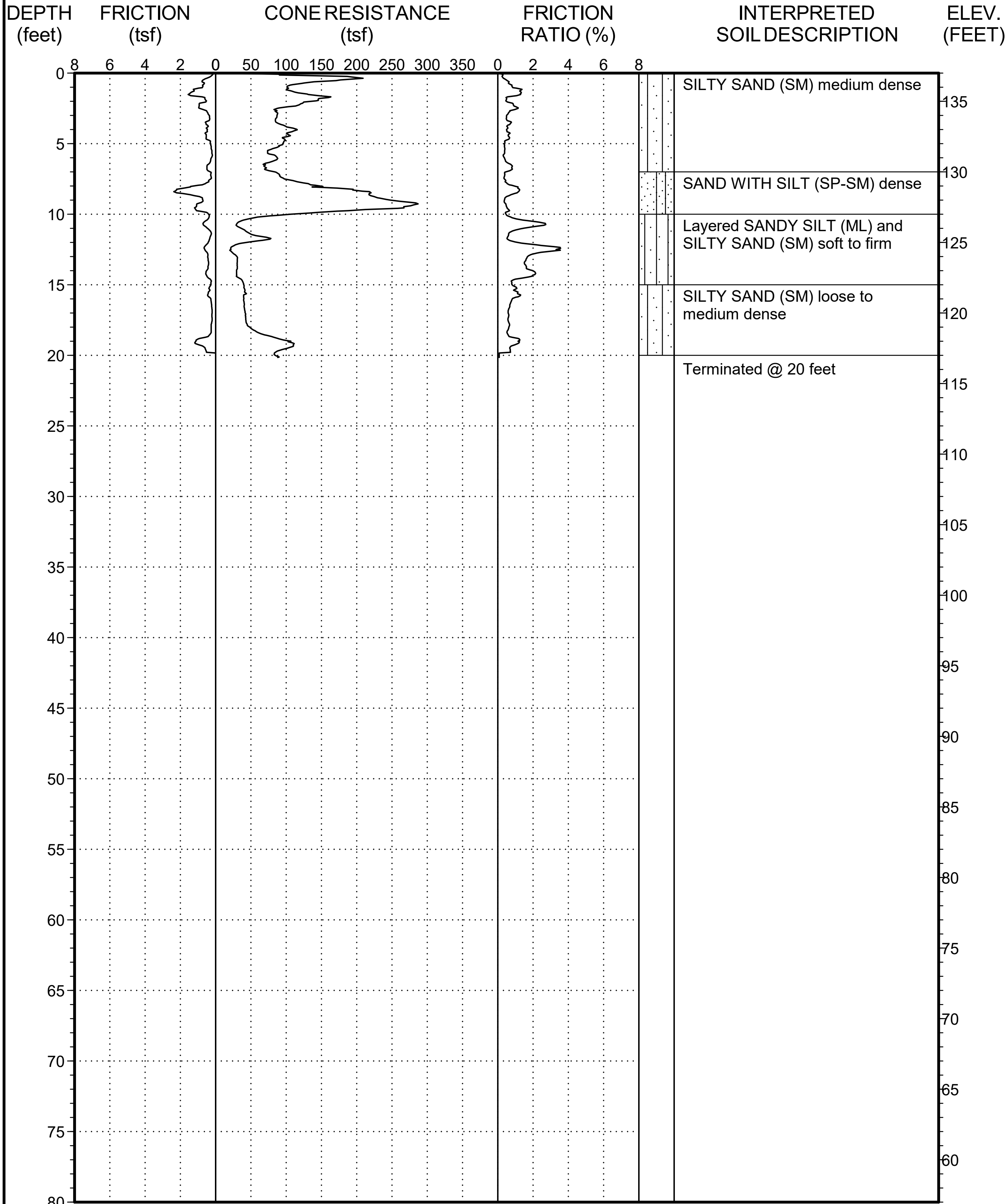
Date performed:6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-2

FIGURE A-3



Date performed: 6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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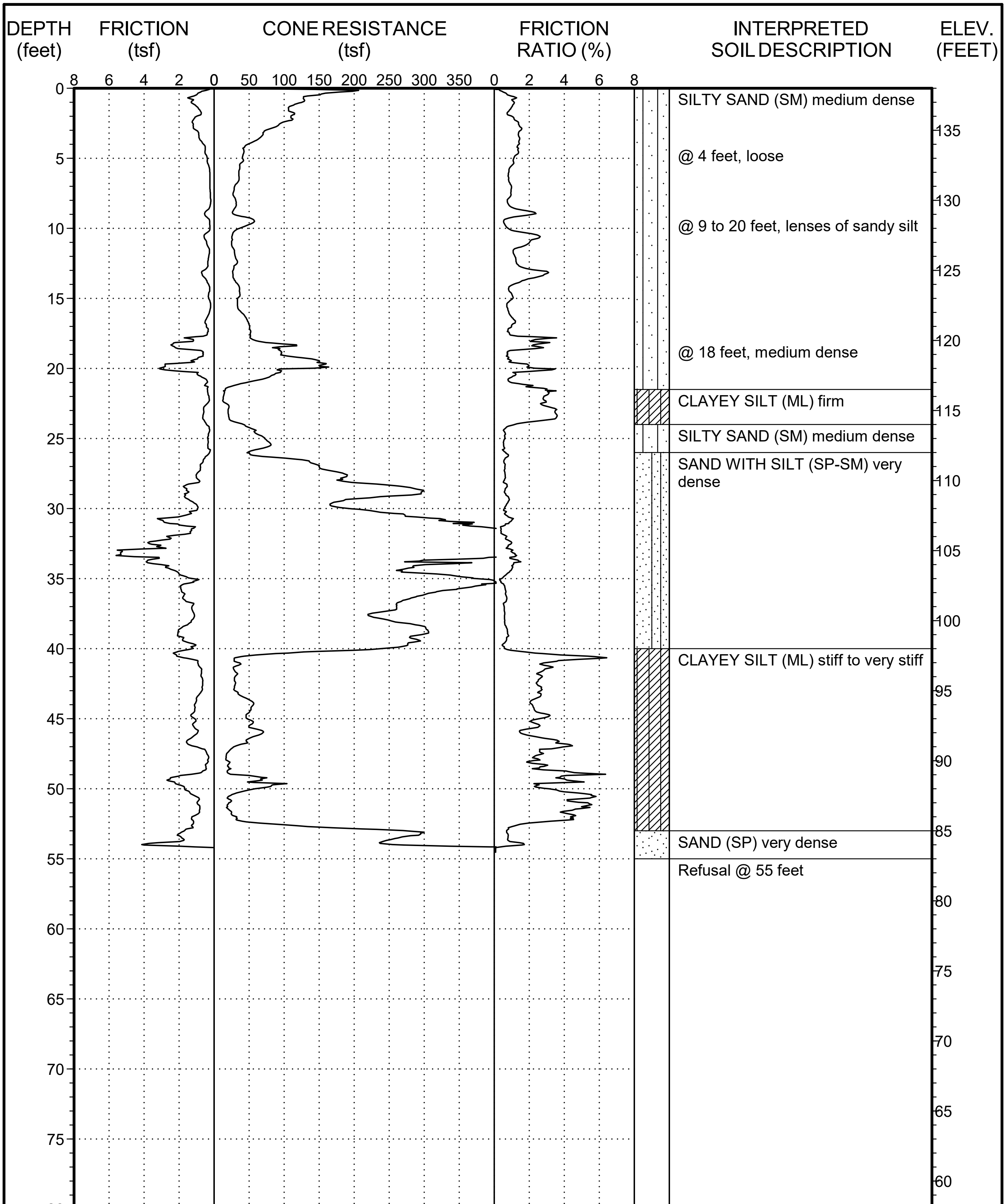
PANATTONI SANTA ANA

LOG OF CPT NO. C-3

FIGURE A-4



Date performed:6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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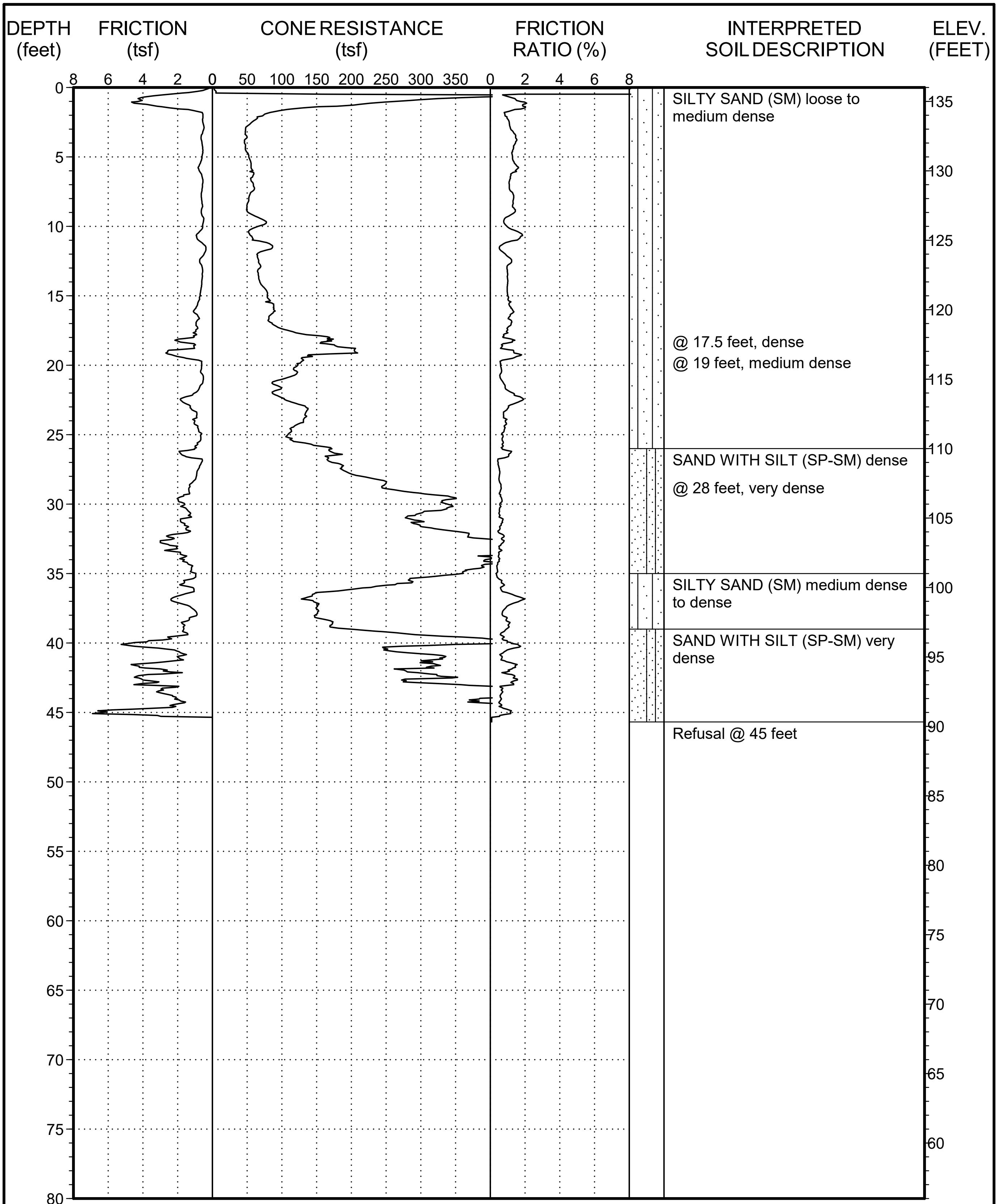
PANATTONI SANTA ANA

LOG OF CPT NO. C-4

FIGURE A-5



Date performed:6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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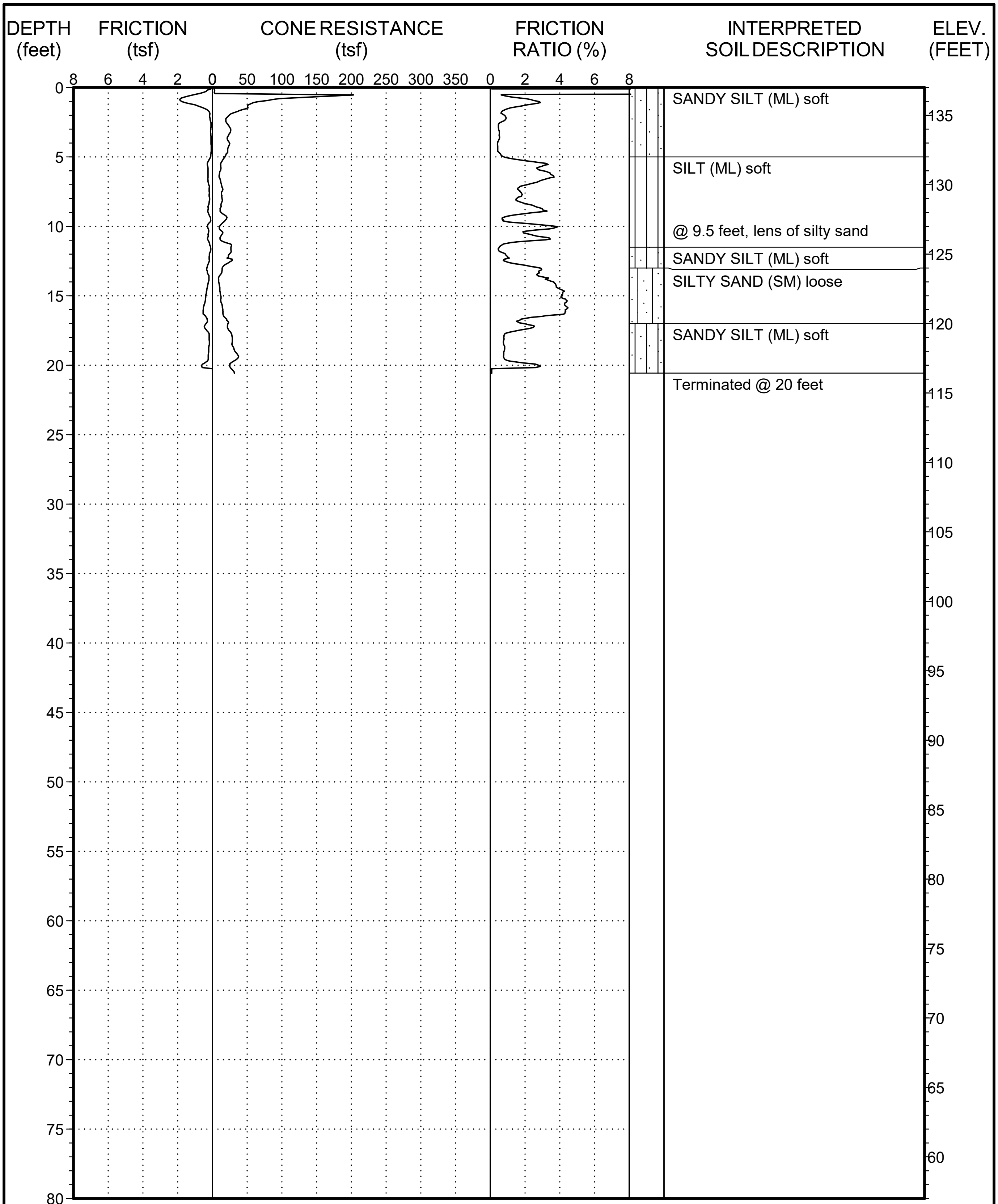
PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-5

FIGURE A-6



Date performed:6-26-20

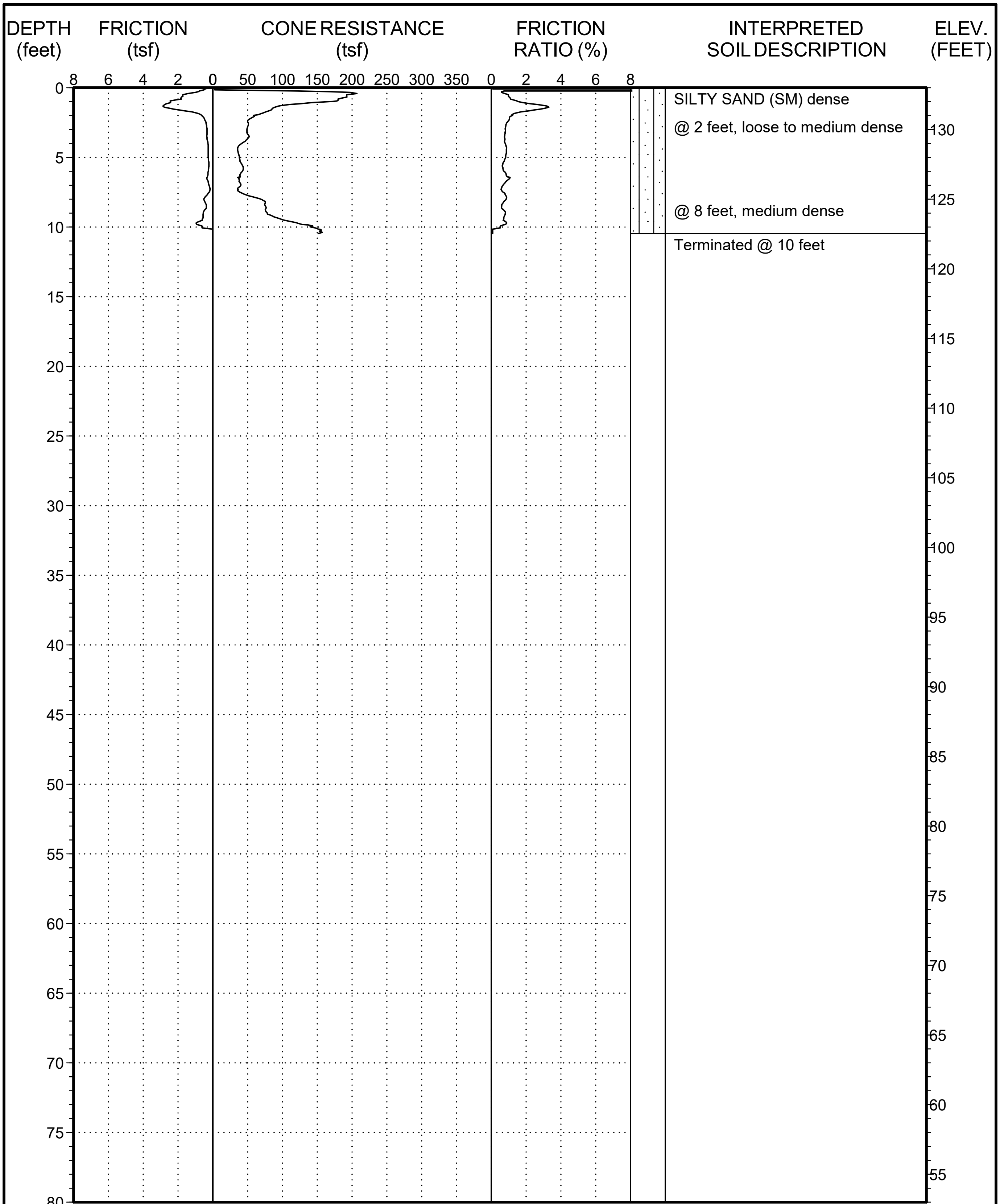
This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

PROJECT NO.: 2992.I

PANATTONI SANTA ANA

LOG OF CPT NO. C-6

FIGURE A-7



Date performed: 6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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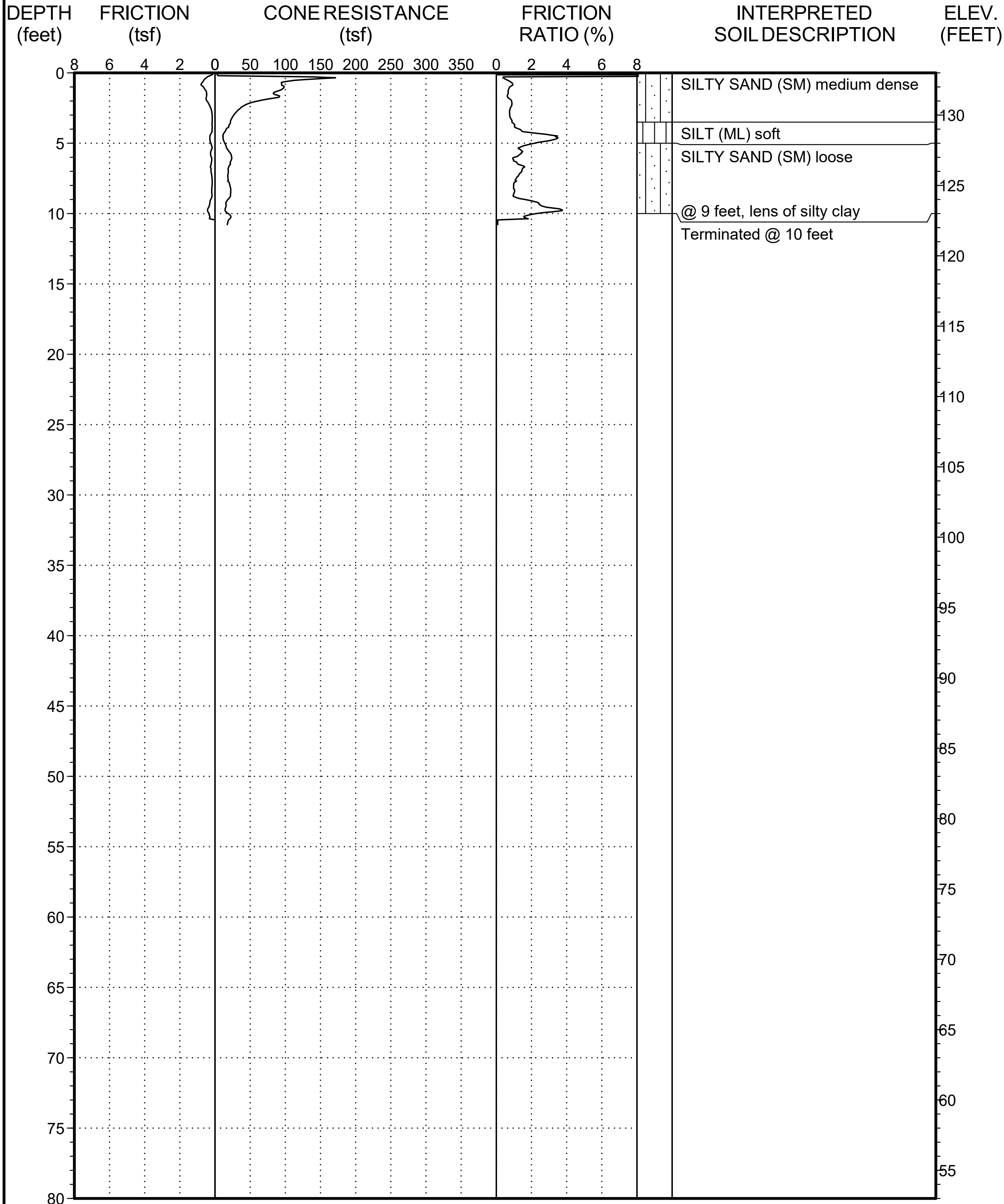
PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-7

FIGURE A-8



Date performed:6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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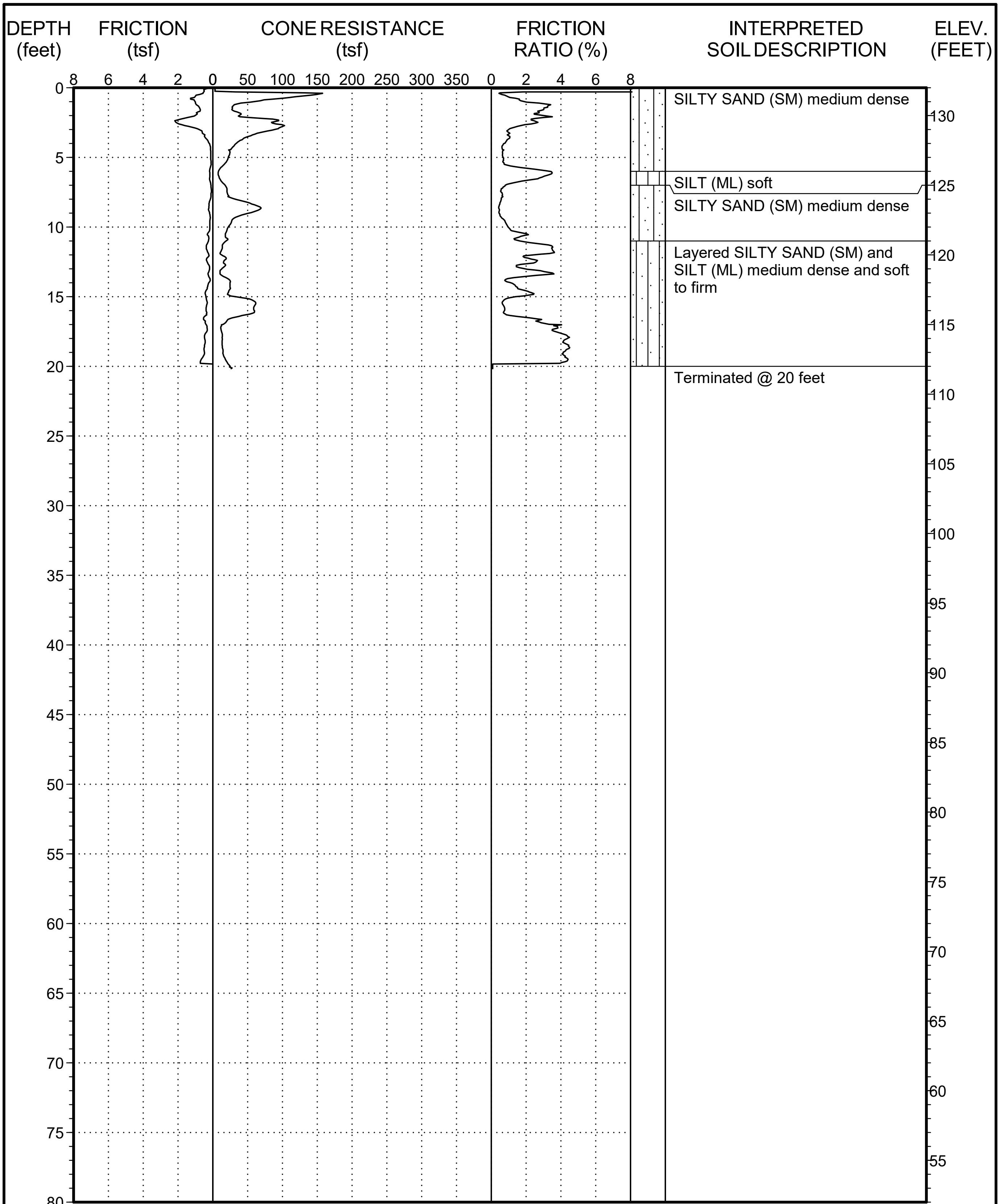
PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-8

FIGURE A-9



Date performed: 6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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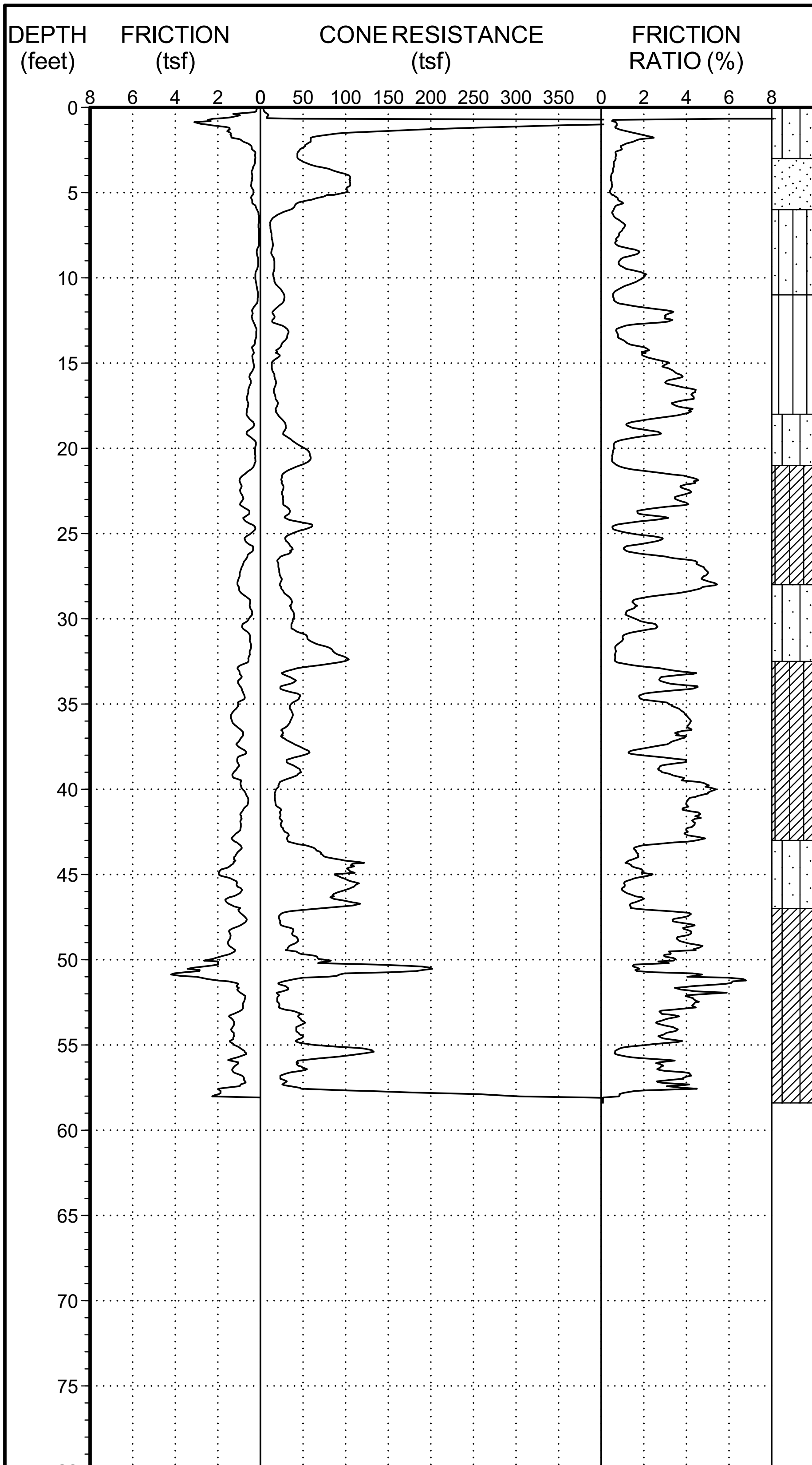
PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-9

FIGURE A-10



INTERPRETED SOIL DESCRIPTION	ELEV. (FEET)
SILTY SAND (SM) medium dense	135
SAND (SP) medium dense	
SANDY SILT (ML) soft	130
SILT (ML) firm to stiff @ 14 feet, lens of silty sand	125
SILTY SAND (SM) loose to medium dense	120
CLAYEY SILT (ML) firm to stiff @ 24 & 26 feet, lenses of silty sand	115
SILTY SAND (SM) loose to medium dense	110
CLAYEY SILT (ML) stiff @ 35 feet, lens of silty sand @ 38 feet, lens of silty sand	105 100
SILTY SAND (SM) medium dense	95
SILTY CLAY (CL) very stiff to hard @ 50 feet, silty sand lens @ 55 feet, silty sand lens	90 85
Refusal @ 58 feet	80 75 70 65 60

Date performed:6-26-20

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF CPT NO. C-10

FIGURE A-11

APPENDIX B

APPENDIX B

EXPLORATORY BORINGS

The subsurface conditions at the site were investigated by drilling and sampling seven exploratory borings. The borings were advanced to depths ranging from 10 to 21 feet below the existing ground surface. The locations of the explorations are shown on the Existing and Proposed Site Plans, Figures 2 and 3, respectively.

The exploratory borings were drilled using truck-mounted hollow-stem auger drill equipment. Relatively undisturbed samples were obtained using a brass-ring lined sampler (ASTM D 3550). The brass-rings have an inside diameter of 2.42 inches. The ring samples were driven into the soil by a 140-pound hammer dropping 30 inches. The number of blows needed to drive the sampler into the soil was recorded as the penetration resistance.

At selected locations, disturbed samples were obtained using a split-spoon sampler by means of the Standard Penetration Test (SPT, ASTM D 6066). The spoon sampler was driven into the soil by a 140-pound hammer dropping 30 inches, employing the “free-fall” hammer described above. After an initial seating drive of 6 inches, the number of blows needed to drive the sampler into the soil a depth of 12 inches was recorded as the penetration resistance. These values are the raw uncorrected blow counts.

The field explorations for the investigation were performed under the continuous technical supervision of GPI's representative, who visually inspected the site, maintained detailed logs of the borings, classified the soils encountered, and obtained relatively undisturbed samples for examination and laboratory testing. The soils encountered in the borings were classified in the field and through further examination in the laboratory in accordance with the Unified Soils Classification System. Detailed logs of the borings are presented in Figures B-1 to B-7 in this appendix.

The boring and well locations were laid out in the field by measuring from existing site features. Ground surface elevations at the exploration locations were estimated from internet sources and should be considered very approximate.

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS* This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
			B	0	Fill: **SILTY SAND (SM)** brown, slightly moist	
7.1	107	48	D		Natural: **SILTY SAND (SM)** brown, slightly moist, dense, trace gravel	
3.1	103	25	D		@ 4 feet, dry, medium dense	135
				5		
1.5		77	D		@ 6 feet, very dense, traces cobbles	
2.0		33	S		**SAND WITH SILT (SP-SM)** light brown, dry, dense, with gravel	130
				10		
2.0		30	S		@ 10 feet, medium dense to dense	
4.5		8	S		@ 12 feet, slightly moist, loose, trace clay	
						125
12.2		8	S		**SANDY SILT (ML)** brown, very moist, firm, trace clay	
				15		
9.9		12	S		**SILTY SAND (SM)** brown, slightly moist to moist, medium dense, with gravel	
3.6	109	58	D			
						120
					Total Depth 19 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20

EQUIPMENT USED:
8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft):
Not Encountered

GPI

PROJECT NO.: 2992.I

PANATTONI SANTA ANA

LOG OF BORING NO. B-1

FIGURE B-1

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
					0	2 to 4- Inch BASE	
						Fill: **SILTY SAND (SM)** brown, slightly moist	
	5.6	104	33	D		@ 2 feet, slightly moist, medium dense, with gravel	135
	16.0	95	11	D	5	Natural: **SANDY SILT (ML)** brown, very moist, firm	
	11.2	91	12	D		**SILTY SAND (SM)** brown, moist, loose	130
	2.9	109	16	D		@ 9 feet, dry, medium dense	
	18.2	95			10	**SILT (ML)** brown, wet, stiff	125
	9.3	103	42	D	15	**SILTY SAND (SM)** brown, moist, medium dense	120
	2.3	109	35	D	20	**SAND (SP)** light brown, dry, medium dense, with gravel	
						Total Depth 20 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20

EQUIPMENT USED:
8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft):
Not Encountered

GPI

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PANATTONI SANTA ANA

LOG OF BORING NO. B-2

FIGURE B-2

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				B	0	2 to 4- Inch BASE	
	4.3	113	48	D		Fill: **SILTY SAND (SM)** brown, dry, dense, with gravel	
	4.1	97	33	D		@ 3 feet, medium dense, trace cobbles	135
	2.0	95	20	D	5	Natural: **SAND WITH SILT (SP-SM)** light brown, dry, medium dense	
	9.9	95	11	D		**SILTY SAND (SM)** brown, moist, loose, trace porosity	130
	16.5		18	S	10	@ 10 feet, wet, medium dense	
							125
	12.3	114	25	D	15	**SILT (ML)** brown, moist, very stiff, trace clay	
							120
	14.2		6	S	20	@ 20 feet, firm	
						Total Depth 21.5 feet	

This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20

EQUIPMENT USED:
8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft):
Not Encountered

GPI

PROJECT NO.: 2992.I

PANATTONI SANTA ANA

LOG OF BORING NO. B-3

FIGURE B-3

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
						This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
					0	4-Inch AC over 8-Inch BASE	
	9.3	106	13	D		Fill: **SILTY SAND (SM)** dark brown, moist, loose, with gravel	135
	3.9	102	18	D	5	Natural: **SAND (SP)** light brown, dry, medium dense	
	17.4	93	7	D		**SANDY SILT (ML)** dark brown, very moist, firm, trace sand	130
	19.2	96	10	D	10	**SILT (ML)** brown, wet, firm	
						Total Depth 10 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20
EQUIPMENT USED:
8 " Hollow Stem Auger
GROUNDWATER LEVEL (ft):
Not Encountered

GPI

PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF BORING NO. B-4

FIGURE B-4

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	3-Inch AC over 6-Inch BASE	
					Fill: **SILTY SAND (SM)** brown, moist, some gravel	
9.1	106	14	D		@ 2 feet, dark brown, loose	
7.9	104	11	D		@ 4 feet, trace clay	
				5	Natural: **SILTY SAND (SM)** brown, moist, loose	130
7.8	87	10	D			
10.8		6	S		**SANDY SILT (ML)** brown, moist, firm	
11.5		9	S	10	**SILT (ML)** light brown, moist, stiff	125
9.7		8	S		@ 12 feet, slightly moist, trace sand	
8.1		13	S	15	**SANDY SILT (ML)** brown, slightly moist, stiff	120
6.7		15	S			
4.2	107	37	D		**SILTY SAND (SM)** brown, dry, medium dense, with gravel	
					Total Depth 19 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20

EQUIPMENT USED:
8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft):
Not Encountered

GPI

PROJECT NO.: 2992.I

PANATTONI SANTA ANA

LOG OF BORING NO. B-5

FIGURE B-5

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	7-Inch AC	
5.7	118	14	D		Fill: **SILTY SAND (SM)** light brown, slightly moist, loose	
6.4	94	17	D		Natural: **SILTY SAND (SM)** light brown, slightly moist, medium dense	130
12.4	93	7	D	5	@ 5 feet, moist, loose	
10.1	98	10	D			125
22.2	94	13	D		**SILT (ML)** brown, wet, stiff	
				10	Total Depth 10 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20

EQUIPMENT USED:
8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft):
Not Encountered

GPI

PROJECT NO.: 2992.I

PANATTONI SANTA ANA

LOG OF BORING NO. B-6

FIGURE B-6

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS* This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
			B	0	3-Inch AC over 4-Inch BASE	130
					Fill: **SILTY SAND (SM)** brown, slightly moist	
8.5	103	15	D		Natural: **SILTY SAND (SM)** brown, moist, loose	
11.2	111	22	D	5	@ 4 feet, medium dense	
12.0	98	14	D		@ 6 feet, loose	125
8.5	104	13	D	10		
					Total Depth 10 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED:
6-26-20
EQUIPMENT USED:
8 " Hollow Stem Auger
GROUNDWATER LEVEL (ft):
Not Encountered

GPI

PROJECT NO.: 2992.I
PANATTONI SANTA ANA

LOG OF BORING NO. B-7

FIGURE B-7

APPENDIX C

APPENDIX C

LABORATORY TESTS

INTRODUCTION

Representative undisturbed soil samples and bulk samples were carefully packaged in the field and sealed to prevent moisture loss. The samples were then transported to our Cypress office for examination and testing assignments. Laboratory tests were performed on selected representative samples as an aid in classifying the soils and to evaluate the physical properties of the soils affecting foundation design and construction procedures. Detailed descriptions of the laboratory tests are presented below under the appropriate test headings. Test results are presented in the figures that follow.

MOISTURE CONTENT AND DRY DENSITY

Moisture content and dry density were determined from a number of the ring samples. The samples were first trimmed to obtain volume and wet weight and then were dried in accordance with ASTM D 2216. After drying, the weight of each sample was measured, and moisture content and dry density were calculated. Moisture content and dry density values are presented on the boring logs in Appendix B.

GRAIN SIZE DISTRIBUTION

Selected soil samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. That portion of the material retained on the No. 200 sieve was oven-dried and weighed to determine the percentage of the material passing the No. 200 sieve. For one of the samples, the retained material was run through a standard set of sieves in accordance with ASTM D 422. The percentages passing the No. 200 sieve are tabulated below. The grain size distribution obtained from the full sieve analysis is presented in Figure C-2.

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	PERCENT PASSING No. 200 SIEVE
B-1	0 – 5	Silty Sand (SM)	35
B-1	8	Sand with Silt (SP-SM)	7
B-2	6	Silty Sand (SM)	48
B-3	7	Silty Sand (SM)	43
B-5	8	Sandy Silt (ML)	54
B-5	10	Silt (ML)	85

DIRECT SHEAR

Direct shear tests were performed on undisturbed and remolded bulk samples in accordance with ASTM D 3080. The bulk samples were remolded to approximately 90 percent of maximum density (ASTM D1557). The samples were placed in the shear machine, and a normal load comparable to the in-situ overburden stress was applied. The samples were inundated, allowed to consolidate, and then were sheared to failure. The tests were repeated on additional test specimens under increased normal loads. Shear stress and sample deformation were monitored throughout the test. The results of the direct shear tests are presented in Figures C-2 to C-3.

CONSOLIDATION

Two one-dimensional consolidation tests were performed on undisturbed samples in accordance with ASTM D2435. After trimming the ends, the sample was placed in the consolidometer and loaded to up to 0.4 ksf. Thereafter, the sample was incrementally loaded to a maximum load of up to 12.8ksf. The samples were inundated at 1.6 ksf. Sample deformation was measured to 0.0001 inch. Rebound behavior was investigated by unloading the sample back to 0.4 ksf. The results of the consolidation tests, in the form of percent consolidation versus log pressure, are presented in Figures C-4 and C-5.

COMPACTION TEST

A maximum dry density/optimum moisture test was performed in accordance with ASTM D 1557 on a representative bulk sample of the site soils. The sample was first screened through the No. 4 sieve and the sample retained was weighed to determine the material retained on the No. 4 sieve. The amount retained was used to determine the rock corrected maximum dry density in accordance with ASTM D 1557 specifications. The test results for the screened (passing No. 4 sieve) and rock-corrected sample are as follows:

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)
B-3	0 – 5	Silty Sand (SM)	128	9.0
		Silty Sand (SM) with rock correction	130	9.0

EXPANSION INDEX TEST

An expansion index was performed on a bulk sample. The test was performed in accordance with ASTM D4829 to assess the expansion potential of the on-site fill soils. The results of the test are summarized below.

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	EXPANSION INDEX, EI	EXPANSION POTENTIAL
B-3	0-5	Silty Sand (SM)	1	Low

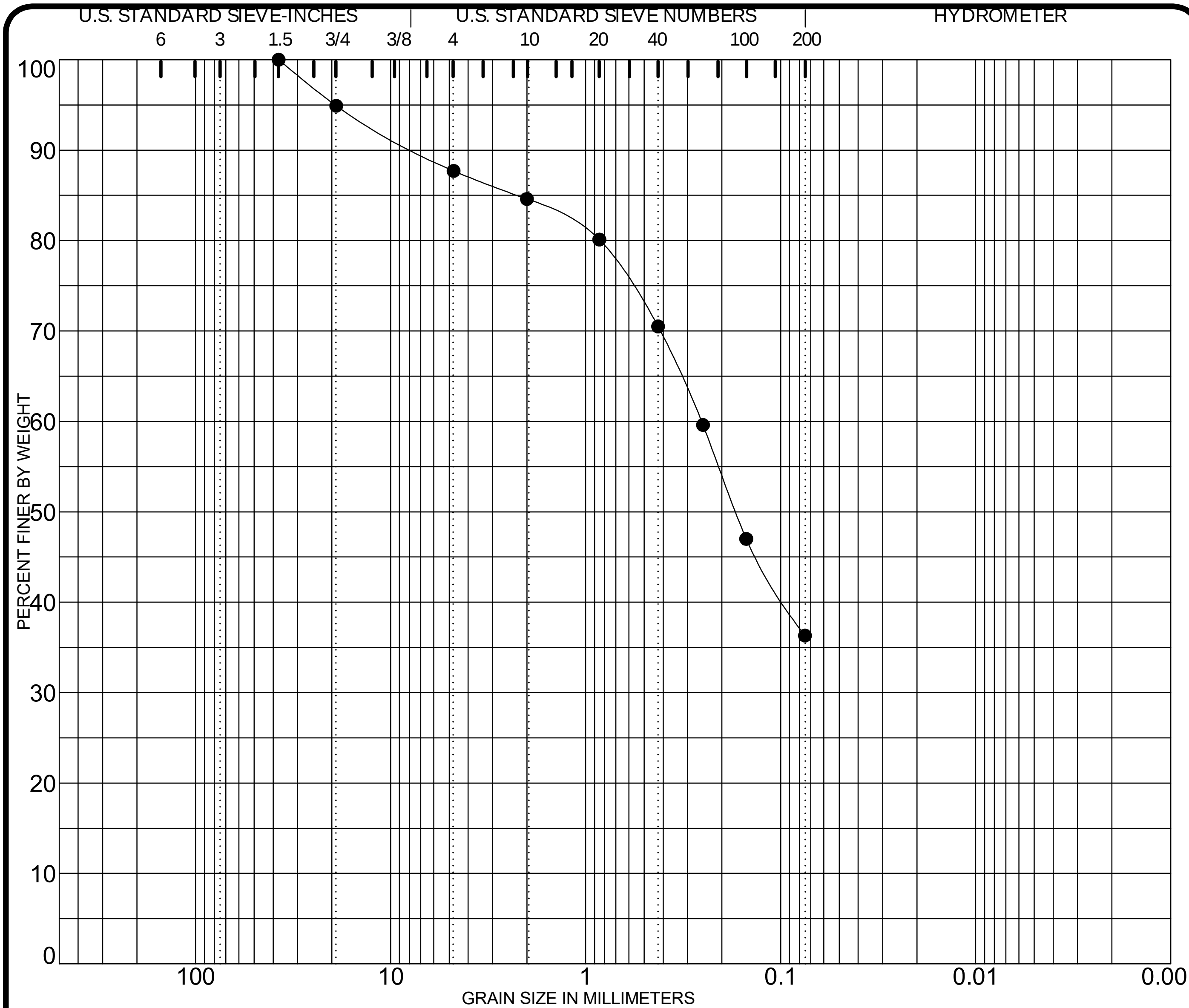
R-VALUE

Suitability of the near-surface soils for pavement was evaluated by conducting an R-value test. The test was performed in accordance with ASTM D 2844 by GeoLogic Associates (GLA) under subcontract to GPI. The result of the test is as follows:

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	R-VALUE BY EXUDATION
B-1	0 – 5	Silty Sand (SM)	39

CORROSIVITY

Soil corrosivity testing was performed by HDR a soil sample provided by GPI. The test results are summarized in Table 1 of this Appendix.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Location		Classification	MC%	LL	PL	PI	Cc	Cu
●	B-1	0-5	SILTY SAND (SM)						

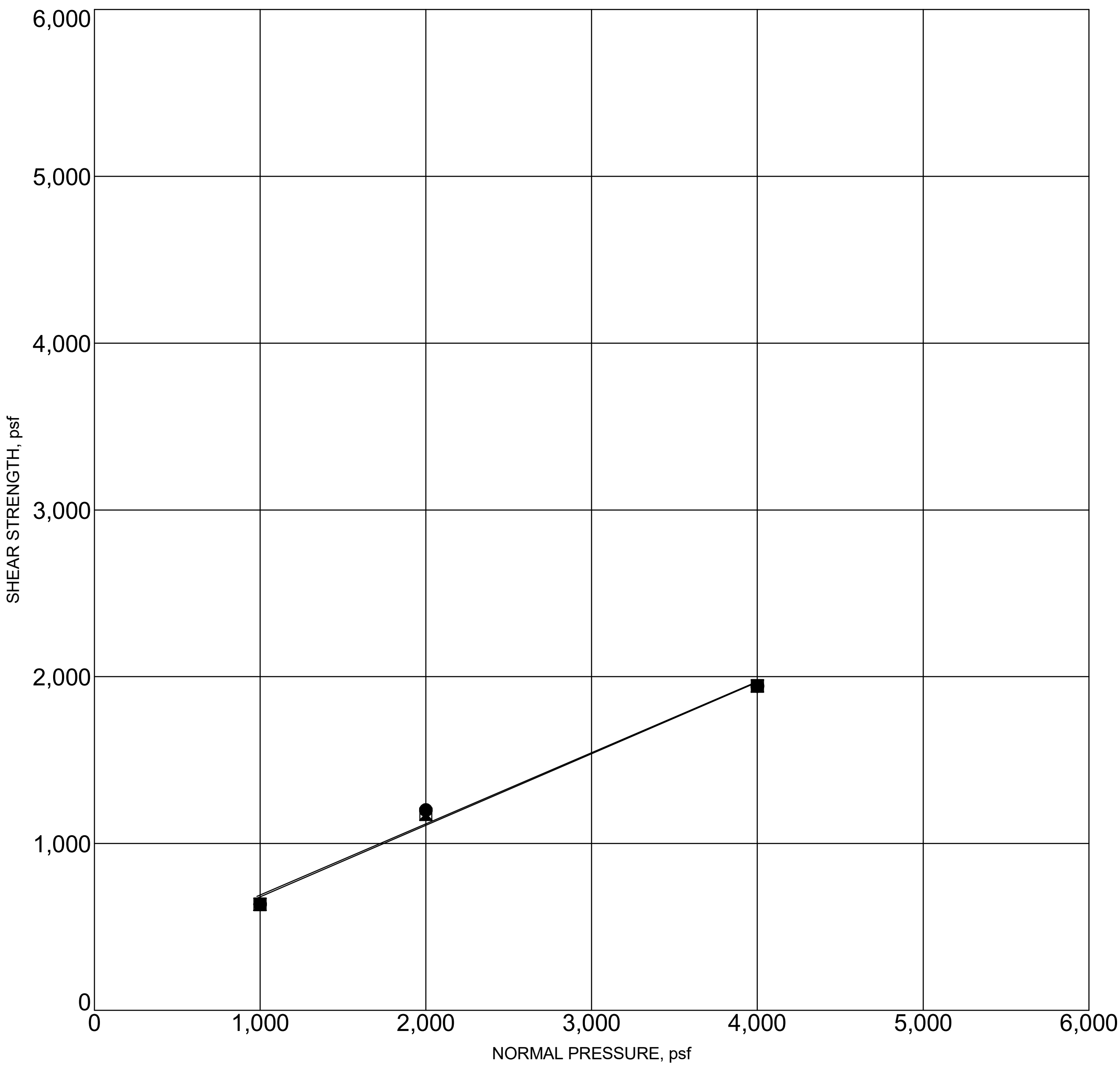
	Sample Location		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	0-5	37.50	0.25			12.3	51.4	36.3	

PROJECT: PANATTONI SANTA ANA PROJECT NO. 2992.I

GPI

GRAIN SIZE DISTRIBUTION

FIGURE C-1



● **PEAK STRENGTH**
Friction Angle= 23 degrees
Cohesion= 264 psf

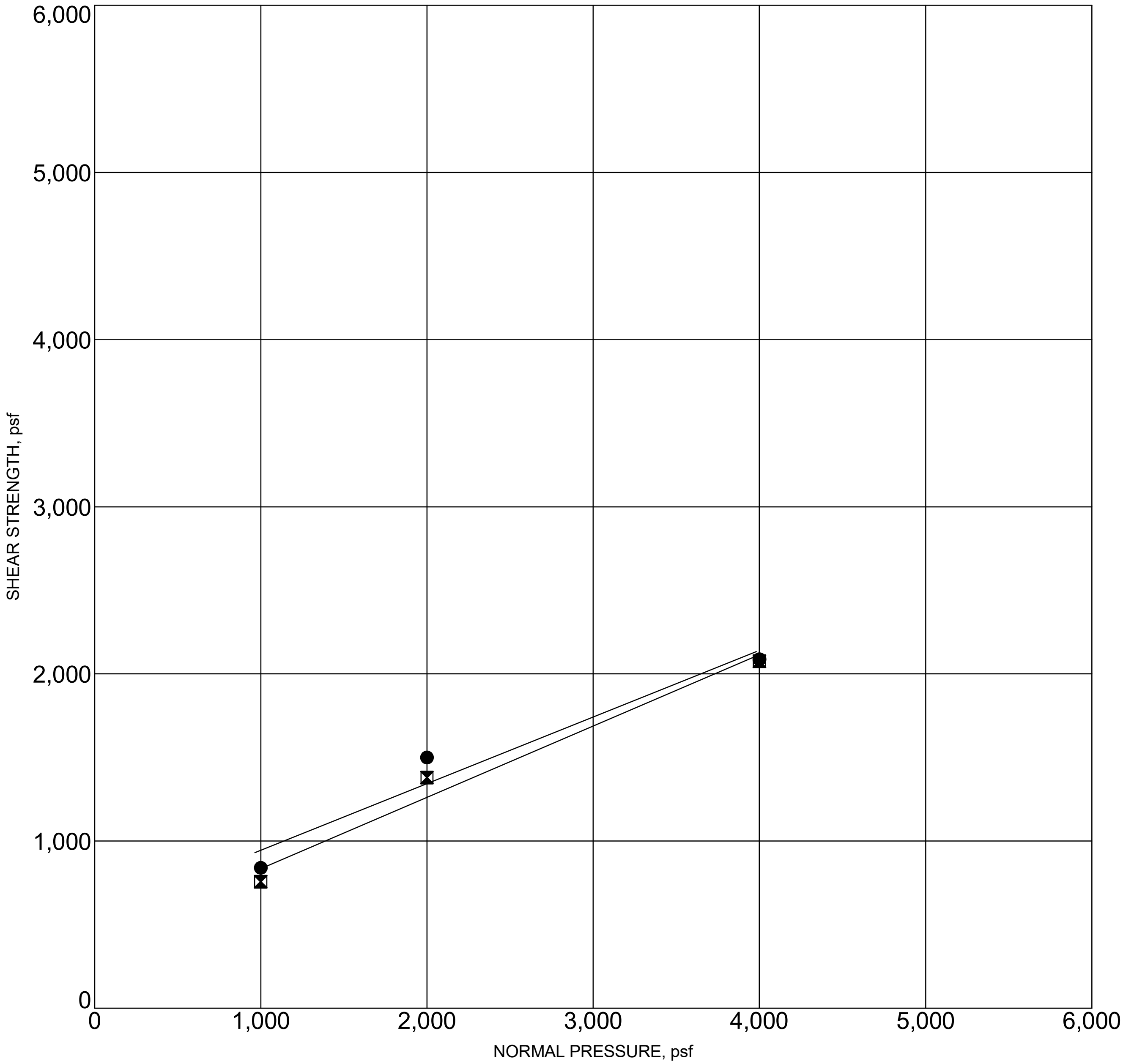
ULTIMATE STRENGTH
Friction Angle= 23 degrees
Cohesion= 252 psf

Sample Location		Classification	DD,pcf	MC,%
B-2	6.0	SILTY SAND (SM)	91	11.2

PROJECT: PANATTONI SANTA ANA PROJECT NO.: 2992.I

DIRECT SHEAR TEST RESULTS

FIGURE C-2



● **PEAK STRENGTH**
Friction Angle= 22 degrees
Cohesion= 546 psf

⧗ **ULTIMATE STRENGTH**
Friction Angle= 23 degrees
Cohesion= 408 psf

Note: Samples remolded to 90% of maximum dry density.

Sample Location		Classification	DD,pcf	MC,%
B-3	0-5	SILTY SAND (SM)	115	9.0

PROJECT: PANATTONI SANTA ANA PROJECT NO.: 2992.I

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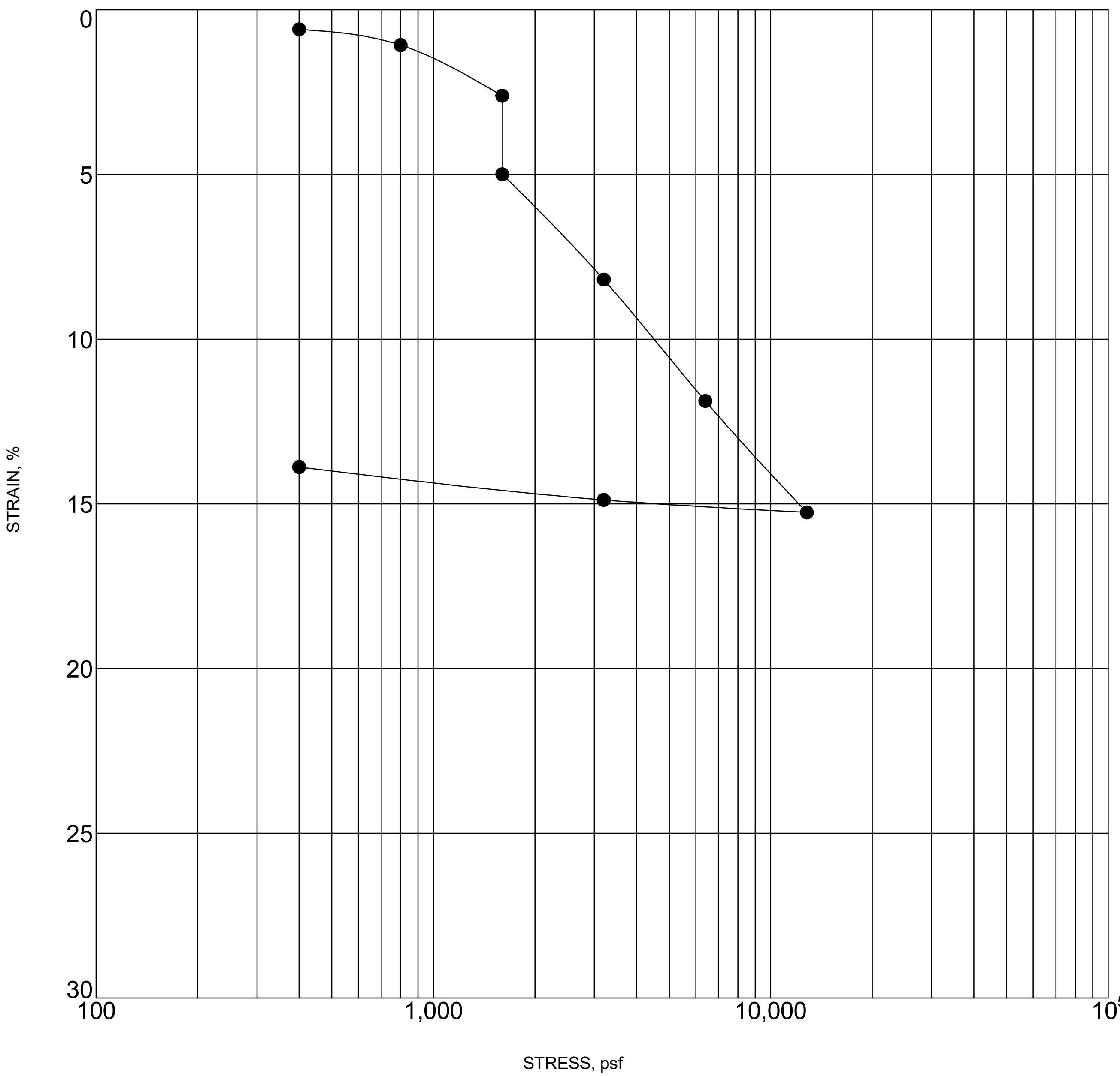
DIRECT SHEAR TEST RESULTS

FIGURE C-3



Sample inundated at 1600 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-3	7.0	SILTY SAND (SM)	95	9.9

PROJECT: PANATTONI SANTA ANA PROJECT NO.: 2992.I

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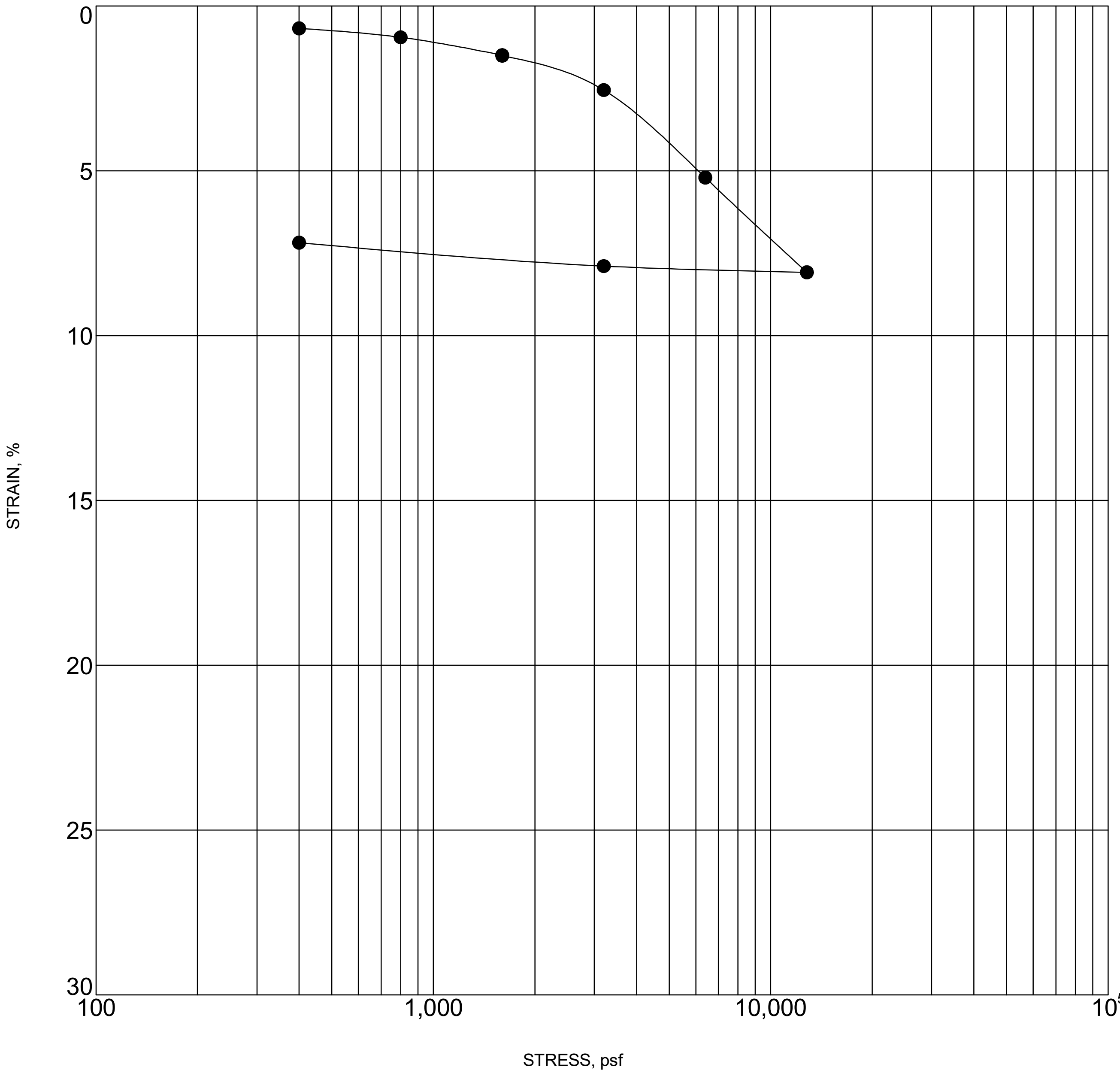
CONSOLIDATION TEST RESULTS

FIGURE C-4



Sample inundated at 1600 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-4	6.0	SANDY SILT (ML)	93	17.4

PROJECT: PANATTONI SANTA ANA PROJECT NO.: 2992.I

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CONSOLIDATION TEST RESULTS

FIGURE C-5

Table 1 - Laboratory Tests on Soil Samples

Geotechnical Professionals, Inc.
Panattoni - Santa Ana
Your #2992.I, HDR Lab #20-0423LAB
10-Jul-20

Sample ID			
			B-3 @ 0-5'
Resistivity		**Units**	
as-received		ohm-cm	60,000
saturated		ohm-cm	6,800
pH			8.1
Electrical Conductivity		mS/cm	0.09
Chemical Analyses			
Cations			
calcium	Ca^{2+}	mg/kg	52
magnesium	Mg^{2+}	mg/kg	6.9
sodium	Na^{1+}	mg/kg	32
potassium	K^{1+}	mg/kg	21
Anions			
carbonate	CO_3^{2-}	mg/kg	27
bicarbonate	HCO_3^{1-}	mg/kg	195
fluoride	F^{1-}	mg/kg	1.1
chloride	Cl^{1-}	mg/kg	5.1
sulfate	SO_4^{2-}	mg/kg	33
phosphate	PO_4^{3-}	mg/kg	ND
Other Tests			
ammonium	NH_4^{1+}	mg/kg	ND
nitrate	NO_3^{1-}	mg/kg	5.8
sulfide	S^{2-}	qual	na
Redox		mV	na

Resistivity per ASTM G187, Cations per ASTM D6919, Anions per ASTM D4327, and Alkalinity per APHA 2320-B.
Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX D

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

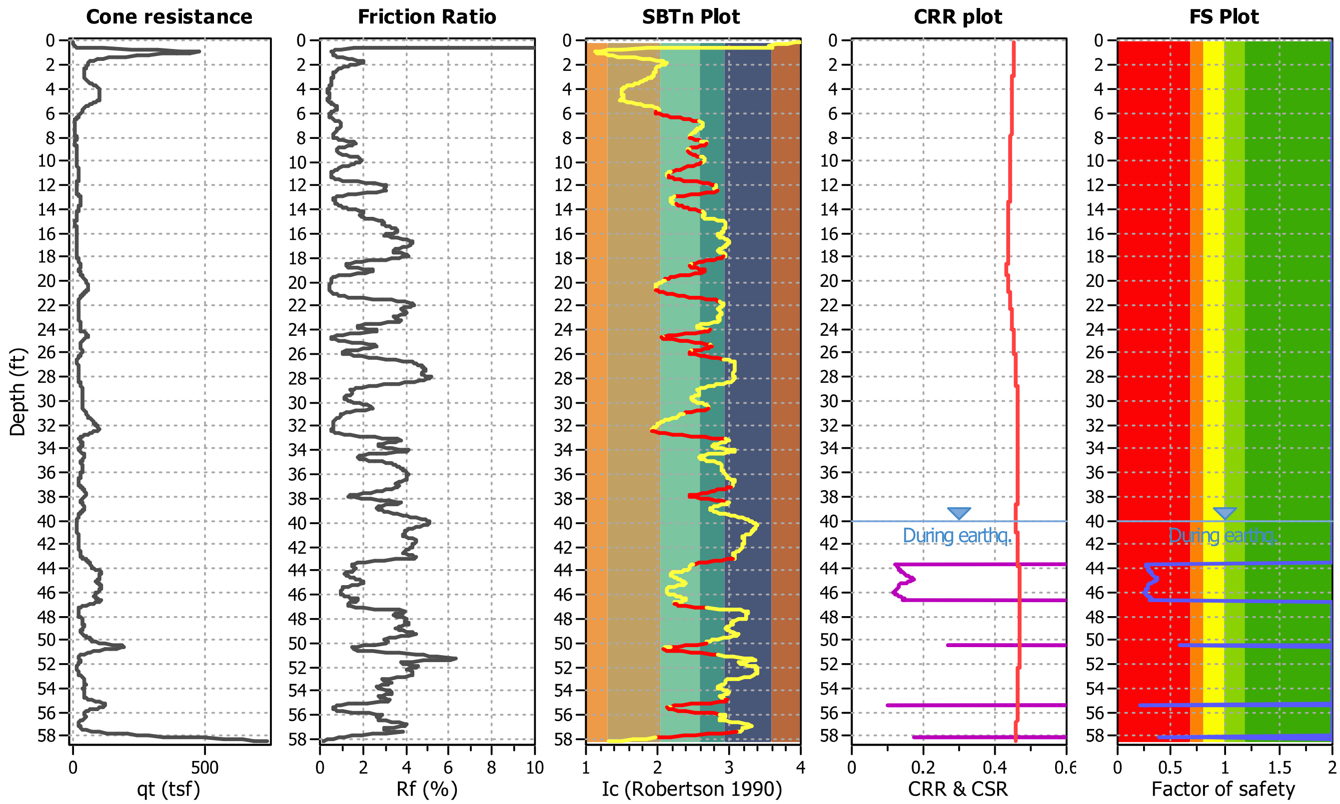
LIQUEFACTION ANALYSIS REPORT

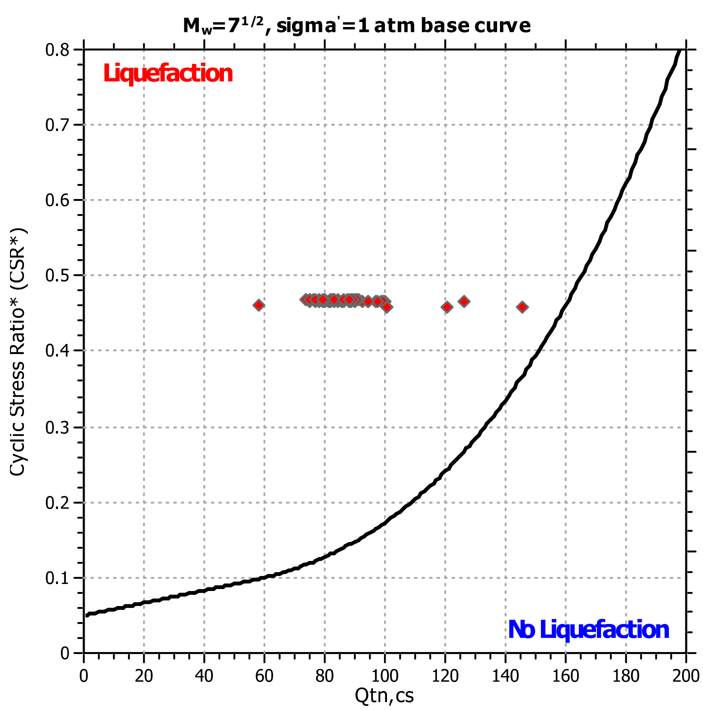
Project title : Panattoni Santa Ana (2992.I) **Location : Santa Ana**

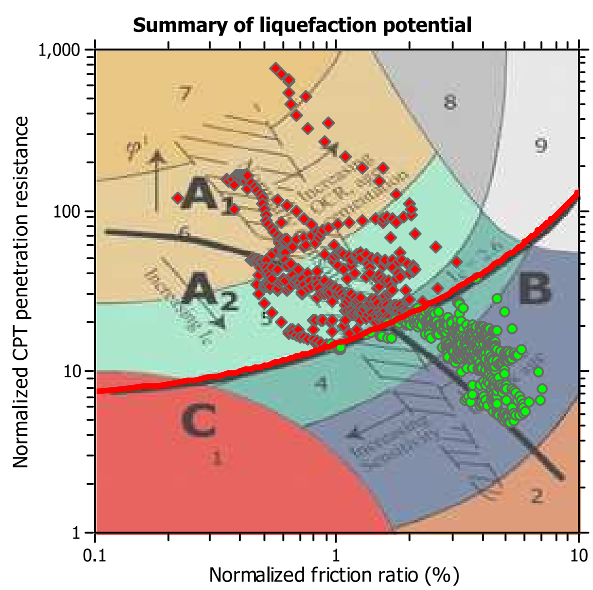
CPT file : C-10

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	60.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	40.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

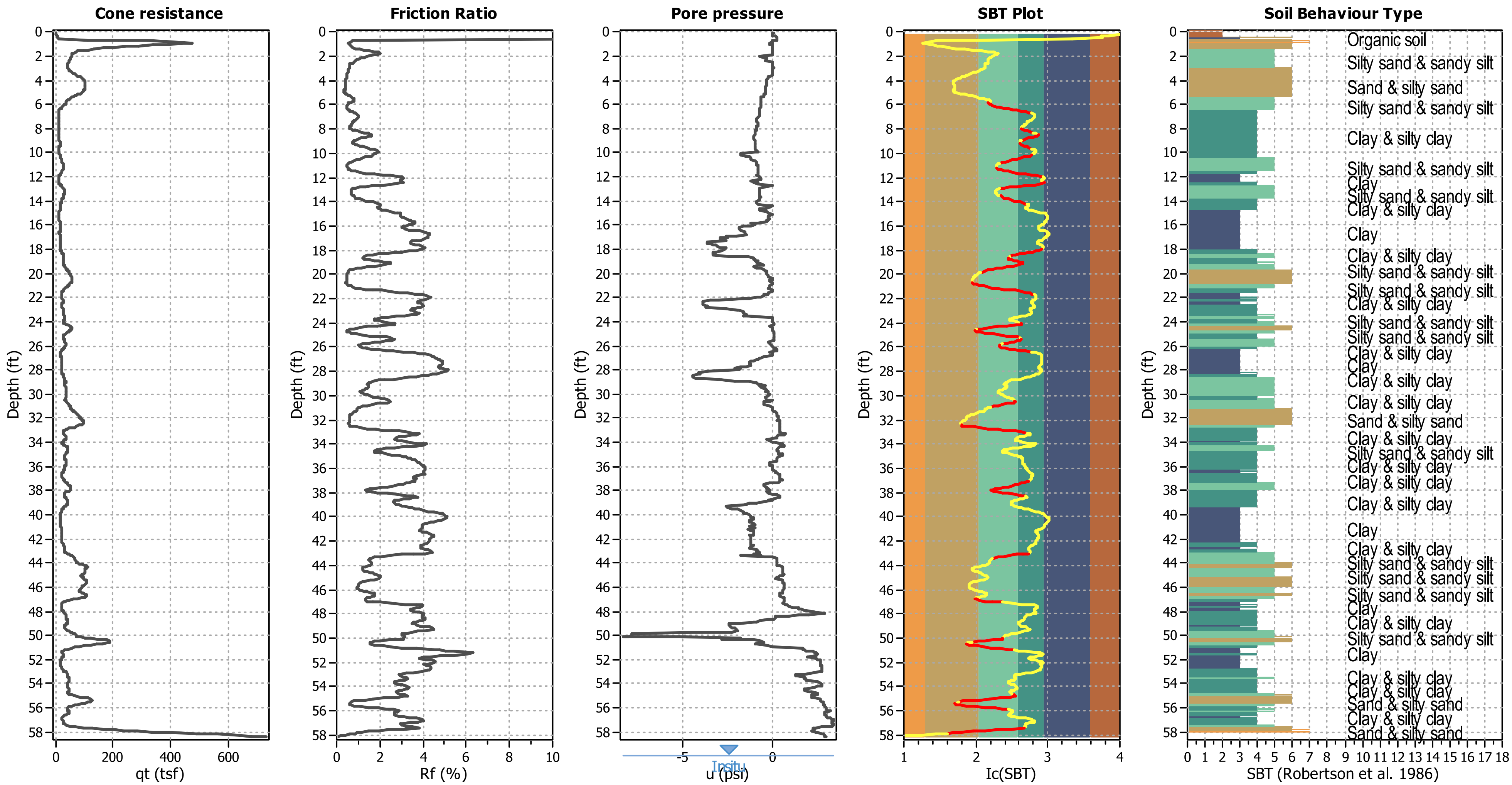






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



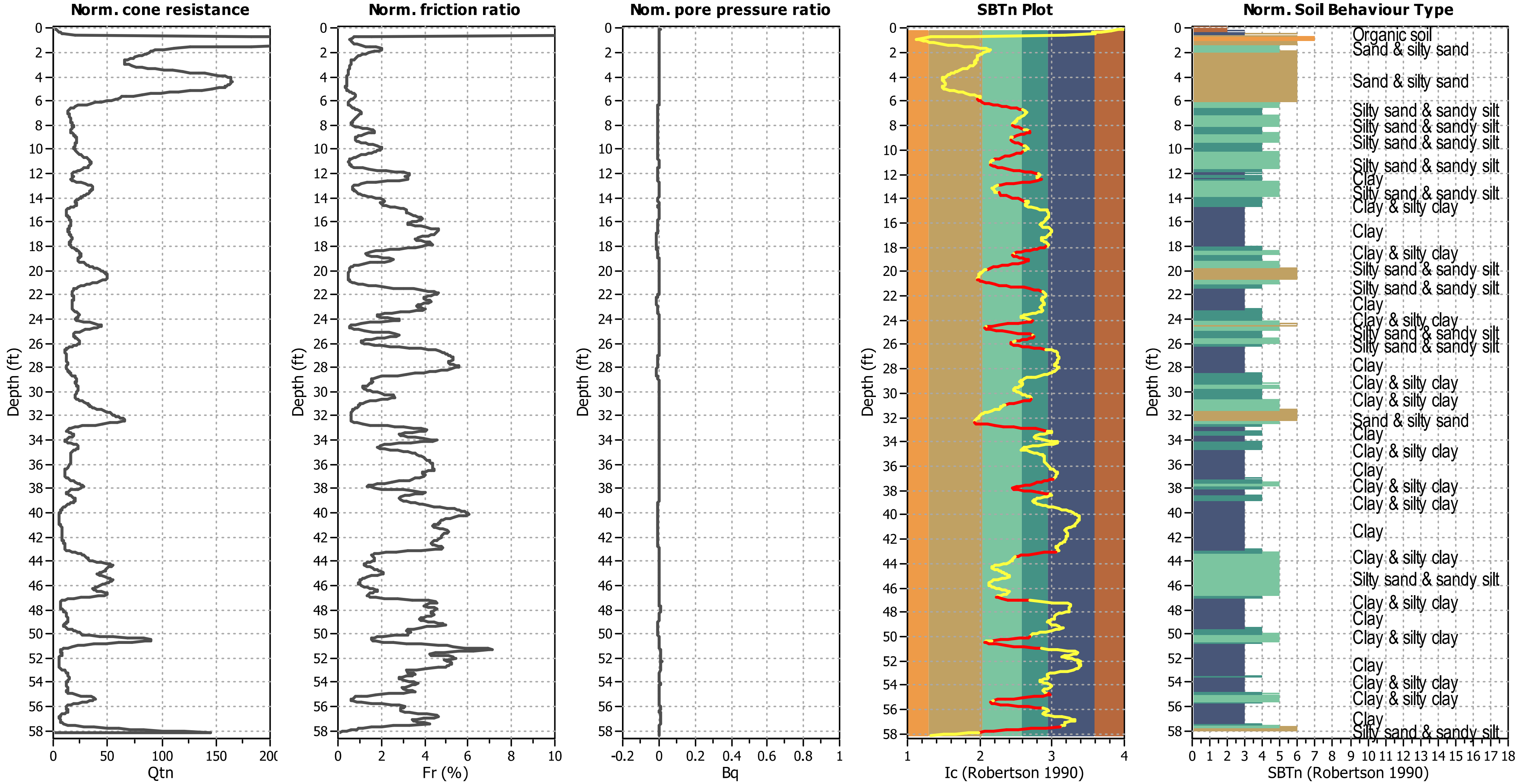
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	60.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



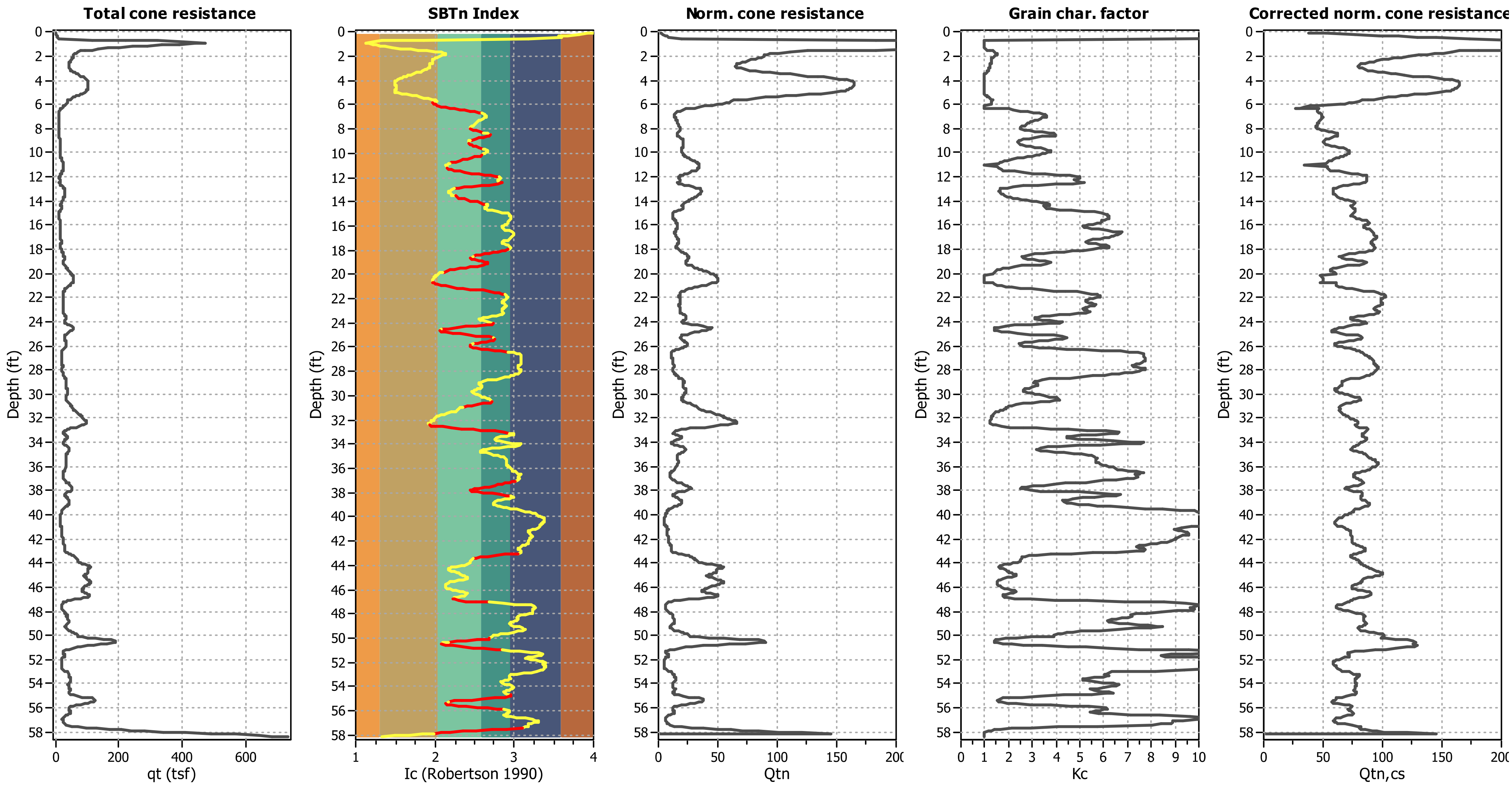
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	$K_σ$ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	60.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

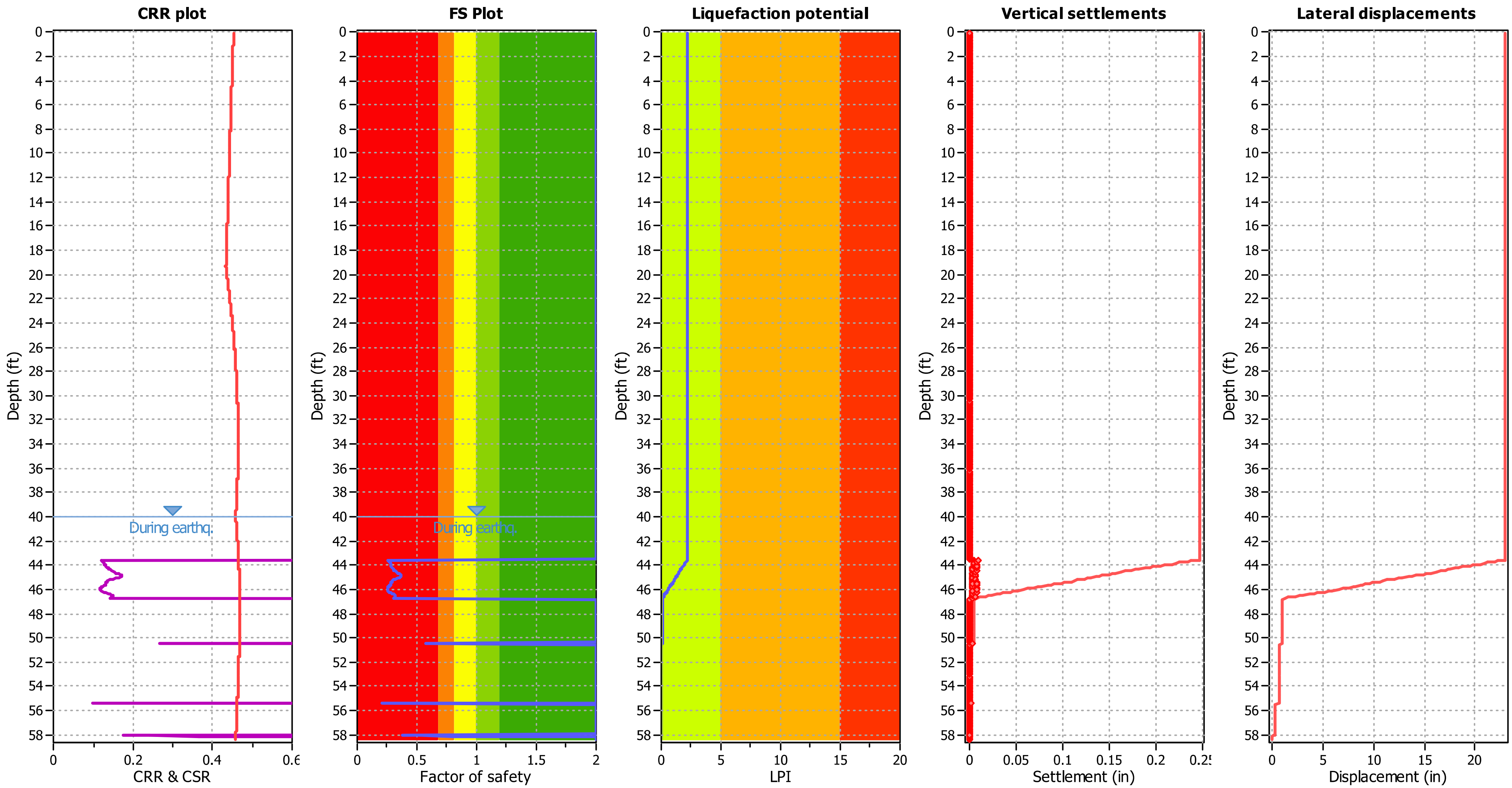
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	60.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	60.00 ft	Fill height:	N/A	Limit depth:	N/A

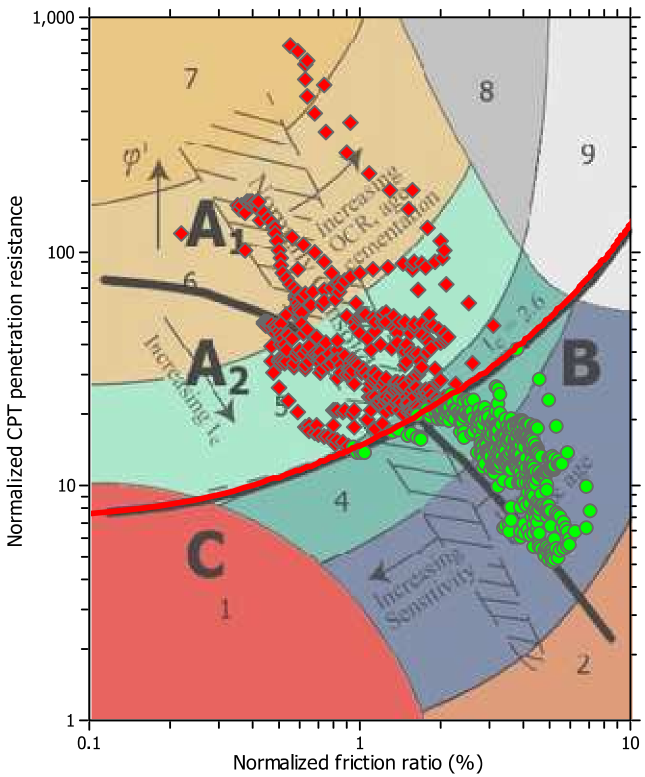
F.S. color scheme

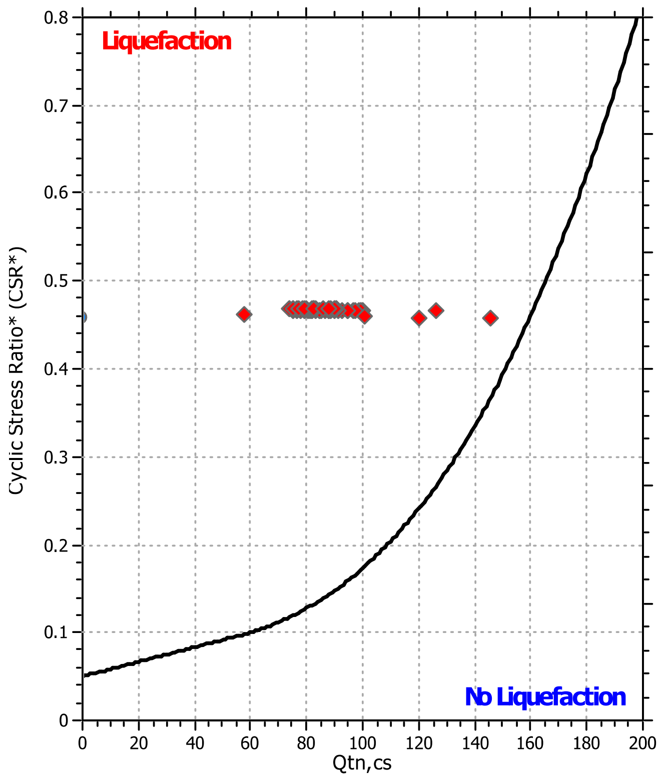
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

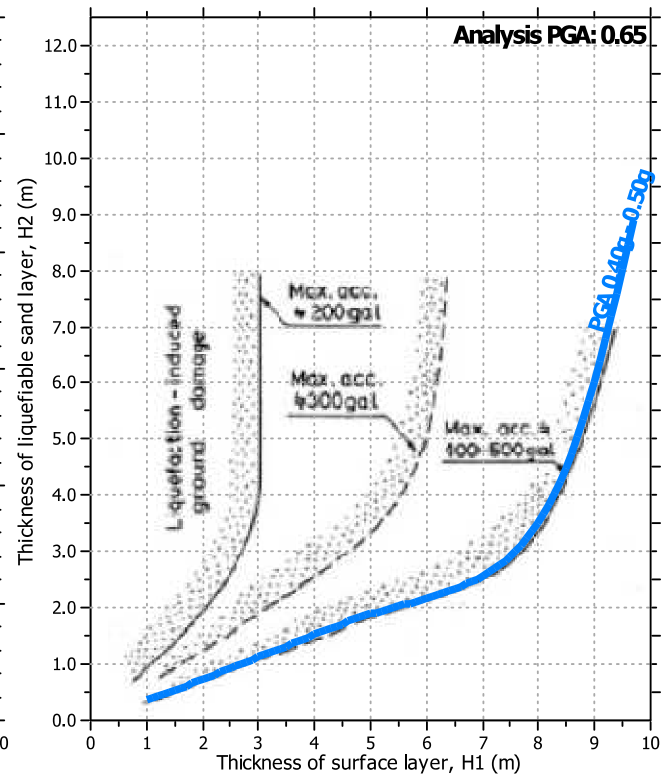
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



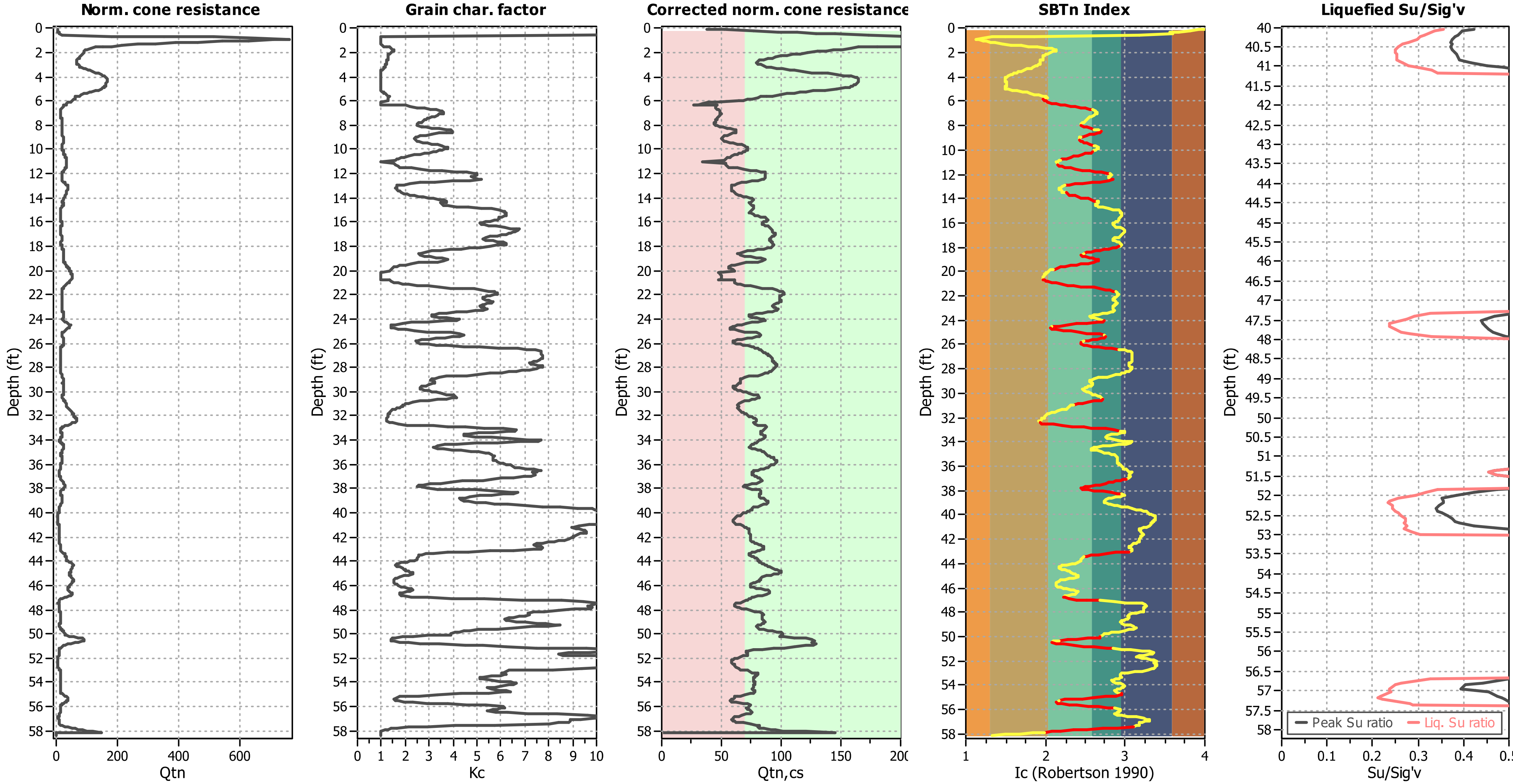




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	60.00 ft	Fill height:	N/A	Limit depth:	N/A

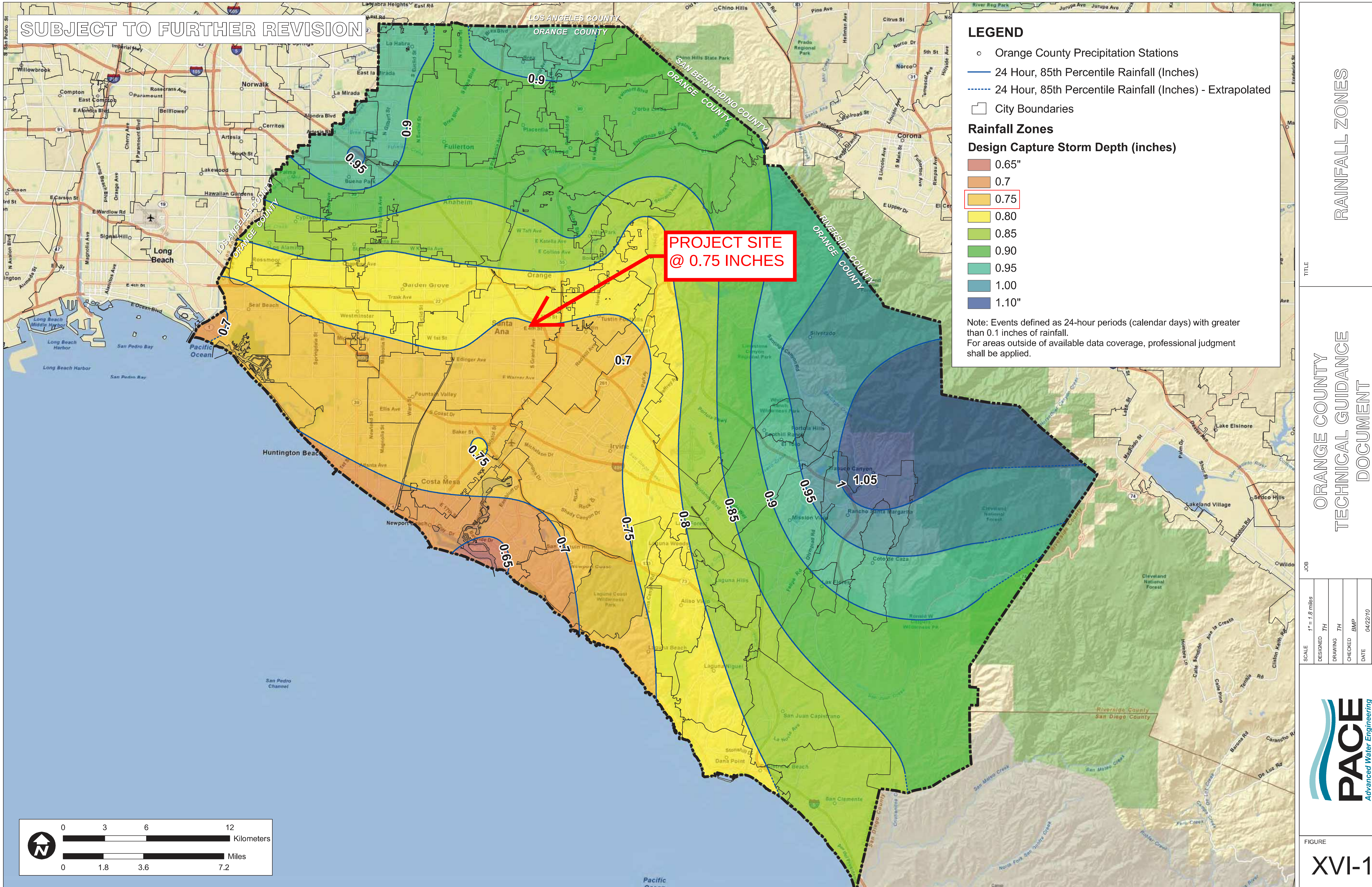
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	60.00 ft	Fill height:	N/A	Limit depth:	N/A

ATTACHMENT D
BMP CALCULATIONS



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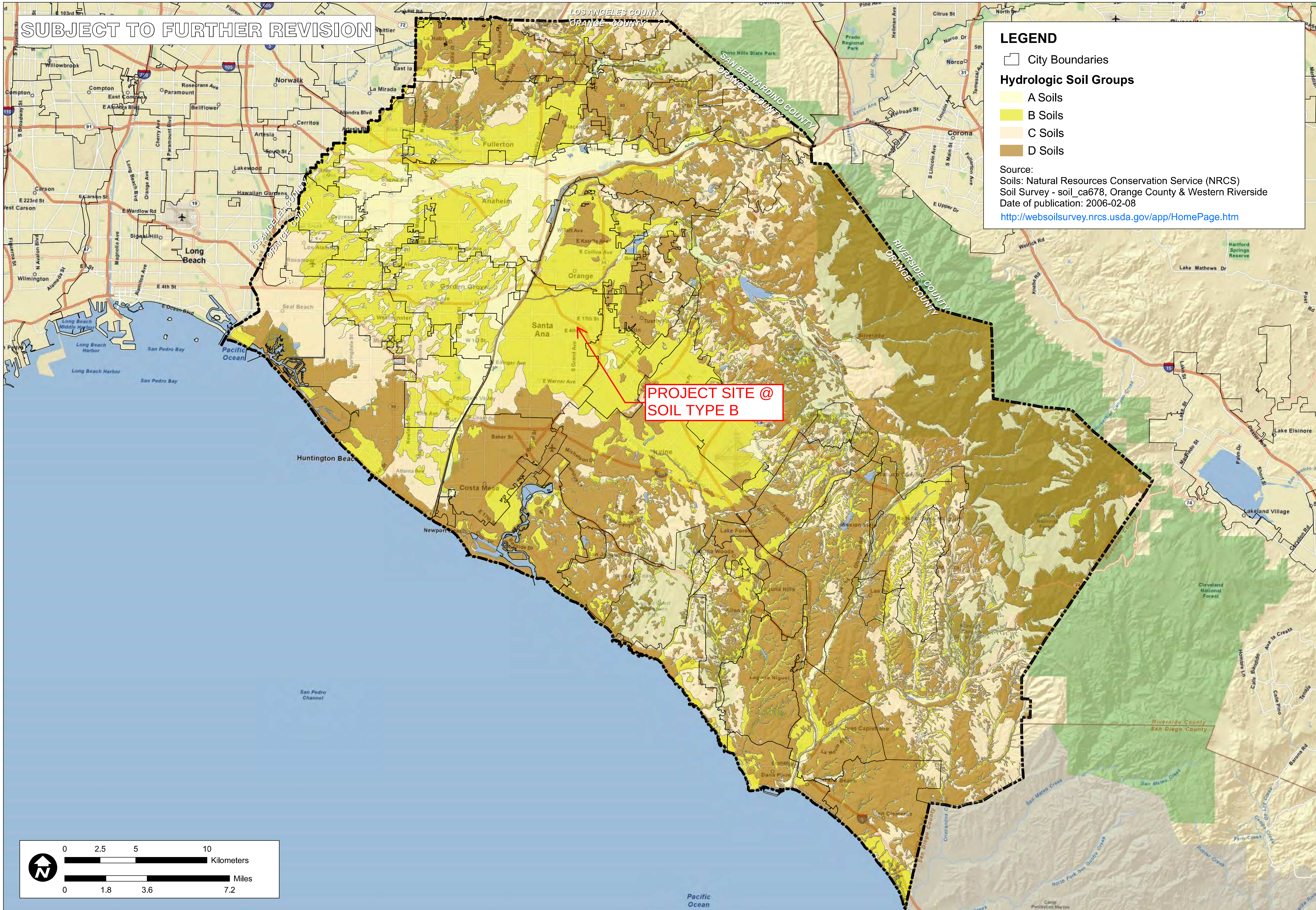


NRCS HYDROLOGIC SOILS GROUPS

TITLE

ORANGE COUNTY INFILTRATION STUDY

JOB

ORANGE CO. CA

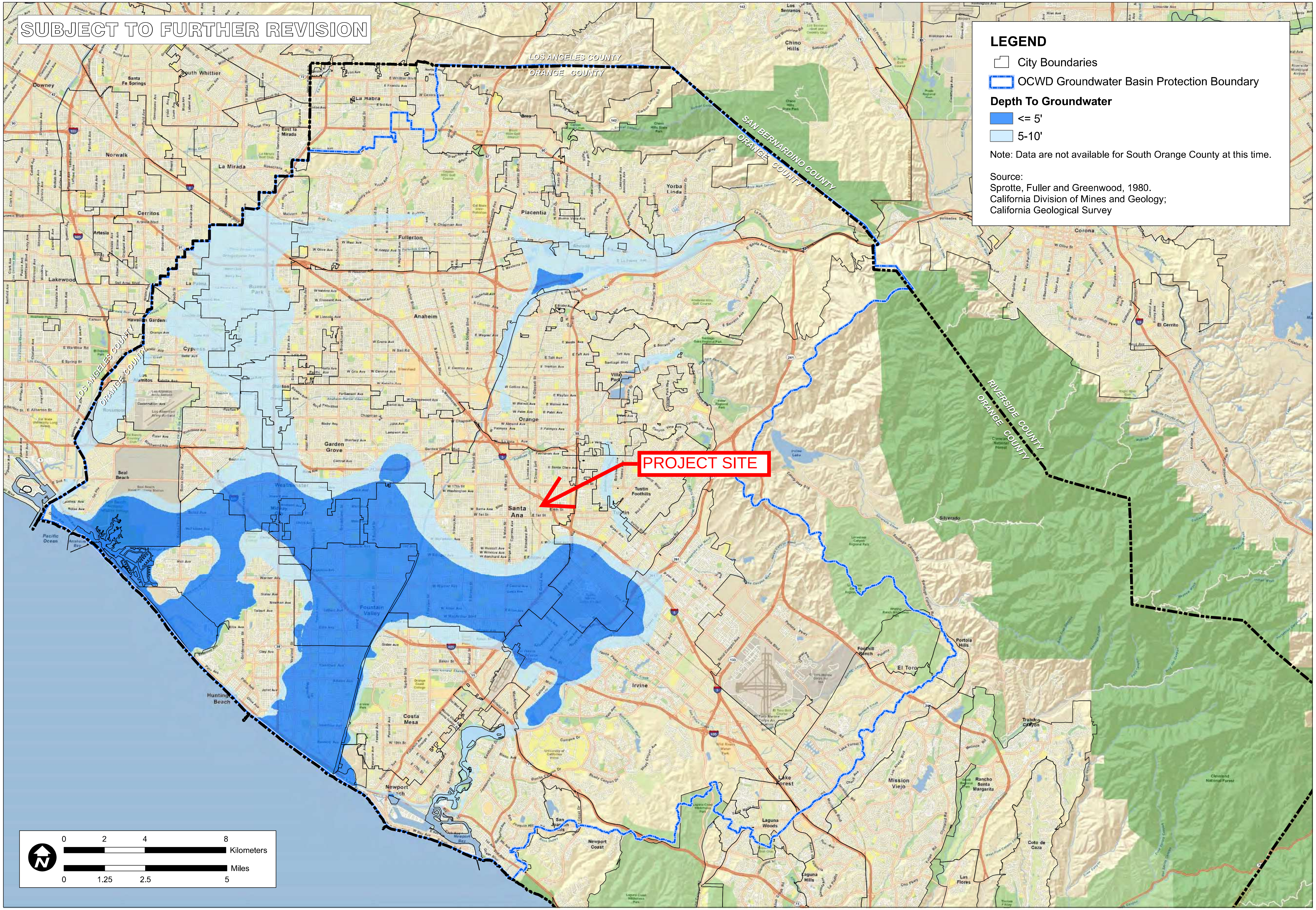
SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE

XVI-2a

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasibility_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd



P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2e_DepthToGroundwater15ft_20110215.mxd

TITLE
NORTH ORANGE COUNTY
MAPPED SHALLOW GROUNDWATER

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

SCALE 1" = 1.25 miles
DESIGNED TH
DRAWING TH
CHECKED BMP
DATE 02/09/11
JOB NO. 9526-E

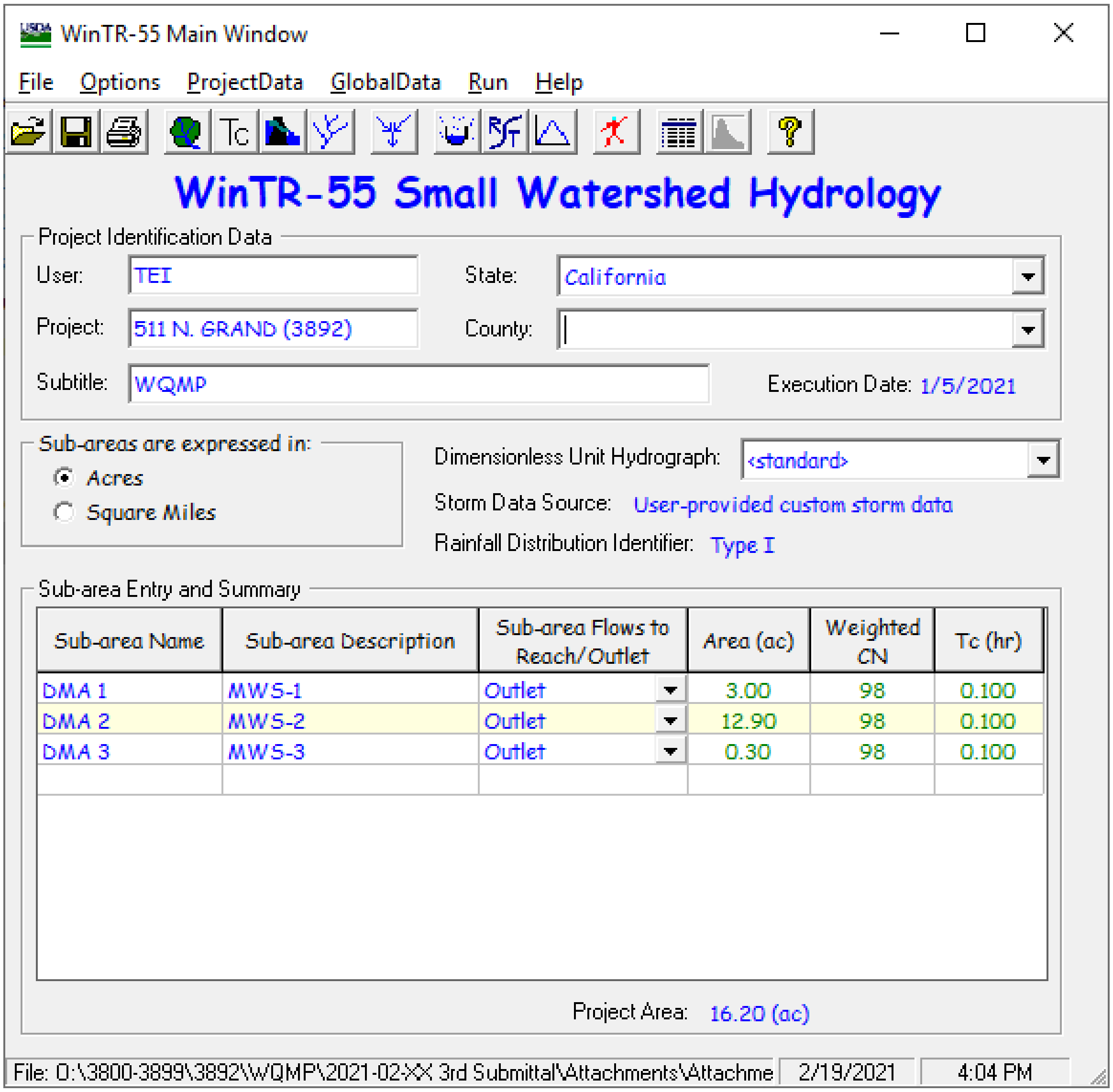
PACE
Advanced Water Engineering

FIGURE
XVI-2e

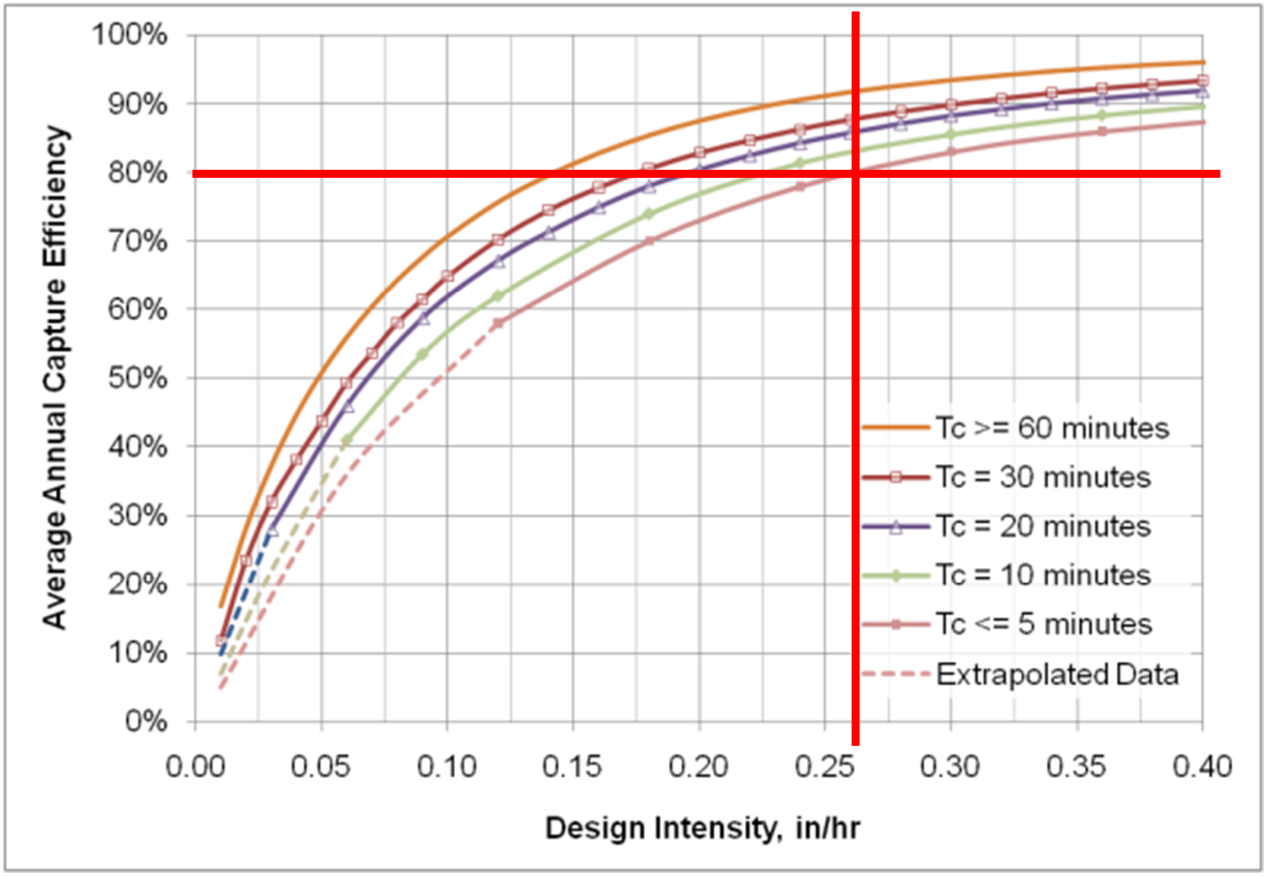
Worksheet D: Capture Efficiency Method for Flow-Based BMPs (DMA 1)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See **Appendix IV.2**)	T_c=	5	
2	Using **Figure III.4**, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.263	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (**Worksheet A**)	d_{HSC}=	--	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (**Worksheet A**)	Y_2=	--	%
5	Using **Figure III.4**, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	--	
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1 - I_2$	I_{design}=	0.263	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.00	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.78	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.735	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.579	cfs
Supporting Calculations				
Describe system: Model: MWS-L-8-20-V @ 3.5’ HGL QTY: 1 Treatment Rate: 0.594 cfs each Total Treatment Rate: 0.594 cfs > SQDF				
Provide time of concentration assumptions:				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs



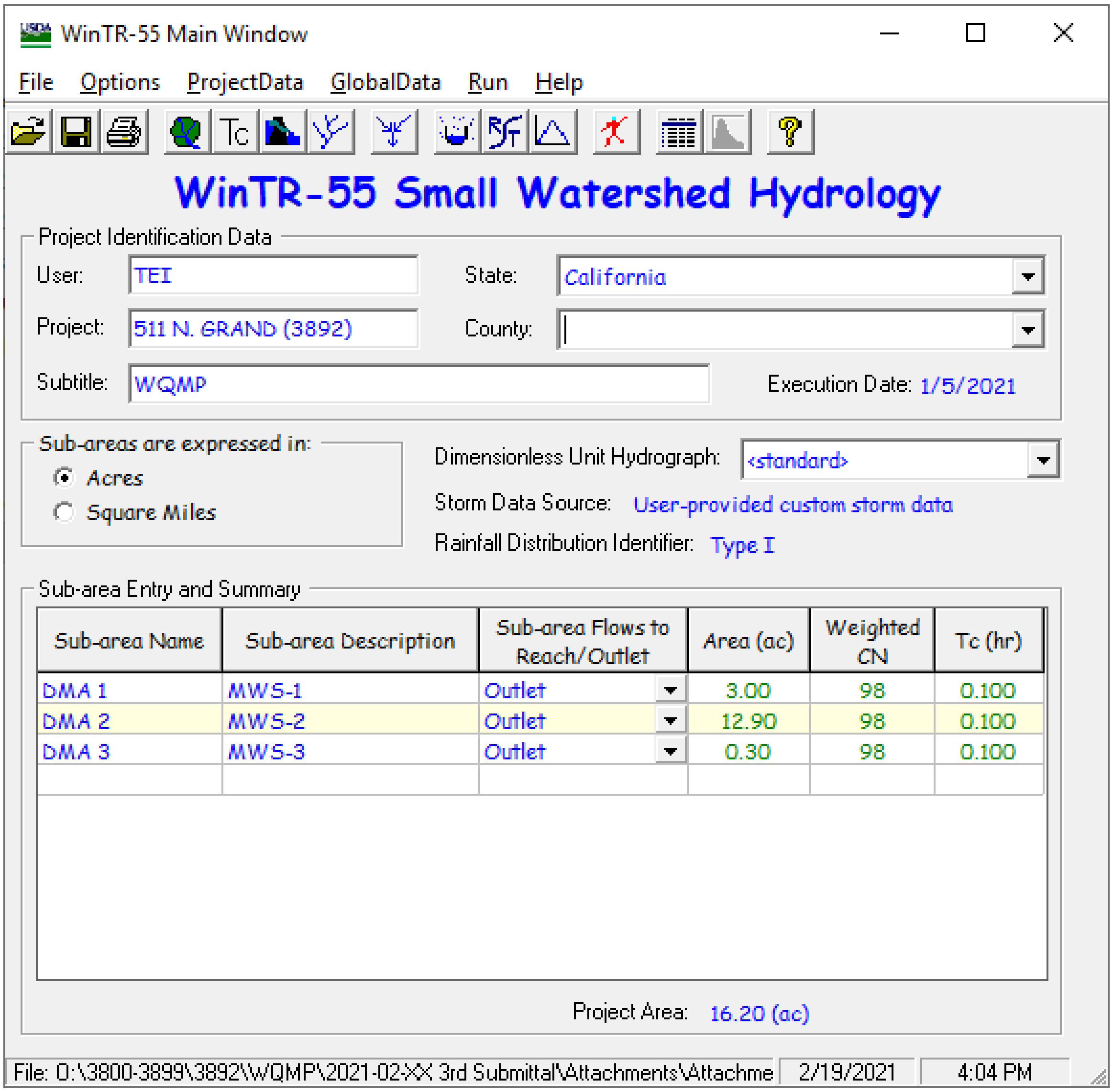
Worksheet D: Capture Efficiency Method for Flow-Based BMPs



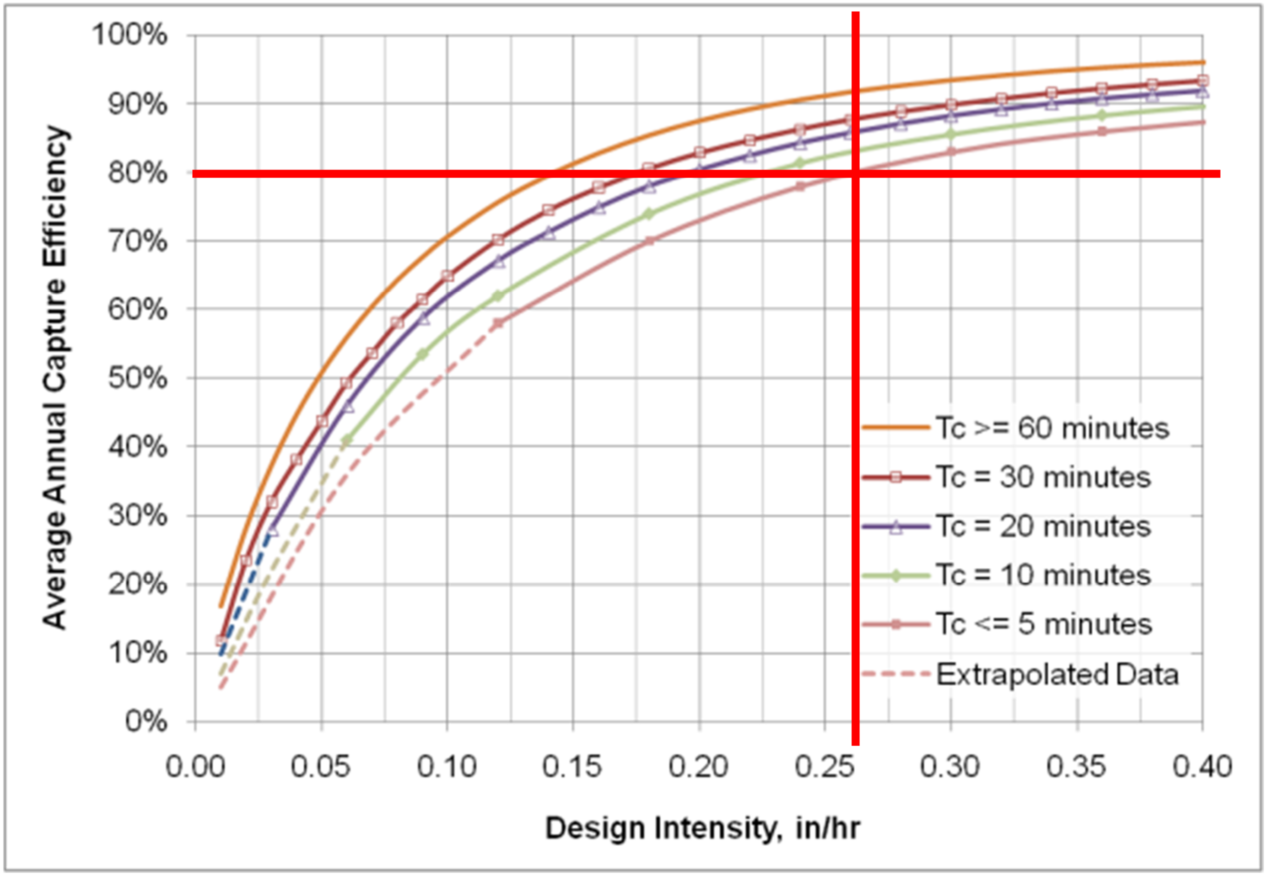
Worksheet D: Capture Efficiency Method for Flow-Based BMPs (DMA 2)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See **Appendix IV.2**)	T_c=	5	
2	Using **Figure III.4**, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.263	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (**Worksheet A**)	d_{HSC}=	--	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (**Worksheet A**)	Y_2=	--	%
5	Using **Figure III.4**, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	--	
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1\text{-}I_2$	I_{design}=	0.263	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	12.90	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.88	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.810	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	2.743	cfs
Supporting Calculations				
Describe system: Model: MWS-L-8-20-V @ 3.4’ HGL QTY: 5 Treatment Rate: 0.577 cfs each Total Treatment Rate: 2.885 cfs > SQDF				
Provide time of concentration assumptions:				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs



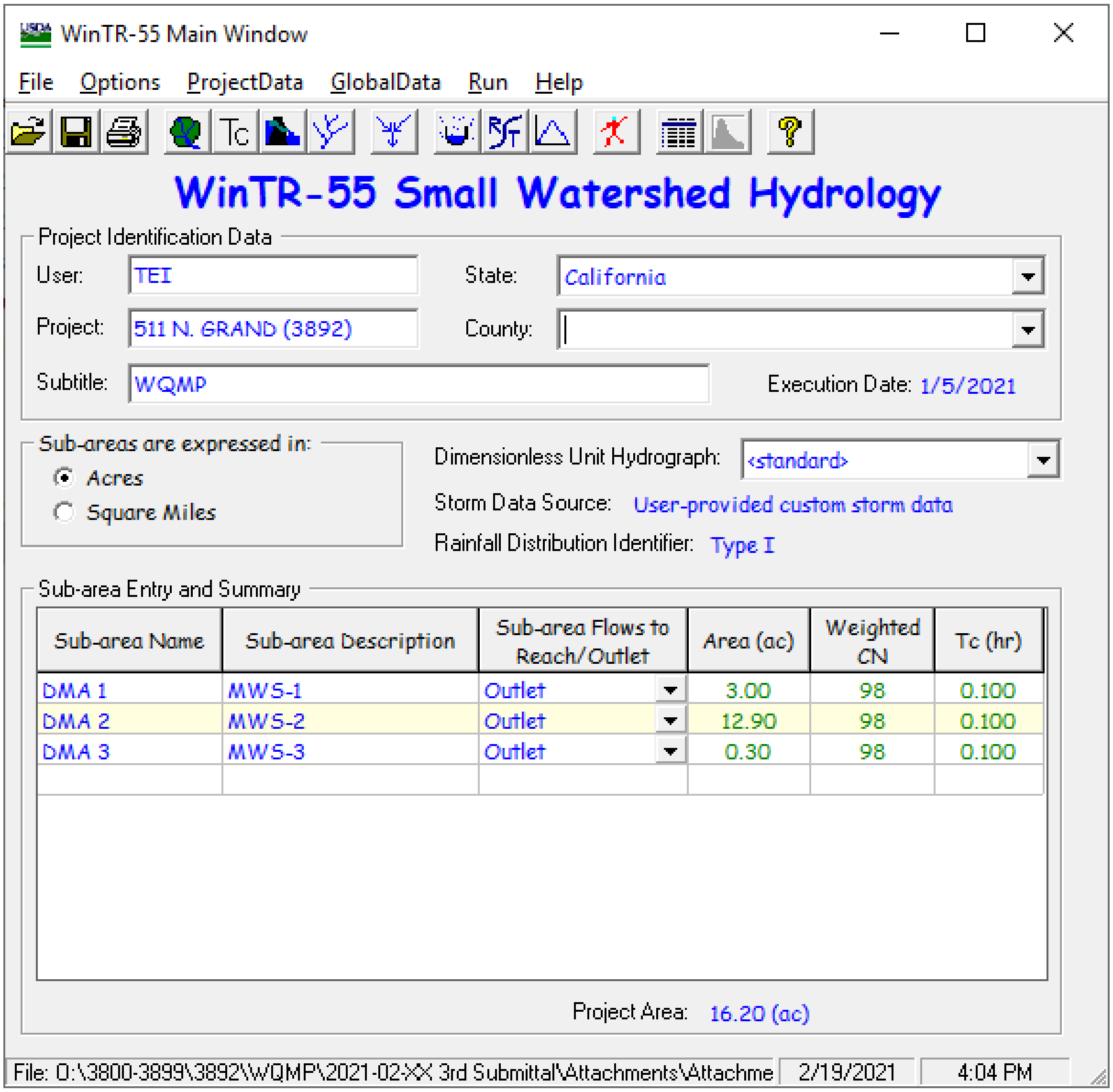
Worksheet D: Capture Efficiency Method for Flow-Based BMPs



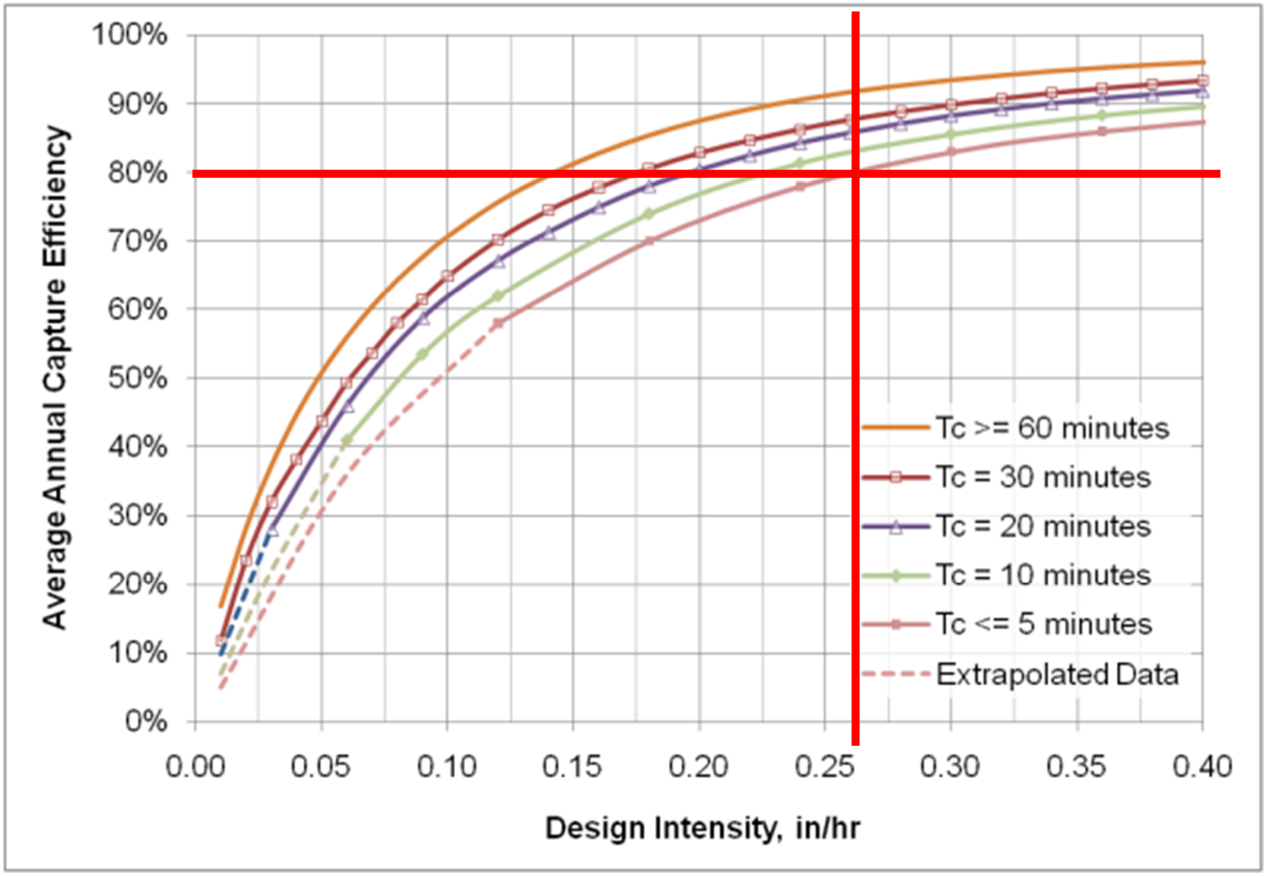
Worksheet D: Capture Efficiency Method for Flow-Based BMPs (DMA 3)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See **Appendix IV.2**)	T_c=	5	
2	Using **Figure III.4**, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.263	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (**Worksheet A**)	d_{HSC}=	--	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (**Worksheet A**)	Y_2=	--	%
5	Using **Figure III.4**, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	--	
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1 - I_2$	I_{design}=	0.263	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.30	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.72	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.690	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.054	cfs
Supporting Calculations				
Describe system: Model: MWS-L-4-4-V @ 3.6’ HGL QTY: 1 Treatment Rate: 0.055 cfs each Total Treatment Rate: 0.055 cfs > SQDF				
Provide time of concentration assumptions:				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs



Worksheet D: Capture Efficiency Method for Flow-Based BMPs



MWS Linear 2.0 HGL Sizing Calculations

MWS MODEL SIZE	WETLAND PERMITER LENGTH	LOADING RATE GPM/SF	HGL HEIGHT: SHALLOW MODELS																				STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS								
			1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.65	3.70	3.75	3.80	3.85	3.90	3.95
MWS-L-4-4	6.70	1.0	0.022	0.023	0.025	0.026	0.028	0.029	0.031	0.032	0.034	0.035	0.037	0.038	0.040	0.042	0.043	0.045	0.046	0.048	0.049	0.051	**0.052**	0.054	0.055	0.056	0.057	0.058	0.058	0.059	0.060	0.061
MWS-L-3-6	10.06	1.0	0.032	0.035	0.037	0.039	0.042	0.044	0.046	0.048	0.051	0.053	0.055	0.058	0.060	0.062	0.065	0.067	0.069	0.072	0.074	0.076	**0.078**	0.081	0.083	0.084	0.085	0.087	0.088	0.089	0.090	0.091
MWS-L-4-6	9.30	1.0	0.030	0.032	0.034	0.036	0.038	0.041	0.043	0.045	0.047	0.049	0.051	0.053	0.055	0.058	0.060	0.062	0.064	0.066	0.068	0.070	**0.073**	0.075	0.077	0.078	0.079	0.080	0.081	0.082	0.083	0.084
MWS-L-4-8	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124	0.126	0.127	0.129	0.131	0.132	0.134
MWS-L-4-13	18.40	1.0	0.059	0.063	0.068	0.072	0.076	0.080	0.084	0.089	0.093	0.097	0.101	0.106	0.110	0.114	0.118	0.122	0.127	0.131	0.135	0.139	**0.144**	0.148	0.152	0.154	0.156	0.158	0.160	0.163	0.165	0.167
MWS-L-4-15	22.40	1.0	0.072	0.077	0.082	0.087	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.165	0.170	**0.175**	0.180	0.185	0.188	0.190	0.193	0.195	0.198	0.200	0.203
MWS-L-4-17	26.40	1.0	0.085	0.091	0.097	0.103	0.109	0.115	0.121	0.127	0.133	0.139	0.145	0.151	0.158	0.164	0.170	0.176	0.182	0.188	0.194	0.200	**0.206**	0.212	0.218	0.221	0.224	0.227	0.230	0.233	0.236	0.239
MWS-L-4-19	30.40	1.0	0.098	0.105	0.112	0.119	0.126	0.133	0.140	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.209	0.216	0.223	0.230	**0.237**	0.244	0.251	0.255	0.258	0.262	0.265	0.269	0.272	0.276
MWS-L-4-21	34.40	1.0	0.111	0.118	0.126	0.134	0.142	0.150	0.158	0.166	0.174	0.182	0.189	0.197	0.205	0.213	0.221	0.229	0.237	0.245	0.253	0.261	**0.268**	0.276	0.284	0.288	0.292	0.296	0.300	0.304	0.308	0.312
MWS-L-6-8	18.80	1.0	0.060	0.065	0.069	0.073	0.078	0.082	0.086	0.091	0.095	0.099	0.104	0.108	0.112	0.116	0.121	0.125	0.129	0.134	0.138	0.142	**0.147**	0.151	0.155	0.157	0.160	0.162	0.164	0.166	0.168	0.170
MWS-L-8-8	29.60	1.0	0.095	0.102	0.109	0.115	0.122	0.129	0.136	0.143	0.149	0.156	0.163	0.170	0.177	0.183	0.190	0.197	0.204	0.211	0.217	0.224	**0.231**	0.238	0.245	0.248	0.251	0.255	0.258	0.262	0.265	0.268
MWS-L-8-12	44.40	1.0	0.143	0.153	0.163	0.173	0.183	0.194	0.204	0.214	0.224	0.234	0.245	0.255	0.265	0.275	0.285	0.296	0.306	0.316	0.326	0.336	**0.346**	0.357	0.367	0.372	0.377	0.382	0.387	0.392	0.397	0.402
MWS-L-8-16	59.20	1.0	0.190	0.204	0.217	0.231	0.245	0.258	0.272	0.285	0.299	0.312	0.326	0.340	0.353	0.367	0.380	0.394	0.408	0.421	0.435	0.448	**0.462**	0.476	0.489	0.496	0.503	0.509	0.516	0.523	0.530	0.537
MWS-L-8-20	74.00	1.0	0.238	0.255	0.272	0.289	0.306	0.323	0.340	0.357	0.374	0.391	0.408	0.425	0.442	0.459	0.476	0.493	0.509	0.526	0.543	0.560	**0.577**	0.594	0.611	0.620	0.628	0.637	0.645	0.654	0.662	0.671
MWS-L-10-20 or MWS-L-8-24	88.80	1.0	0.285	0.306	0.326	0.346	0.367	0.387	0.408	0.428	0.448	0.469	0.489	0.509	0.530	0.550	0.571	0.591	0.611	0.632	0.652	0.673	**0.693**	0.713	0.734	0.744	0.754	0.764	0.774	0.785	0.795	0.805
4'x'4 media cage	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	0.115	0.119	0.122	0.124						

SITE SPECIFIC DATA

PROJECT NUMBER	TEI 3892		
PROJECT NAME	625 N. Grand Avenue		
PROJECT LOCATION	Santa Ana, CA		
STRUCTURE ID			
TREATMENT REQUIRED			
WATER QUALITY FLOW RATE (CFS)	2.75		
PEAK FLOW RATE (CFS)	55		
PEAK STORM DURATION (YEARS)	100		
PIPE & ELEVATION DATA			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE	PER PLAN	PER PLAN	36"
OUTLET PIPE	PER PLAN	PER PLAN	36"
RIM ELEVATION	PER PLAN		
LOADING & SOIL DATA			
SURFACE LOADING	H-20		
FRAME & COVER	(1) ø30" (2) 3' X 6' HATCH		
CORROSIVE SOIL CONDITIONS	MILDLY CORROSIVE		
GROUNDWATER ELEVATION	40' + BELOW		

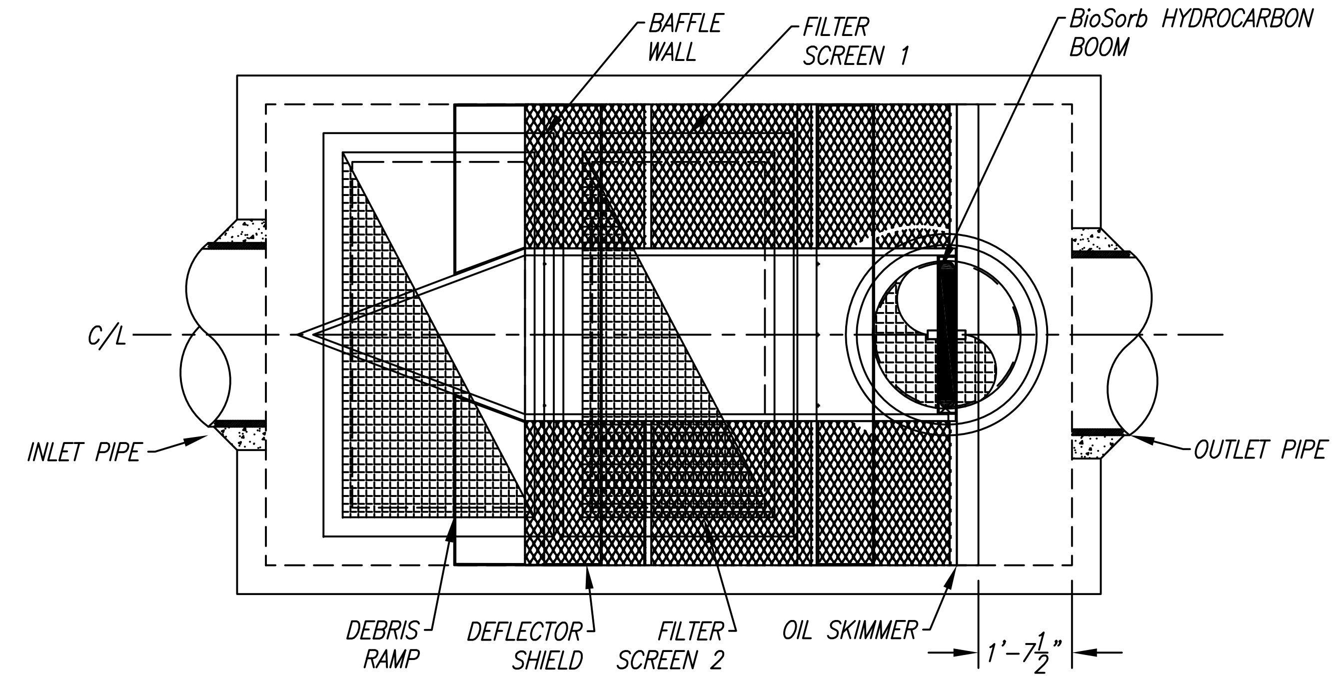
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.

DSBB PERFORMANCE DATA

TREATMENT FLOW RATE (CFS)	8.06
SETTLING AREA (SF)	96.0
LOADING RATE (GPM/SF)	####
SCREEN SYSTEM STORAGE CAPACITY (CF)	84.38
SEDIMENT STORAGE CAPACITY (CF)	324.00
80% TSS REMOVAL @ 126 MICRON	

DSBB STORAGE CAPACITIES

CAGE SCREEN CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
SCREEN 1	7.50	2.50	2.25	42.19
SCREEN 2	7.50	2.50	2.25	42.19
SEDIMENT CHAMBER CAPACITY				
CHAMBER 1	4.50	8.00	3.00	108.00
CHAMBER 2	4.42	8.00	3.00	108.00
CHAMBER 3	4.50	8.00	3.00	108.00



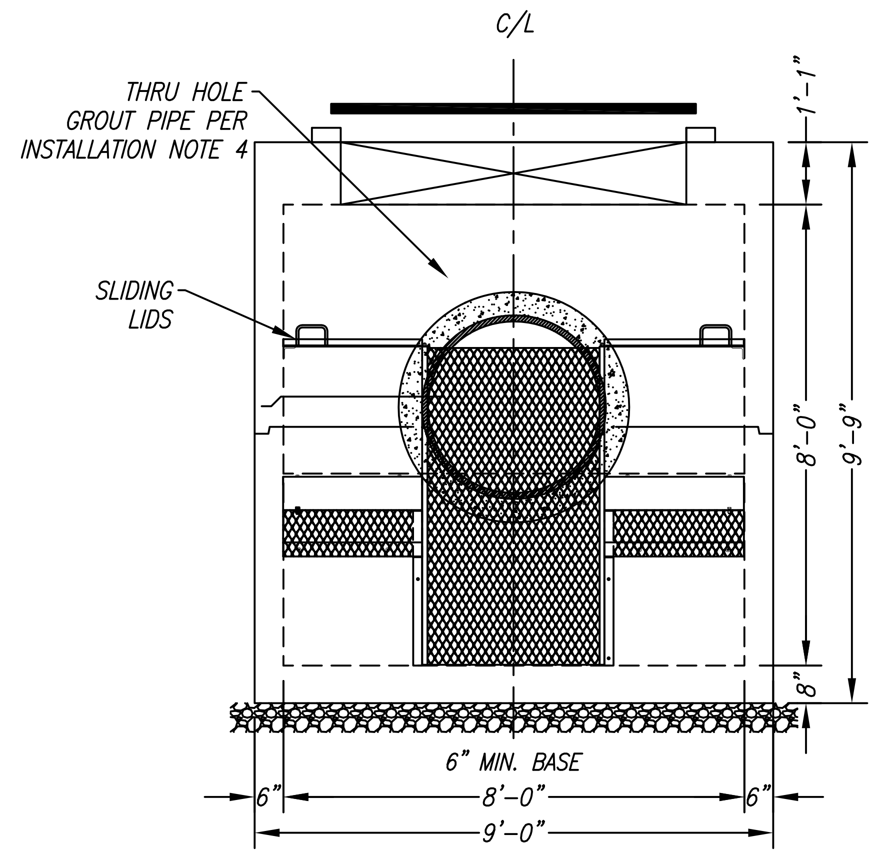
PLAN VIEW

GENERAL NOTES

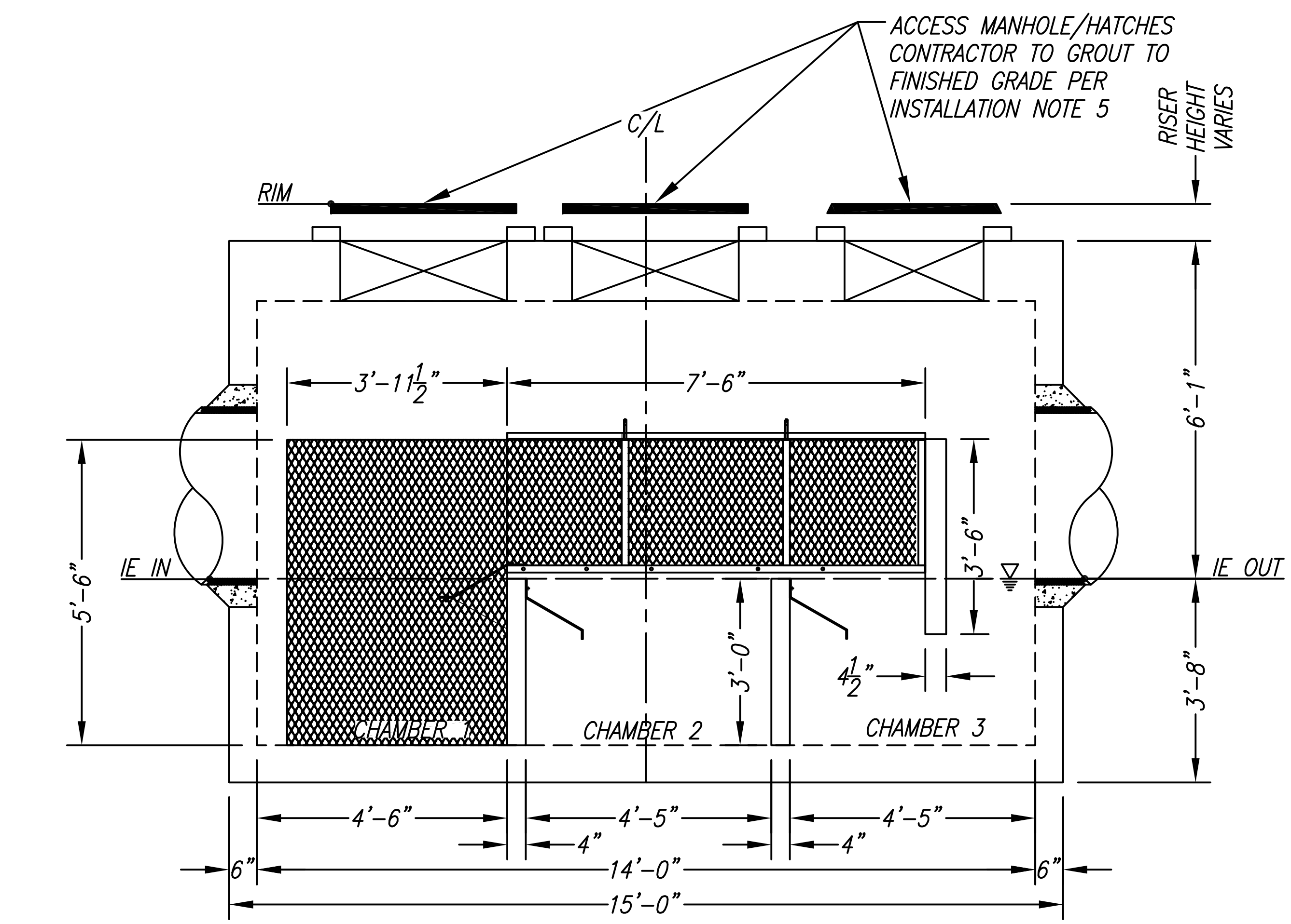
1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.
3. LIDS FOR SCREEN SYSTEM & ALTERNATIVE HATCHES AVAILABLE UPON REQUEST.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE DSBB UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"–12" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON–SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.



END VIEW



ELEVATION VIEW

Bio Clean
A Forterra Company

DSBB-8-14-96
DUAL STAGE HYDRODYNAMIC SEPARATOR
STANDARD DETAIL

5/3/18SSERTICH

625 N. GRAND AVE — SANTA ANA, CA — PUMP#1
PACKAGED STORM WATER LIFT STATION, - MANUFACTURED BY PACIFIC SOUTHWEST INDUSTRIES

SCOPE OF SUPPLY:

Furnish and install complete pre-packaged storm water pump lift station model #PSI-THI011221-P1 as manufactured by Pacific Southwest Industries, (national phone# 800-358-9095), No exceptions shall be taken to this specification without engineers approval.
NOTE: Due to the specific nature of this pump station/ equipment and its operational sequence, any contractor not intending to purchase and supply as specified, by model number, must provide full submittals for review and approval prior to ordering, no exceptions. send full submittals to, www.submittalapproval.com, allow one week for a response.

The pre-packaged Lift Station shall incorporate a quick removal system manufactured by the pump manufacturer. The pump(s) shall be guided to the discharge base elbow by stainless steel guide rails. The rails shall extend from the discharge base elbow to the upper guide bracket mounted on fiberglass channel just below the basin cover. Stainless steel lifting chain or cable shall be supplied and properly installed to remove the pump from the wet well. The internal discharge piping shall be completely pre-plumbed in PVC pipe and extend 12" beyond the wet well side wall for contractor connection to the force main piping. The pump(s) discharge pipe shall have a check and ball valve installed on each discharge line. The Lift Station shall include three liquid level controls on a removable float tree and a control panel suitable for surface mounting. The pump(s), quick removal system and the level sensors shall be housed in a fiberglass wet well (basin) and shall be of sufficient length to maintain the rim of the wet well at grade.

PUMPS:
Each Tsurumi non clog model#100BZ41.5 shall be capable of delivering 270 G.P.M. at 13.3 Feet TDH. The pump(s) shall be designed to pump wastewater, sewage or effluent containing solids without damage during operation. The pump(s) shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

MATERIALS OF CONSTRUCTION:
Construction of major parts of the pumping unit(s) including casing, impeller, and discharge elbow shall be manufactured from gray cast iron, ASTM A48 CLASS 35. Unit(s) shall have a field adjustable and/or replaceable, cast iron shield type wear plate or wear rings. Internal and external surfaces coming into contact with the pumpage shall be protected by a fused polymer coating. All exposed fasteners shall be stainless steel. All units shall be furnished with a discharge elbow with 150 lb. (10 Kg./Cm2) flat face flange and NPT companion flange. impellers shall be of the solids handling design equipped with back pump out vanes and shall be slip fit to the shaft and key driven. The pump casing shall incorporate an air relief valve.

MECHANICAL SEAL:
All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber and further protected by an exclusionary oil seal located between the bottom seal faces and the fluid being pumped. The oil chamber shall be fitted with a device that shall provide positive lubrication of the top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Mechanical seals shall be rated to preclude the incursion of water up to 42.6 PSI (98.4 Ft.). Units shall have silicon carbide mechanical seal faces.

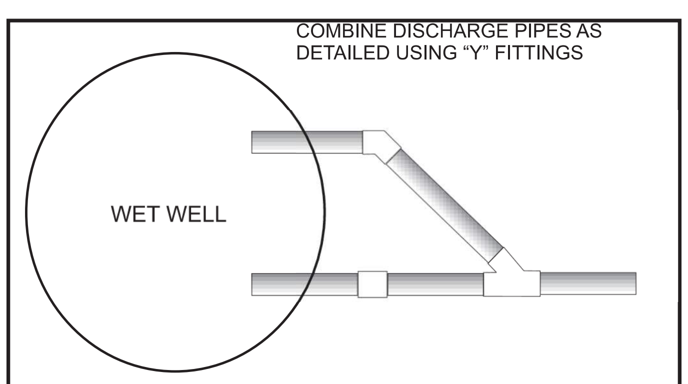
MOTOR:
The pump motor(s) shall be 2 HP, 1.5 kW, 460V, 60 Hz. 3 Phase and shall be NEMA MG-1, Design Type B equivalent. Motor(s) shall be rated at 3.9 full load amps. Motors shall have a 1.15 service factor and shall be rated for 20 starts per hour. Motor(s) shall be air filled, copper wound, class F insulated with built in thermal protection for each winding. Motor shaft shall be 420 or 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. On units up to 10 Hp (75 kW), the bottom bearing shall be a single row, double shielded, C3, deep groove type ball bearing. On units 15 Hp. (11 kW), the bottom bearing shall be two row, double shielded, C3 deep groove type ball bearings. The top bearing on all units shall be single row, double shielded, C3, deep groove type ball bearings. Motor housing and bearing housing shall be gray cast iron, ASTM A48 CLASS 30. Motors shall be D.O.L. or Star-delta start (15 Hp.), shall be suitable for across the line start or variable speed applications, utilizing a properly sized variable frequency drive.

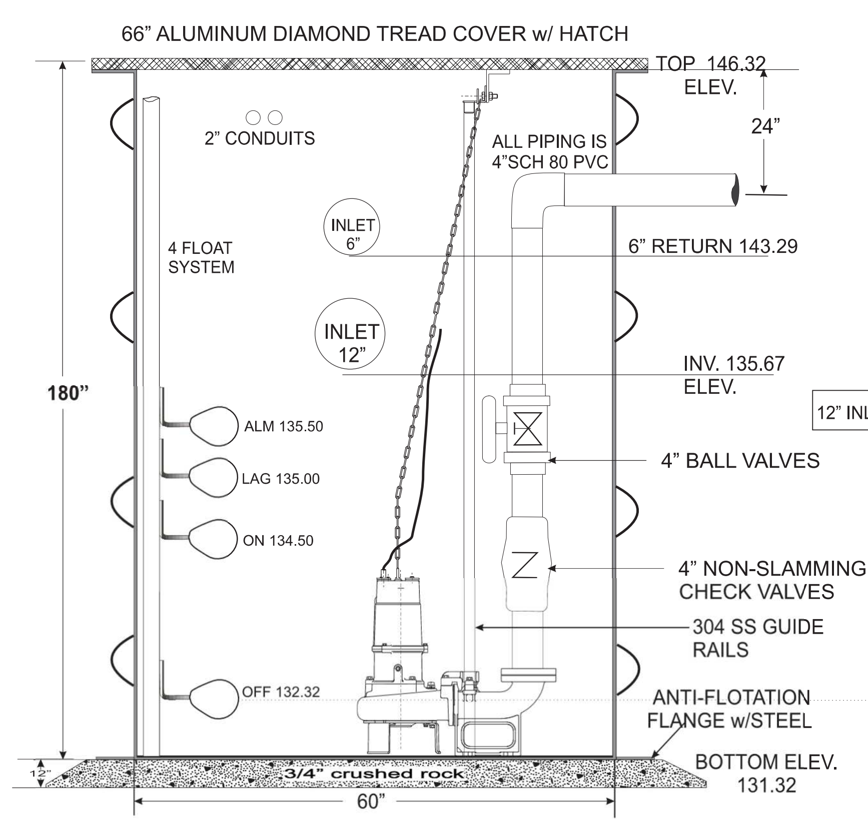
POWER CABLE AND CABLE ENTRANCE:
The pump power cable shall be suitable for submersible pump applications. Units up to 5 Hp. shall be supplied with a cable entrance that incorporates built in strain relief, a one piece, three way mechanical compression seal with a fatigue reducing cable boot. On units 7.5 Hp. and above, the cable entrance shall incorporate built in strain relief, and combination three way mechanical compression sealing with a fatigue reducing/thermal expansion rubber boot. The power cable shall be field replaceable utilizing standard submersible pump cable. The cable entrance assembly on all units shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

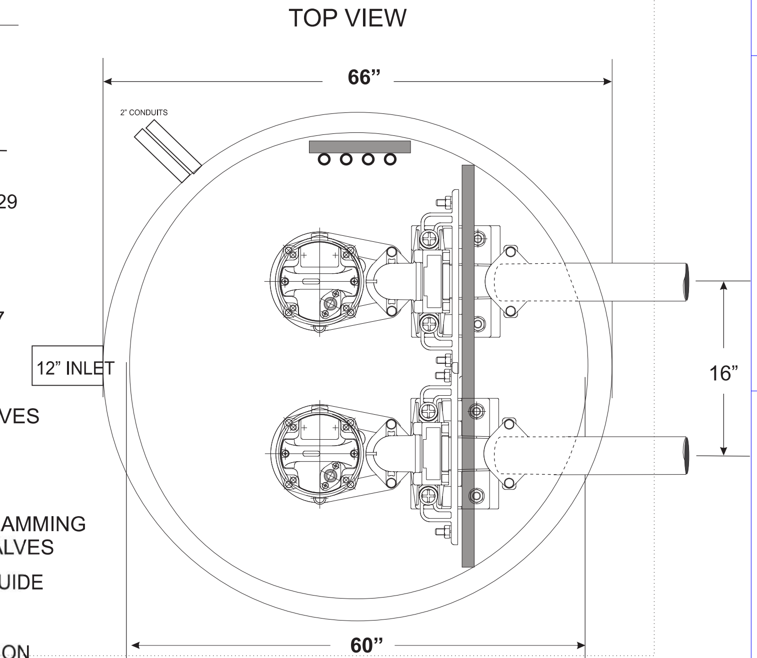
DUPLEX ALTERNATING CONTROL PANEL:
The control panel shall have a NEMA 4X door -in -door dead front lockable fiberglass enclosure suitable for wall mounting. A motor circuit protector shall be provided for each pump and magnetic starter with three leg overload protection for each pump. A Smart relay shall be provided with automatic load selector to alternate pumps on each successive cycle of operation, exercise timers, elapsed time meters, and cycle counter. The starter shall have auxiliary contacts to operate both pumps in an override condition. The control circuit shall not be affected in the event that either pump trips the pump circuit breaker. H.O.A. switches and run lights shall be supplied for each pump. A terminal strip shall be provided to terminate all incoming power, pumps, level sensors and remote alarm wiring. A 100VA control transformer shall be provided to supply reduced voltage to the control circuit. The control panel shall offer a high water alarm light, top mounted for 360 degree visibility. An external push button shall be provided to silence the audible alarm. U.L. 508 listed shop.

FIBERGLASS WET WELL
The fiberglass wet well shall be suitable direct burial installation. The wet well shall be no less than 60 inches in diameter and will be 180 inches in length. The laminate shall have a barcol hardness of a least 90% of the resin manufactures minimum specified hardness for cured resin on both the interior and exterior surfaces. The minimum wall thickness of the wet well shall not be less than 3/16". The wet well manufacturer shall encapsulate a steel base plate with stainless steel studs for the mounting of the quick removal system. The top rim flange must be no less than 2" wider than the ID of the wet well 66"O.D.) The wet well will be provided with 12" inlet fitting for field installation by the contractor at the elevation and location as indicated on the plans. All other penetrations shall be sealed by using "Uniseal" fitting or "Flex boot" fittings.

ALUMINUM DIAMOND TREAD FOOT TRAFFIC COVERS:
The wet well will be covered with a solid 1/4" thick aluminum diamond tread cover suitable for load up to 300 psf. The cover will be solid with no penetrations through it. The cover will be gasketed and bolted to the rim flange of the fiberglass tank using 7/16" stainless steel hex head bolts. No covers using epoxy paint will be acceptable.







NOTE: EACH PUMP WILL DELIVER FULL Q FLOW OF 270GPM.

PUMP MODEL: 100BZ41.5
2HP 460V 3 PH FLA 3.9 AMP
PERFORMANCE:
270 GPM AT 13.3 TDH

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
(800) 358 9095
PACKAGED LIFT STATION

Hazen-Williams Equation
Head Loss in Water Pipe

$f = 0.2083\ (100 / c)^{1.852}\ q^{1.852} / d_h^{4.8655}$

c = 150 HDPE/PVC

q = 270 GPM

dh = 3.83 for 4" SCH80

FRICTION LOSS PER 100 FT

4.55 FT

H(total) = H(f) + H(static)

H(total) = 13.33 FT

STORM LIFT STATION PROFILE & CALCULATIONS

EQUIVALENT PIPE RUN CALCULATION

4" SCH 80 PVC PIPE		**30.0 FT**
4" PVC SCH 80 90 ELBOW	**(1) X 10 FT**	**10.0 FT**
4" PVC SCH 80 45 BEND	**(1) X 5 FT**	**5.0 FT**
4" PVC SCH 80 TEE	**(0) X 22 FT**	**0.0 FT**
4" CHECK VALVE	**(1) X 26 FT**	**26.0 FT**
4" BALL VALVE	**(1) X2.3 FT**	**2.3 FT**
TOTAL EQUIVALENT LENGTH		**73.3 FT**

FRICTION LOSS PER 100 FT 4" PVC @ 270 GPM 4.55 FT PER 100 FT

FRICTION LOSS 73.3/100 X 4.55 FT = 3.33 FT

STATIC HEAD 10.0 FT

TOTAL DEVELOPED HEAD 13.33 FT

PERFORMANCE 270 GPM @ 13.33 TDH THRU 4" PVC LINE

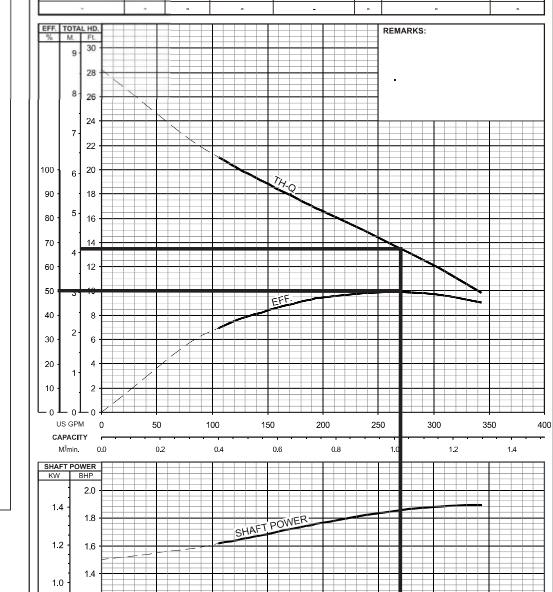
Mar. 12 60-PC-BZ-01

TSURUMI — BZ - SERIES SEWAGE & WASTEWATER PUMPS — PERFORMANCE CURVE

MODEL	BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
(TOS) 100BZ41.5 -61	4"/100mm	2	1.5	1700	3.15" / 80mm	Water	1.0	1.123 cSt.	60F

PUMP TYPE	PHASE	VOLTAGE	AMPERAGE	HZ	STARTING METHOD	INS. CLASS
Sewage & Wastewater Pump	3	208-230 / 460 / 575	8.0-7.8 / 3.9 / 6.0	60	Direct On Line	F

CURVE No.	DATE	PHASE	VOLTAGE	AMPERAGE	HZ	STARTING METHOD	INS. CLASS
-	-	-	-	-	-	-	-



STORM WATER LIFT STATION DETAILS

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
18541 COLLIER AVE., LAKE ELSINORE, CA 92530 PH: 800 358-9095

No.	Date	Description

LIFT STATION DETAILS
625 N. GRAND AVE - SANTA ANA CA
PUMP#1

Date: 01/12/21
Drawn by: OR
Checked by:
Scale: NTS
Sheet No. 1 OF 1

LSD-1

625 N. GRAND AVE — SANTA ANA, CA ---- PUMP#2
PACKAGED STORM WATER LIFT STATION - MANUFACTURED BY PACIFIC SOUTHWEST INDUSTRIES

SCOPE OF SUPPLY:

Furnish and install complete pre-packaged storm water pump lift station model #PSI-THI011221-P2 as manufactured by Pacific Southwest Industries, (national phone# 800-358-9095), No exceptions shall be taken to this specification without engineers approval.
NOTE: Due to the specific nature of this pump station/ equipment and its operational sequence, any contractor not intending to purchase and supply as specified, by model number, must provide full submittals for review and approval prior to ordering, no exceptions. send full submittals to, www.submittalapproval.com, allow one week for a response.

The pre-packaged Lift Station shall incorporate a quick removal system manufactured by the pump manufacturer. The pump(s) shall be guided to the discharge base elbow by stainless steel guide rails. The rails shall extend from the discharge base elbow to the upper guide bracket mounted on stainless steel channel just below the basin cover. Stainless steel lifting chain or cable shall be supplied and properly installed to remove the pump from the wet well. The internal discharge piping shall be completely pre-plumbed in PVC pipe and extend 12" beyond the wet well side wall for contractor connection to the force main piping. The pump(s) discharge pipe shall have a check and ball valve installed on each discharge line. The Lift Station shall include four liquid level controls on mounting brackets and a control panel suitable for surface mounting. The pump(s), quick removal system and the level sensors shall be housed in a fiberglass wet well (basin).

PUMP(S):
Furnish and install KSB Model# KRT-K-200-318 submersible pump(s). Each unit shall be capable of delivering 1300 GPM at 17.0 Feet TDH. The pump(s) shall be designed to pump waste water, sewage or effluent containing 3.95 inch diameter solids without damage during operation. The pump(s) shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

MATERIALS OF CONSTRUCTION:
Construction of major parts of the pumping unit(s) including pump casing, impeller, motor head cover and intermediate brackets shall be manufactured from recyclable, application appropriate resins. The need for a protective coating shall not be required. All exposed fasteners shall be stainless steel and shall have stainless steel mating anchors integrally cast into the mating part. All units shall be furnished with a NPT discharge companion flange. Impellers shall be of the multi-vane, semi-vortex, solids handling design and shall be slip fit to the shaft. The motor shaft shall be machined to provide a positive drive of the impeller. The pump casing shall incorporate an air relief valve.

MECHANICAL SEAL:
All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber. Units shall be fitted with a device that shall provide positive lubrication of top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Units shall have silicon carbide mechanical seal faces. Mechanical seal hardware shall be Stainless steel.

MOTOR:
The pump motor(s) shall be 8.5 HP, 460 V., 60 Hz., 3 Phase and shall be NEMA MG-1, Design Type B equivalent. Motor(s) shall be rated at 11.5 full load amps. Motor(s) shall have a 1.15 service factor and shall be rated for 15 starts per hour. Motor(s) shall be air filled, copper wound, class H insulated with built-in thermal protection. Motor shaft shall be 420 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. The bearings shall be single row, double shielded, C3, deep groove type ball bearings. Bearing seats shall be rolled carbon steel or aluminum die casting. Motor housing shall be 304 stainless steel. Motors shall be suitable variable speed applications, utilizing a properly sized variable frequency drive. (Only for 3 phase.)

POWER CABLE AND CABLE ENTRANCE:
The pump cable shall be suitable for submersible pump applications. The cable entrance shall incorporate built in strain relief, a one piece, three way mechanical compression seal with a fatigue reducing cable boot. The cable entrance assembly shall contain an anti-wicking block to eliminate water incursion into the motor due to Capillary wicking should the power cable be accidentally damaged.

QUICK REMOVAL SYSTEM:
The pumping unit(s) shall be equipped with quick removal system (QRS). The construction shall be such that the pump(s) will automatically connect to the discharge piping when lowered into place on the discharge connector. There shall be no need for personnel to enter the wet well to accomplish installation or removal of the pump(s). The pumping unit(s) shall be fitted with stainless steel lifting chain(s) of sufficient length and strength to permit the raising and lowering of the unit(s). The chain(s) shall be fastened at the top of the structure near the access opening. All parts of the QRS system including base elbow, sliding guide bracket, and guide support shall be manufactured from recyclable, application appropriate resins. The need for a protective coating shall not be required. A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connection with a bracket to connect with the discharge connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a single linear downward motion of the pump with the entire weight of the pumping unit guided by a pawl, thereby wedging the pumping unit tightly against the discharge connector. No portion of the pump shall bear directly on the floor of the sump nor shall a rotary motion of the pump be required for sealing. All fasteners coming into contact with the pumpage shall be stainless steel. Two corrosion resistant guide pipes shall be furnished and installed for each pump to permit raising and lowering of the pump. Guide pipes shall be 3/4 inch (20 mm) in diameter and shall be of adequate length to extend from the lower guide holder to the upper guide bar bracket(s) mounted on the access frame.

DUPLEX ALTERNATING CONTROL PANEL:
The control panel shall have a NEMA 4X door -in -door dead front lockable fiberglass enclosure suitable for wall mounting. A motor circuit protector shall be provided for each pump and magnetic starter with three leg overload protection for each pump. A Smart relay shall be provided with automatic load selector to alternate pumps on each successive cycle of operation, exercise timers, elapsed time meters, and cycle counter. The starter shall have auxiliary contacts to operate both pumps in an override condition. The control circuit shall not be affected in the event that either pump trips the pump circuit breaker. H.O.A. switches and run lights shall be supplied for each pump. A terminal strip shall be provided to terminate all incoming power, pumps, level sensors and remote alarm wiring. A 100VA control transformer shall be provided to supply reduced voltage to the control circuit. The control panel shall offer a high water alarm light, top mounted for 360 degree visibility. The control panel will be equipped with variable speed drives to control the impeller speed of the pumps. An external push button shall be provided to silence the audible alarm. U.L. 508 listed shop. A dry, non-powered contact shall be supplied in the main control panel to interface with the owners computerized security system. This contact is to normally open. The contact will close when the high level alarm float is activated or upon power loss.

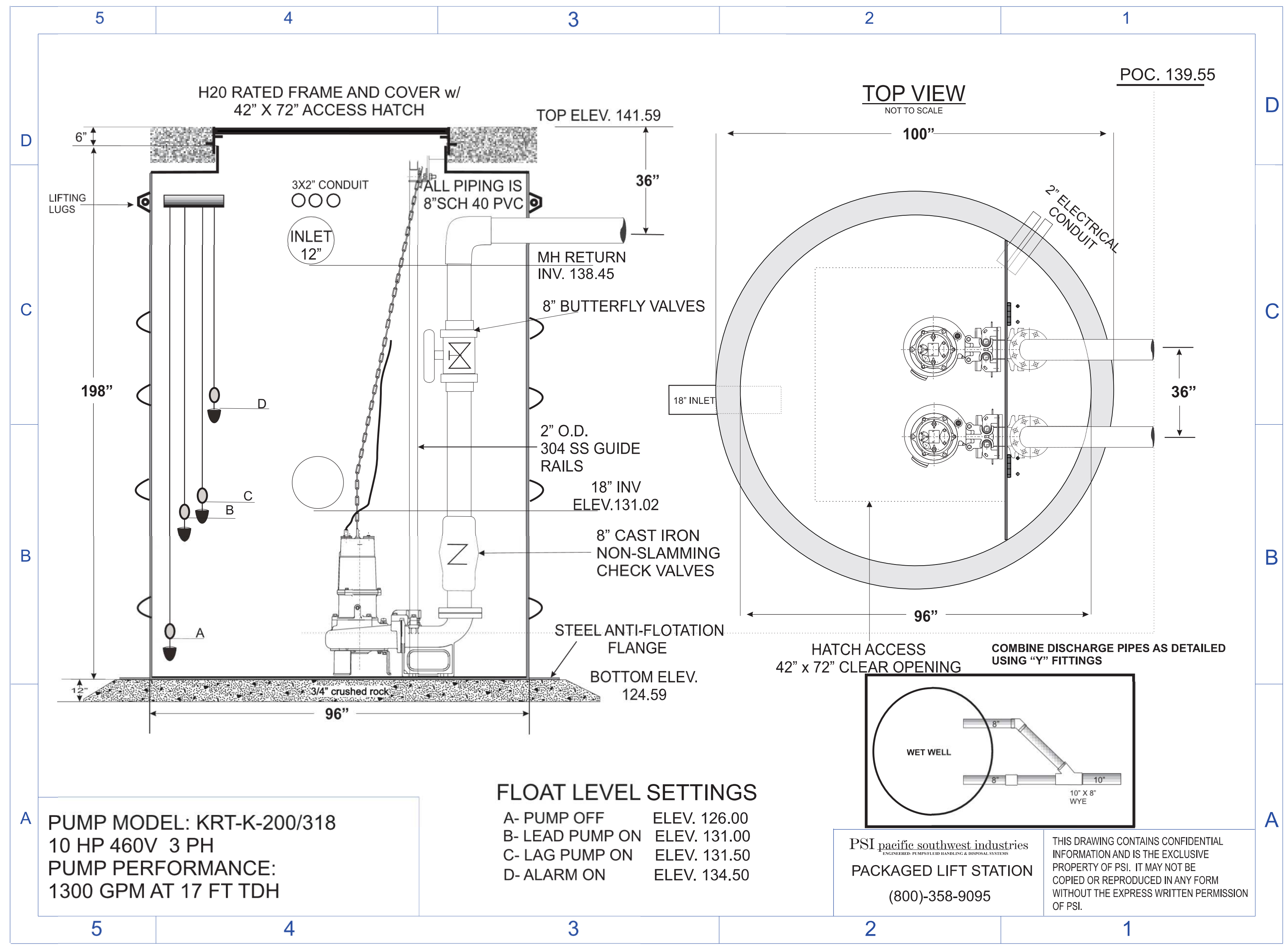
FIBERGLASS WET WELL:
The fiberglass wet well shall be suitable for direct burial installation. The wet well shall be no less than 96 inches in diameter and will be 204 inches in length and contain an anti-flotation flange. The laminate shall have a barcol hardness of a least 90% of the resin manufactures minimum specified hardness for cured resin on both the interior and exterior surfaces. The minimum wall thickness of the wet well shall not be less than 1/4". The wet well manufacturer shall encapsulate a steel base plate with stainless steel studs for the mounting of the quick removal system. The wet well will be provided with a (18") inlet fitting for field installation by the contractor at the elevation and location as indicated on the plans. All other penetrations shall be sealed by using "Uniseal" fittings, "Flex boot" fittings, or "Link-Seal" fittings.

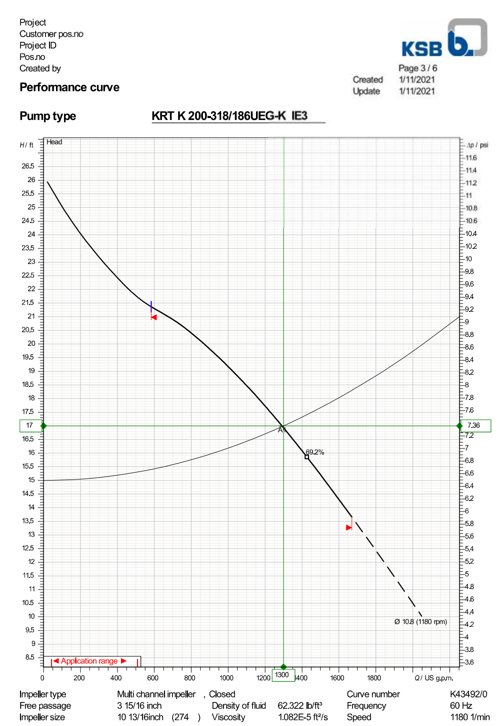
H20 TRAFFIC RATED FRAME AND COVER w/HATCH:
The cover of the wet well and valve vault shall be constructed of fabricated steel w/ galvanized coating and will be suitable for On street traffic loads 15 MPH or less. The covers will be designed to receive H20 wheel loads. The cover will be constructed with a double door, spring assist, bolted frame and cover and 2 door with clear openings of 42" x 72" for the wet well The cover will be shipped loose to be poured in place atop the 12" thick top slab of the wet well and vault. Rebar will be required on 12" centers surrounding the frame and the recess into the top slab 5" minimum anchored with concrete epoxy Compressive yield strength, ASTM D 695 (7 days) 12,000 psi (82MPa) or equal. The concrete will be rated for 3500 PSI or better and formed to extended 12" past the frames on all sides.

STORM LIFT STATION PROFILE & CALCULATIONS

EQUIVALENT PIPE RUN CALCULATION

10" SCH 40 PVC PIPE	20.0 FT
10" PVC SCH 40 90 ELBOW (0) X 26 FT	0.0 FT
10" PVC SCH 40 45 BEND (0) X 13 FT	0.0 FT
TOTAL EQUIVALENT LENGTH	20.0 FT
FRIC LOSS PER 100 FT 10" PVC @ 1300 GPM .776 FT PER 100 FT	
FRICTION LOSS 10" 20.0/100 X .776 FT =	.155 FT
8" SCH40 PVC PIPE	20.0 FT
8" PVC SCH 40 90 ELBOW (1) X 21 FT	21.0 FT
8" PVC SCH 40 45 BEND (1) X 10 FT	10.0 FT
8" CHECK VALVE (1) X 52 FT	52.0 FT
8" BALL VALVE (1) X 4.5 FT	4.5 FT
TOTAL EQUIVALENT LENGTH	107.5 FT
FRIC LOSS PER 100 FT 8" PVC @ 1300 GPM 2.35 FT PER 100 FT	
FRICTION LOSS 8" 107.5/100X 2.35 FT =	2.52 FT
FRICTION LOSS .155 + 2.52	2.68 FT
STATIC HEAD	14.96 FT
TOTAL DEVELOPED HEAD	17.64 FT
PERFORMANCE 1300 GPM @ 17.64 FT TDH THRU 10" PVC LINE	





STORM WATER LIFT STATION DETAILS

PSI pacific southwest industries
ENGINEERED- PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS
30520 COPLASA ST., LAKE ELSINORE, CA 92530 PH: 800 358-9095

No.	Date	Description

LIFT STATION DETAILS
625 N. GRAND AVE - SANTA ANA
PUMP#2

Date:	01/12/21	Scale: NTS
Drawn by:	DT	Sheet No.
Checked by:	OR	1 OF 1

LSD-1

ATTACHMENT E
OPERATIONS AND MAINTENANCE (O&M)

Operations and Maintenance (O&M) Plan

for

DUR2 Santa Ana

511 N. Grand Avenue
Santa Ana, CA 92701

APNs: 398-061-36, -37, -38, -39 // 398-111-31, -32 // 398-391-18, -29, -30

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Non-Structural Source Control BMPs			
Yes	**N1. Education for Property Owners, Tenants and Occupants** The owners will provide the first tenants with information concerning good housekeeping practices that contribute to protection of storm water quality. Please see Section VII for educational materials.	Start up to begin immediately after construction is completed. Maintenance Schedule: The owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. The project site will have annual employee training and new hires within 1 month.	**Owner**
Yes	**N2. Activity Restrictions** Conditions, Covenants and Restrictions (CC&R's) will identify restricting or prohibiting activities once the project is operational. These activities include, but will not be limited to: •Prohibit discharges of fertilizer, pesticides, or animal wastes to streets or storm drains. •Prohibit blowing or sweeping of debris (leaf litter, grass clippings, litter, etc.) into streets or storm drains. •Requirement to keep trash receptacles covered or sheltered by a roof overhang or canopy. •Prohibit vehicle washing, maintenance, or repair on the premises.	Start up to begin immediately after construction is completed. Activity restriction will be enforced daily.	**Owner**
Yes	**N3. Common Area Landscape Management** Maintenance of the landscaping shall be done weekly. Irrigation must be consistent with City's Water Conservation Ordinance (included in Section VII). Fertilizer and pesticide usage will be consistent with County Management Guidelines for Use of Fertilizers and Pesticides.	Start up upon completion of landscaping. Irrigation system shall be inspected monthly by landscape contractor to check for over-watering, leaks, or excessive runoff to paved areas and landscaping shall be maintained weekly and maintenance contractor shall properly dispose of all landscape wastes.	**Owner**
Yes	**N4. BMP Maintenance** BMP maintenance, implementation schedules, and responsible parties are included with each specific BMP narrative.	Start up to begin immediately after construction and all BMP's are completed. LID BMPs to be inspected and maintained as detailed on pages 4 and 5.	**Owner**
Yes	**N7. Spill Contingency Plan** Owner/tenant will have a spill contingency plan based on individual site needs. The plan shall be reviewed yearly for content and suitability for the potential spills at the site. Past spill records should be included in the review to assess plan performance.	Plan shall be reviewed yearly. Training frequency shall increase if any deficiencies are found.	**Owner**

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**N11. Common Area Litter Control** Employees, gardeners, and the property manager will help keep the site free of trash and other debris. The trash enclosure is located on the west side of the service building. It will be the owner's responsibility for having the site inspected weekly and cleaned as necessary.	The site shall be inspected weekly with trash emptied weekly with ongoing maintenance.	**Owner**
Yes	**N12. Employee Training** The owner will prepare guidelines for the tenant and their employees discussing both structural and non-structural BMP's and how to implement them. See Educational Materials and Attachment A in this report.	Start up to begin immediately after construction is completed. The owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. The project site will have annual employee training and new hires within 2 weeks.	**Owner**
Yes	**N13. Housekeeping of Loading Docks** Employees and the property manager will help keep the loading docks free of trash and other debris. It will be the owner's responsibility for having the loading docks inspected weekly and cleaned as necessary.	Loading/unloading docks will be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers. On-going.	**Owner**
Yes	**N14. Common Area Catch Basin Inspection** The owner/maintenance contractor will be responsible for cleaning the catch basins on-site on a regular basis prior to the storm season, no later than October 1st of each year.	Maintenance to begin upon completion of storm drain system. Catch basins and storm drain system will be inspected monthly and vacuumed as necessary.	**Owner**
Yes	**N15. Street Sweeping Private Streets and Parking Lots** The owner/maintenance contractor will have the private drive swept. Hosing or watering of the site will not be permitted as a method of cleaning.	Start up upon completion of the paving. Parking lots and drive isles will be swept or vacuumed monthly (or more often as needed to remove visible debris). If there is any trash or debris in between the routine sweeping it will be swept or vacuumed immediately.	**Owner**
Structural Source Control BMPs			
Yes	**S1. Provide Storm Drain System Stenciling and Signage** All storm drain inlets and catch basins shall have stenciling or labeling such as "No Dumping – Drains to Ocean" and/or other graphical icons to alert the public to the destination of pollutants discharged into stormwater. The County or City can be contacted to determine specific requirements for placards types and methods of application.	Start up to begin immediately after construction is completed. Legibility of stencils and signs must be maintained. The owner/ or maintenance contractor shall inspect signage for legibility at least twice a year.	**Owner**

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**S3. Design and Construct Trash and Waste Storage Areas to Reduce Pollutant Introduction** Trash and waste storage areas will be incorporated on the site. The trash enclosure areas will be paved with an impervious surface to mitigate spills. The trash container lids will remain closed. In addition, storm water runoff from adjoining roofs and pavement must be diverted around the trash area and signs should be posted informing users that hazardous materials are not to be disposed of therein.	Start up to begin immediately after construction is completed. Weekly inspection, cleaning and sweeping of trash area by property owner. Trash to be removed weekly or more as needed.	**Owner**
Yes	**S4. Use Efficient Irrigation Systems and Landscape Design** Irrigation of the landscaping shall be implemented as indicated on the approved landscape drawings and be consistent with the City's Water Conservation Ordinance. The irrigation system shall have rain shutoff controls as well as a programmable timer. Short irrigation cycles should be used to meet with the plant/landscaping needs.	Start up upon completion of landscaping. System shall be inspected by the owner/ or maintenance contractor once a month to check for over watering, broken sprinkler heads or lines, and excessive runoff onto paved areas.	**Owner**
Yes	**S6. Dock Areas** Loading/unloading docks will be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers.	Start up to begin immediately after construction is completed. Weekly inspection, cleaning and sweeping of trash; immediate clean up of spills is required. Keep docks property maintained.	**Owner**

BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Low Impact Development BMPs		
Biotreatment BMP Proprietary Biotreatment / Modular Wetland System	Description of BMP: The Modular Wetlands will be utilized as bioretention treatment of storm water runoff from the project site. Runoff passes through the system horizontally, with planted material at the surface. Start-up date: When storm drain system is complete. Maintenance Schedule: Per manufactures specifications and units shall be inspected twice a year and maintained at least once a year (replacement of media filter), prior to October 1. The units shall be inspected and maintained by a qualified technician with proper disposal of all waste. Refer to maintenance brochure in Attachment D.	**Owner**
Treatment Control BMP Drain Inserts	Description of BMP: Catch basin inserts will need to be inspected four times a year and serviced three times a year. Debris will be removed that may cause the drain to clog. Filter medium needs to be replaced at least once a year. Start-up date: When storm drain system is complete. Maintenance Schedule: Per manufactures specifications and after September 1, shortly before the rainy season, October 1.	**Owner**
Treatment Control BMP Hydrodynamic Separator	Description of BMP: Hydrodynamic separators will need to be inspected semi-annually (by October 1st and February 1st) and maintain, upon reaching 25% capacity. Start-up date: When storm drain system is complete. Maintenance Schedule: Per manufactures specifications and after September 1, shortly before the rainy season, October 1.	**Owner**

BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Sump Pump PSI Pump	Description of system: The proposed pumps will be utilized to pump flows into the proposed Modular Wetland Systems. Start up date: When BMP system is complete. Maintenance Schedule: Per manufactures specifications pump system shall be inspected twice a year. Preventative maintenance and service to be performed by a qualified technician is recommended. Inspection and maintenance includes: • Check automatic operation of system as well as manual operation by use of float activation and selector switch, respectively. • Inspect floats for proper elevation and movement. • Check voltage and amperage for each motor. • Hose down lift station to clean walls, pumps, and floats. • Inspection of mechanical seals to be done once every two (2) years.	**Owner**

Required Permits

No permits are required.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

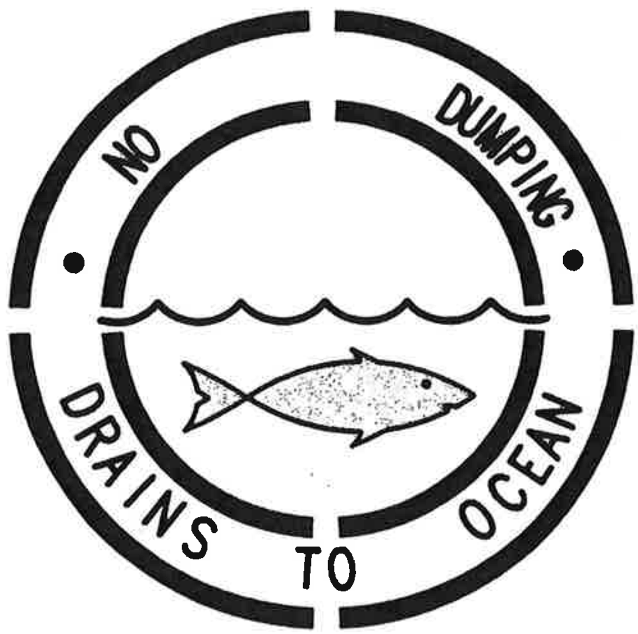
RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: ____________________

Name of Person Performing Activity (Printed): ____________________

Signature: ____________________

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed
Modular Wetland (Biofiltration)	
Drain Inserts	
Hydrodynamic Separator	
Sump Pump	



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

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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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.

Drain Inlet Insert MP-52

General Description

Drain inlet inserts, also known as catch basin, drop inlet or curb inlet inserts, are used to remove pollutants at the point of entry to the storm drain system. There are a multitude of inserts of various shapes and configurations including baffles, baskets, boxes, fabrics, sorbent media, screens, and skimmers. The effectiveness of drain inlet inserts depends on their design, application, loading, and frequency of maintenance to remove accumulated sediment, trash, and debris.

Inspection / Maintenance Considerations

Routine inspection and maintenance is necessary to maintain functionality of drain inlet inserts and to prevent re-suspension and discharge of accumulated pollutants. Maintenance activities vary depending on the type of drain inlet insert being implemented; refer to the manufacturer's recommendations for more information.

Advanced BMPs Covered

Treatment Control

Maintenance Concerns

- *Sediment, Trash, and Debris Accumulations*
- *Pollutant Re-suspension and Discharge*

Targeted Constituents*

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

*****_Removal Effectiveness varies for different manufacturer designs. See New Development and Redevelopment Handbook-Section 5 for more information._

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Drain Inlet Insert MP-52

Inspection Activities	Suggested Frequency
☐ Verify that stormwater enters the unit and does not leak around the perimeter.	After construction.
☐ Inspect for sediment, trash, and debris buildup and proper functioning.	At the beginning of the wet season and after significant storms
Maintenance Activities	**Suggested Frequency**
☐ Remove accumulated sediment, trash, and debris. ☐ Replace sorbent media.	At the beginning of the wet season and as necessary

References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, April, 2010. http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf.

California Stormwater Quality Association. *Stormwater Best Management Practice Handbook, New Development and Redevelopment*, 2003. https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

Orange County Stormwater Program. Technical Guidance Document BMP Fact Sheets. http://media.ocgov.com/gov/pw/watersheds/documents/wqmp/tgd/technical_guidance_document_bmp_fact_sheets.asp.

San Francisco Public Utilities Commission, et al. San Francisco Stormwater Design Guidelines. Appendix A, Stormwater BMP Fact Sheets, June, 2010. http://www.sfwater.org/modules/showdocument.aspx?documentid=2778.

Tahoe Regional Planning Agency. Best Management Practices Handbook, 2012. http://www.tahoebmp.org/Documents/2012%20BMP%20Handbook.pdf.

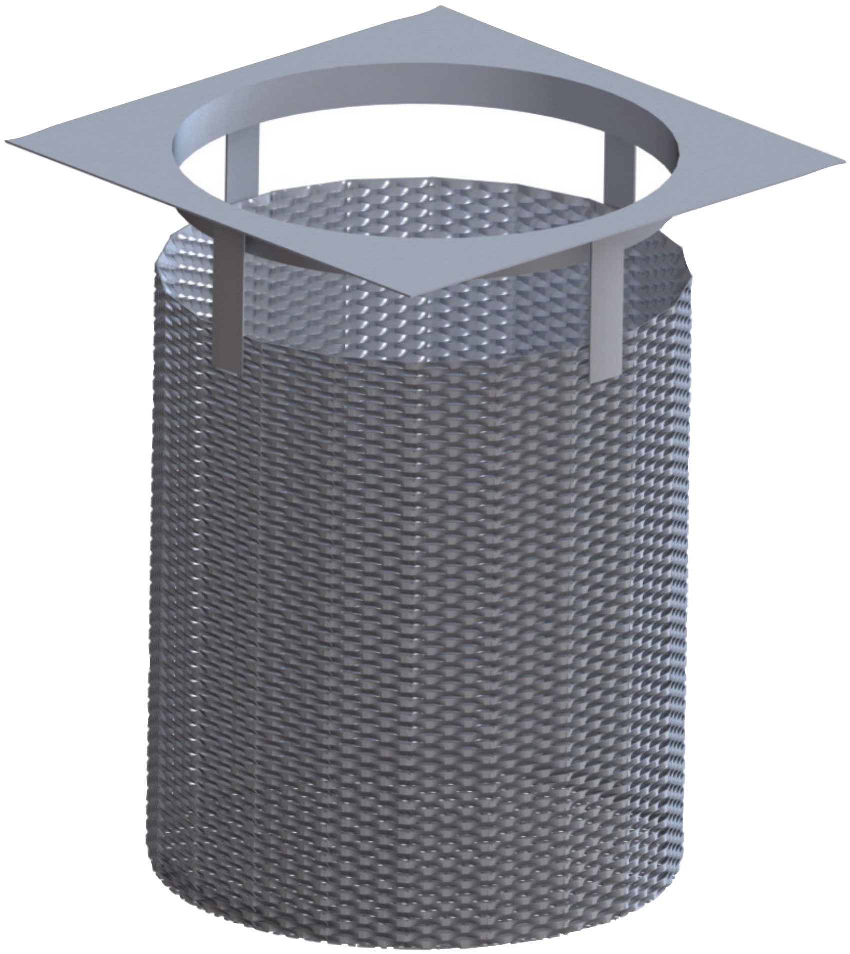
U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development and Redevelopment. BMP Fact Sheets. Available at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

Ventura Countywide Stormwater Quality Management Program. *Technical Guidance Manual for Stormwater Quality Control Measures*, May, 2010. http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura%20Technical%20Guidance%20Document_5-6-10.pdf.

Grate Inlet Filter

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE



Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

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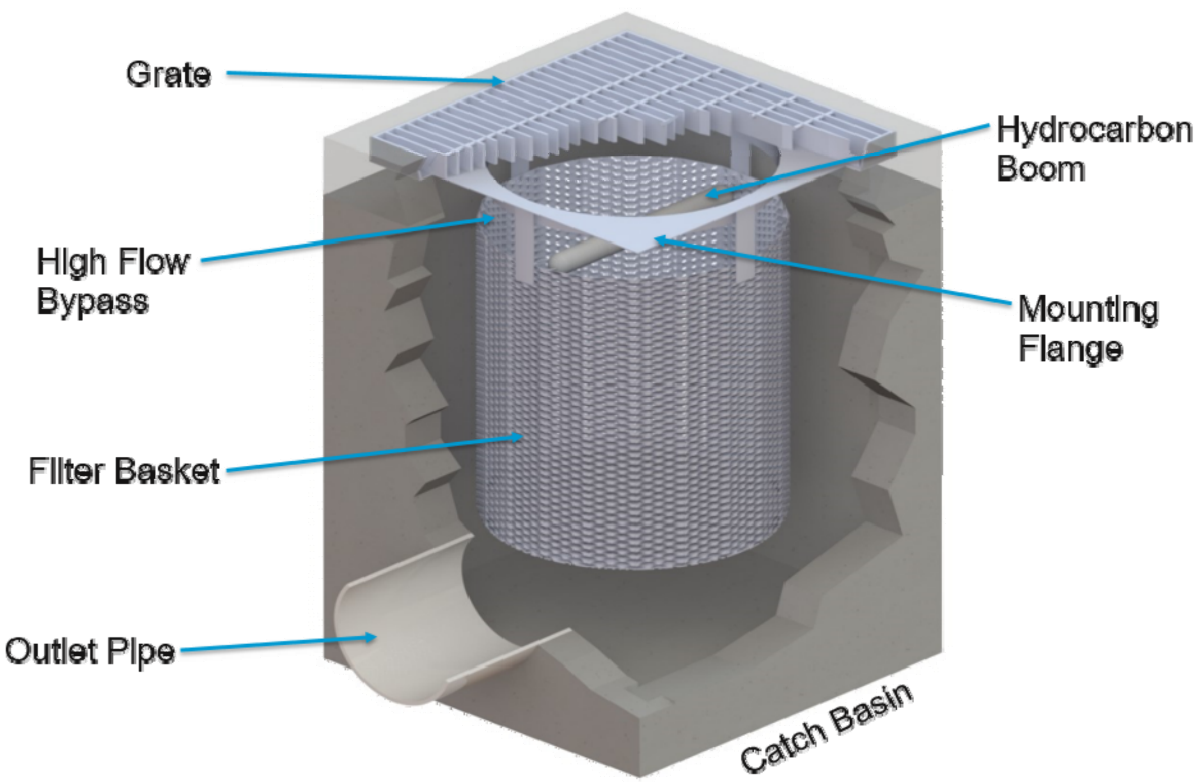
OPERATION & MAINTENANCE

The 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, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. This filter is made of 100% stainless steel and is available and various sizes and depths allowing it to fit in any grated catch basin inlet. The filters heavy duty construction allows for cleaning with any vacuum truck. The filet 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.

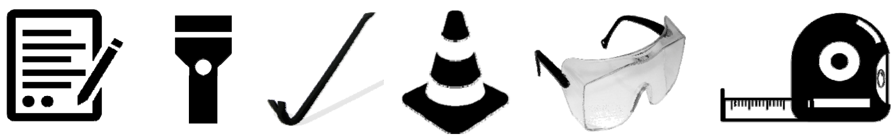


System Diagram:

Inspection Equipment

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

- Bio Clean Environmental 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.

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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:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-GRATE-12-12-12	10.00	12.00	0.27	0.55
BC-GRATE-18-18-18	16.00	18.00	1.05	2.09
BC-GRATE-24-24-24	21.00	24.00	2.41	4.81
BC-GRATE-30-30-24	27.00	24.00	3.98	7.95
BC-GRATE-36-36-24	33.00	24.00	5.94	11.88
BC-GRATE-48-48-18	44.00	18.00	7.92	15.84

Maintenance Equipment

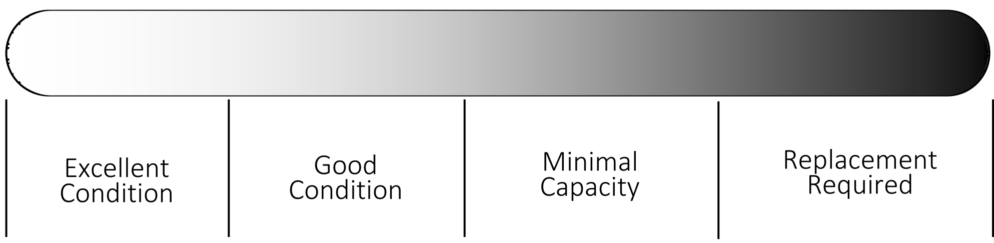
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can easily cleaned by hand:

- Bio Clean Environmental 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 of 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.
- Follow 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.

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Maintenance Sequence

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

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.

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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.

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.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

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Inspection and Maintenance Report
Catch Basin Only

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)

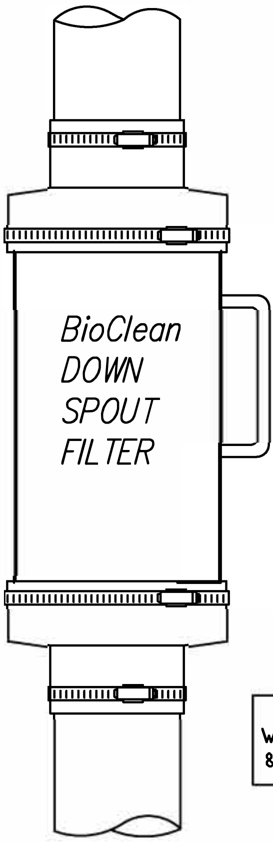
Office personnel to complete section to the left.

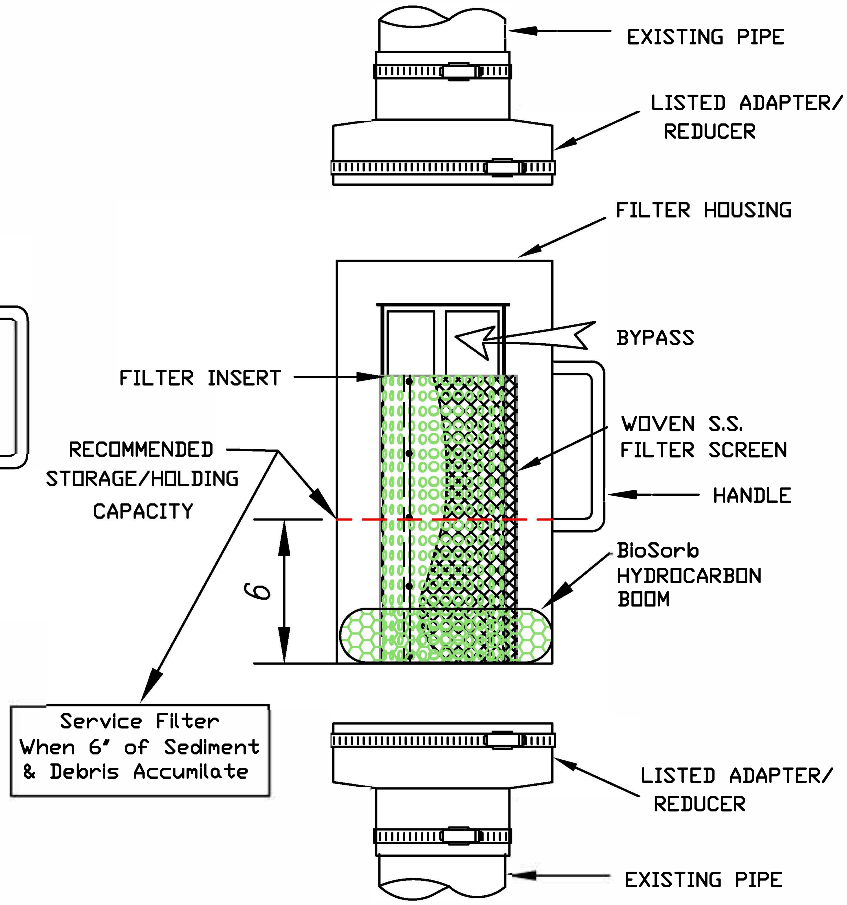
Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5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

Comments:

SERVICE MANUAL
(Cleaning Procedures)

Bio Clean DOWNSPOUT FILTER
Screen Type With Hydrocarbon Boom





TOOLS AND EQUIPMENT NEEDED:

DETAIL OF PARTS

1. Medium size flat scred driver
2. BioSorb hydrocarbon boom. 25-1/2" X 2" dia.
   (Call Bio Clean to order)
3. Trash container or bag
4. Wooden dowel approx. 3' x 1/2' dia.

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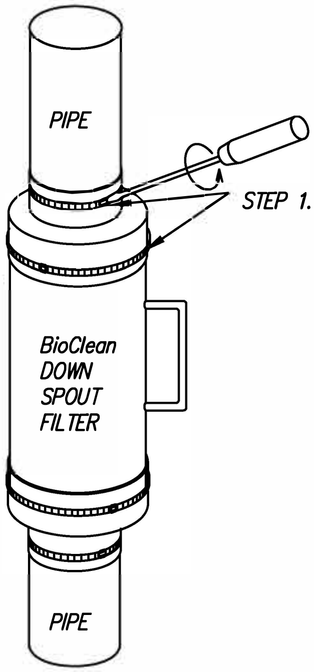
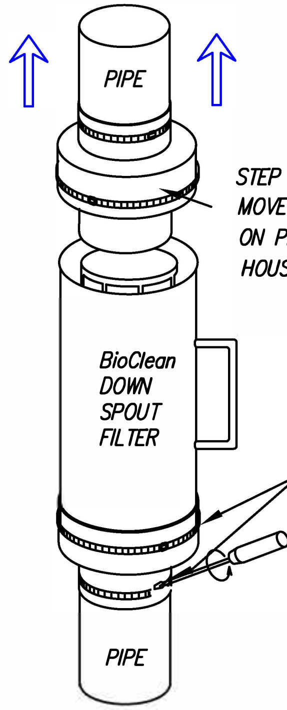
REMOVING FILTER



STEP 1. LOOSEN BOTH TOP CLAMPS WITH SCREW DRIVER.



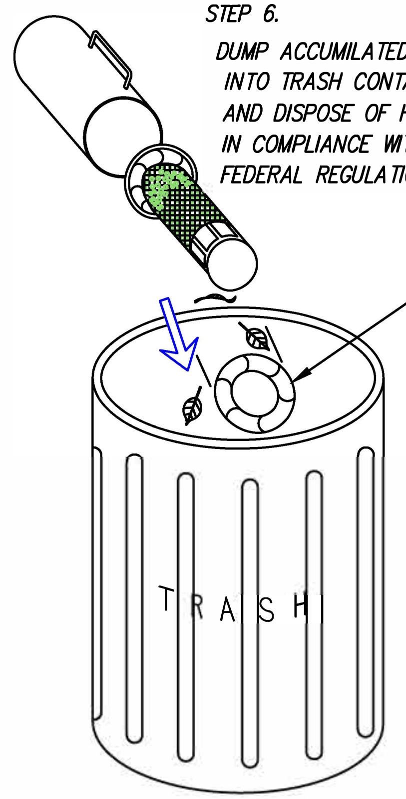
STEP 2.
MOVE LISTED ADAPTER/REDUCER UP ON PIPE UNTIL THE FILTER HOUSING IS CLEAR TO REMOVE.

STEP 3.
LOOSEN BOTH BOTTOM CLAMPS WITH SCREW DRIVER.

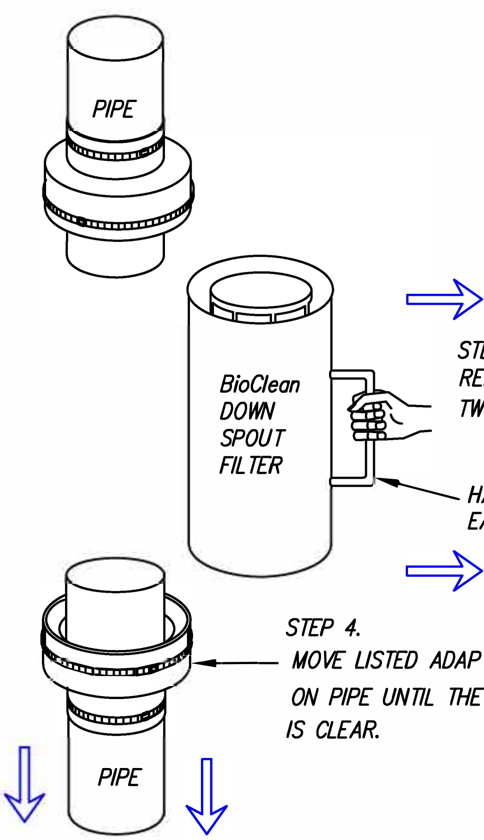
(STEP 4. AT BOTTOM LEFT OF PAGE)

CLEANING FILTER

STEP 6.
DUMP ACCUMILATED DEBRIS OUT OF FILTER INTO TRASH CONTAINER. REMOVE FILTER INSERT AND DISPOSE OF HYDROCARBON BOOM IN COMPLIANCE WITH LOCAL STATE & FEDERAL REGULATIONS.



HYDROCARBON BOOM



STEP 5.
REMOVE FILTER USING TWO HANDS.

HANDLES FOR EASY REMOVAL.

STEP 4.
MOVE LISTED ADAPTER/REDUCER DOWN ON PIPE UNTIL THE FILTER HOUSING IS CLEAR.

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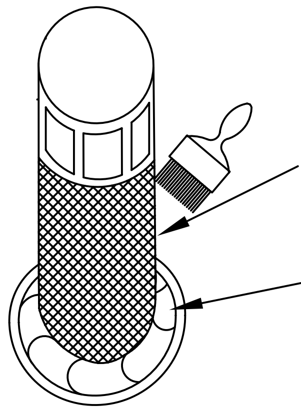
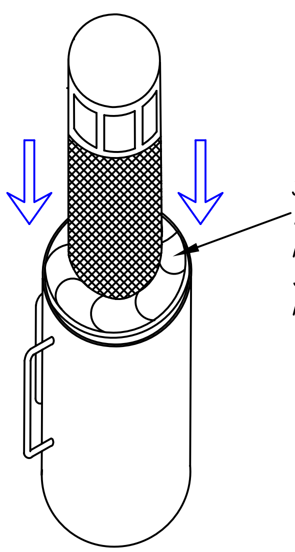


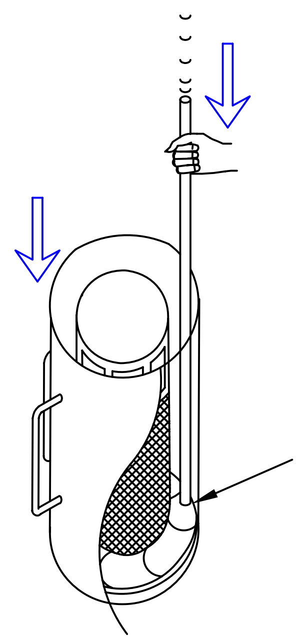
STEP 7.
BRUSH DEBRIS OFF SCREEN.

STEP 8.
INSTALL NEW BOOM AROUND
BASE OF FILTER INSERT

REPLACING FILTER INSERT



STEP 9.
POSITION FILTER INSERT
INTO HOUSING.
STUFF HYDROCARBON BOOM
INSIDE.



STEP 10.
PUSH FILTER INSERT
TO BOTTOM OF HOUSING.
AND STUFF HYDROCARBON BOOM
TO BOTTOM OF FILTER USING
DOWEL FOR ASSISTANCE.

REPLACING FILTER

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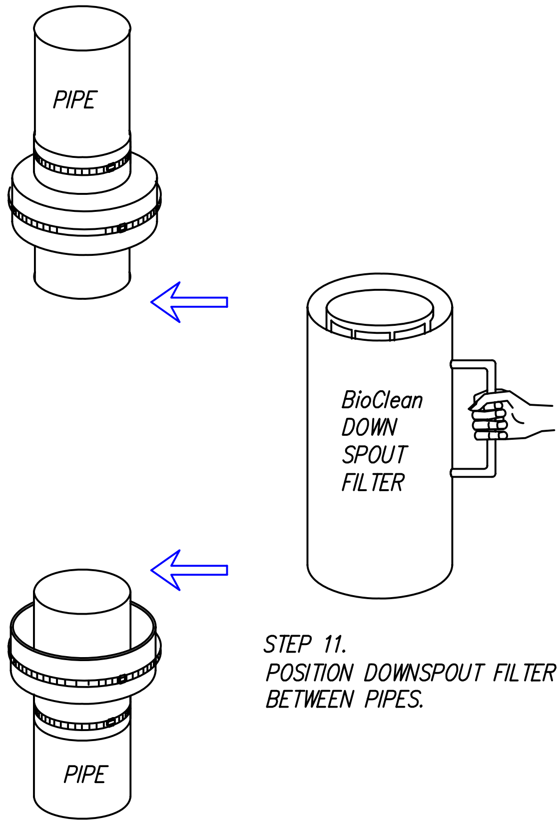
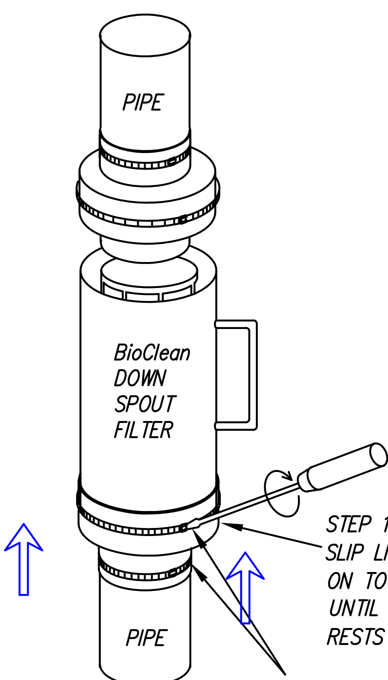
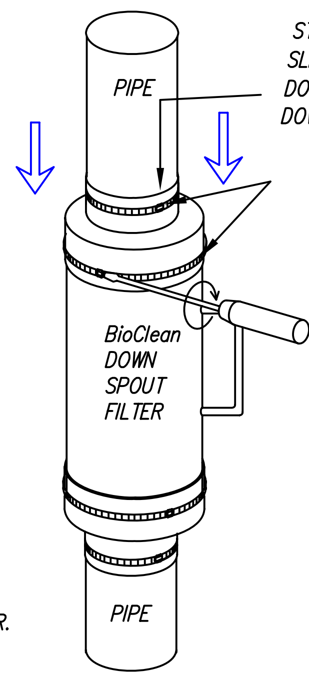


STEP 11.
POSITION DOWNSPOUT FILTER BETWEEN PIPES.



STEP 12.
SLIP LISTED ADAPTER/REDUCER UP ON TO DOWNSPOUT FILTER UNTIL BASE OF DOWNSPOUT FILTER RESTS IN BOTTOM OF ADAPTER/REDUCER.

STEP 13.
SECURE BY TIGHTENING BOTH CLAMPS.



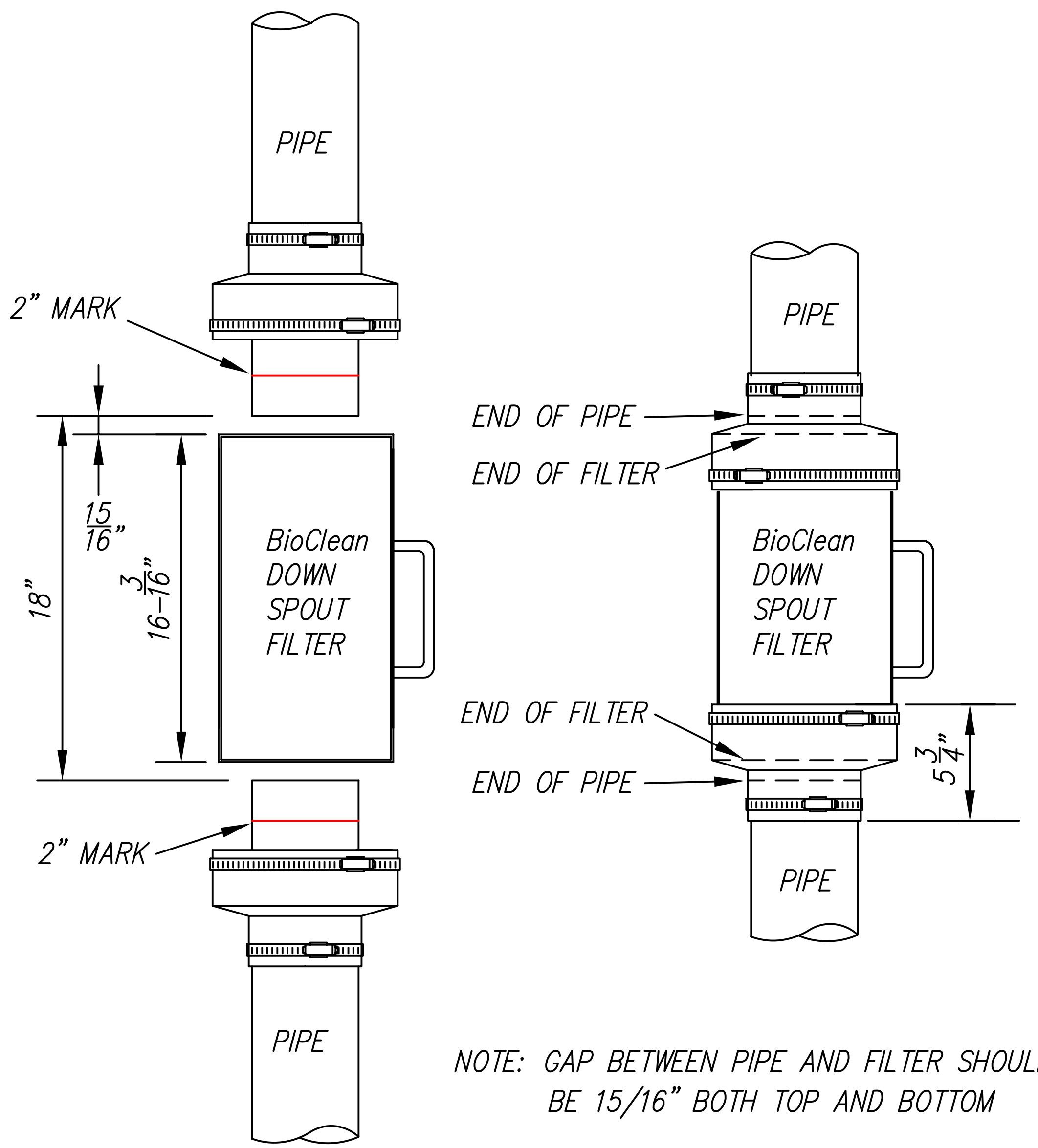
STEP 14.
SLIP LISTED ADAPTER/REDUCER DOWNWARD ON TO DOWNSPOUT FILTER.

STEP 15.
SECURE BY TIGHTENING BOTH CLAMPS WITH SCREWDRIVER.

ENSURE CLAMPS ARE PROPERLY TIGHTENED.
SERVICE COMLPLETE.

APPROPRIATE INSTALLATION

FILTER CENTERED BETWEEN PIPES WITH EVEN GAPS ON TOP AND BOTTOM



NOTE: GAP BETWEEN PIPE AND FILTER SHOULD BE 15/16" BOTH TOP AND BOTTOM

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DUAL STAGE

Hydrodynamic Separator (DSBB)

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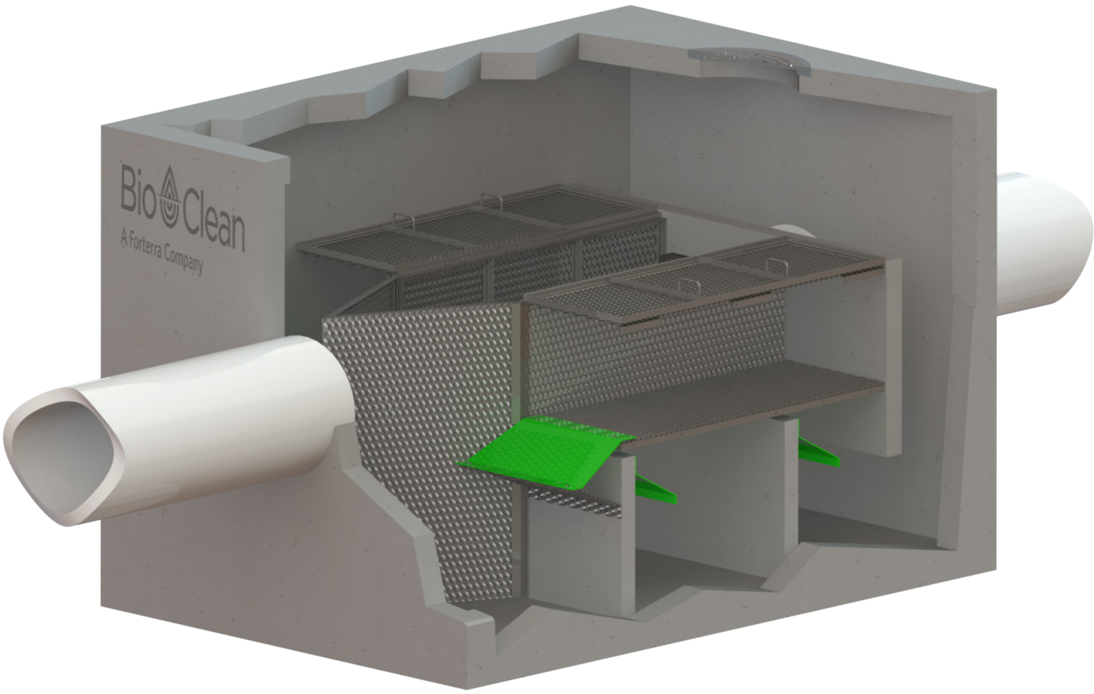
OPERATION & MAINTENANCE



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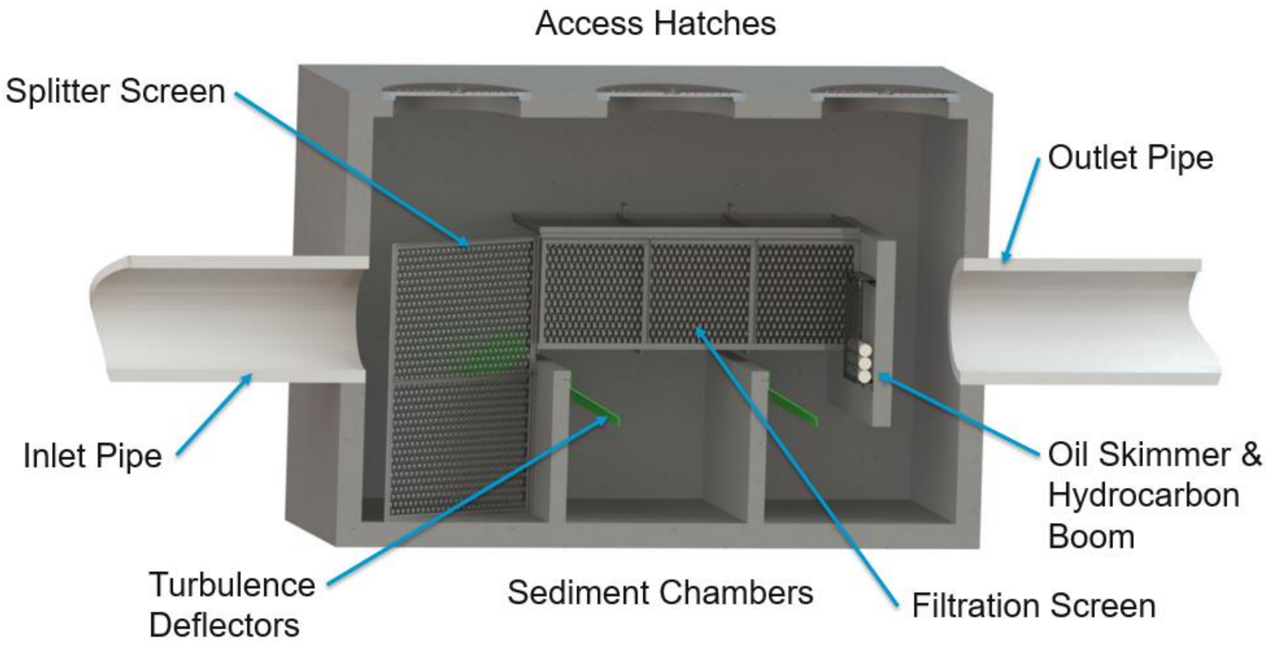
OPERATION & MAINTENANCE

The Debris Separating Baffle Box (DSBB), a stormwater dual-stage Hydrodynamic Separator is designed to remove high levels of trash, debris, sediments and hydrocarbons. The innovative screening system directs floatable trash, debris, and organics into raised filtration screens for dry state storage which prevents septic conditions, odor, nutrient leaching and allows for easy removal. The raised filtration screens are assisted by a non-clogging inlet splitting screen which directs flows to the filtration screens while maintaining high treatment flow rates. The DSBB is able to effectively capture and store sediment with no maintenance or loss of treatment capacity for several years based on annual average loading in most regions.

Yet, as with all stormwater BMPs, inspection and maintenance on the DSBB Hydrodynamic Separator 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 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:

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Inspection Equipment

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

- Bio Clean Environmental Inspection Form (contained within this manual).
- Flashlight.
- Manhole hook or appropriate tools to remove access hatches and covers.
- 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 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 DSBB 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 DSBB Separator 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 nearby pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have 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 system through the access hatches. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system.
- Look for any out of the ordinary obstructions in the inflow pipe, sediment chambers, filtration screens, splitter screen, or outflow pipe. Write down any observations on the inspection form.

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- Through observation and/or digital photographs estimate the amount of floatable debris accumulated inside the filtration screens. Record this information on the inspection form. Check both the right and left filtration screens if applicable.
- Utilizing a tape measure or measuring stick estimate the amount of sediment accumulated in each of the three sediment chambers. Record this depth on the inspection form.
- Observe the condition and color of the hydrocarbon booms and any floating oils in front of the boom cage. 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 system or its inlet or outlet.
- Excessive accumulation of floatable trash, debris and foliage in the filtration screens in which the length and width of the chambers screens is more than half full and/or flow into the screens is fully impeded by these debris. Large items blocking the entrance.
- Excessive accumulation of sediment in any of the three separation chambers is more than half-full (18” to 27” depending on the model size). See chart below:

Model	**Sediment Chamber**				**Screen Basket Dimensions**				**Hydrocarbon Boom Cage**		
	ID Length (in)	ID Width (in)	Sediment Chamber Depth (in)	Sediment Chamber Capacity at 50% Full (cu ft)	Screen Basket Quantity	Screen Basket Width (in)	Screen Basket Height (in)	Screen Basket Capacity (cu ft)	Cage Height (in)	Cage Width (in)	Booms
2.5-4	48	30	36	14.8	2	9	12	3.3	9	5	1
3-6	72	36	36	26.8	2	11	18	9.0	15	7	1
4-6	72	48	36	35.8	2	15	18	12.3	15	11	1
4-8	96	48	36	47.8	2	15	24	22.0	21	11	2
5-10	120	60	36	70.0	2	19	24	34.0	21	15	2
6-12	144	72	36	102.0	2	22	24	47.4	21	21	2
8-12	144	96	36	136.0	2	30	27	72.7	24	29	2
8-14	168	96	36	160.0	2	30	27	84.4	24	29	2
10-14	168	120	36	200.0	2	38	27	106.9	24	37	2
11-16	192	132	45	309.4	2	40	33	160.4	30	45	3
11-24	288	132	54	569.3	2	40	36	263.3	33	45	3
11-34	408	132	54	816.8	2	40	36	373.3	33	45	3

Maintenance Equipment

It is recommended that a vacuum truck be utilized to minimize the time required to maintain the DSBB Separator:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Flashlight.
- Manhole hook or appropriate tools to 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 maintenance of the system. Exception is deeper units entry may be required to open filtration screen lids and replace hydrocarbon booms.
- Vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down from any associated upstream detention systems. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Debris captured in the filtration screens requires time to dry out which decreases time to remove and associated weight. Cleaning of the filtration screens and sediment chambers can be performed from finish surface without entry into the vault utilizing a vacuum truck on most installations. Depth and configuration of the installation may create conditions which would require entry for some or all of the maintenance procedures. Configuration and size of access hatches also effects the conditions in which entry may be required. Once all safety measures have been set up cleaning of the filtration screens, hydrocarbon boom(s) and/or sediment chambers can proceed as followed:

- Remove all access hatches (requires traffic control and safety measures to be completed prior).
- Locate the right and left filtration screens. Manhole or hatch access will be provided to each of these screens. As highlighted below. Depending on the configuration of the DSBB the filtration screens may or may not have hinged lids depending on factors such as online or offline bypass, water level at peak flow, back flow conditions amongst other site-specific variables. Units that have lids are designed with hinges and locking mechanisms along the sidewall of the structure that can be unlocked by finish surface with an extension rod. The length of this rod is limited and for deeper installs entry may be required to unlock and open the lids.

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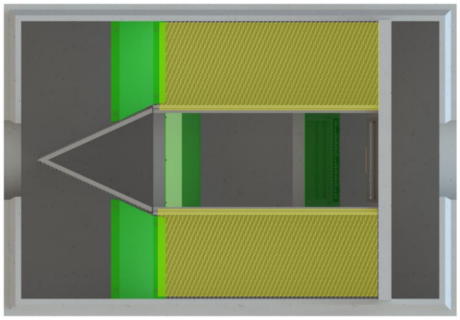
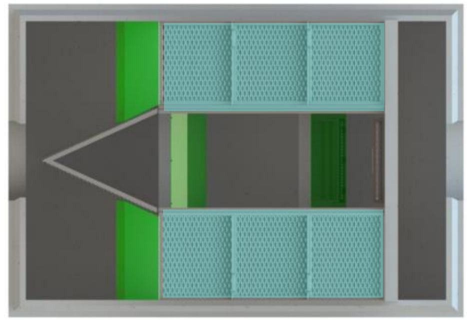
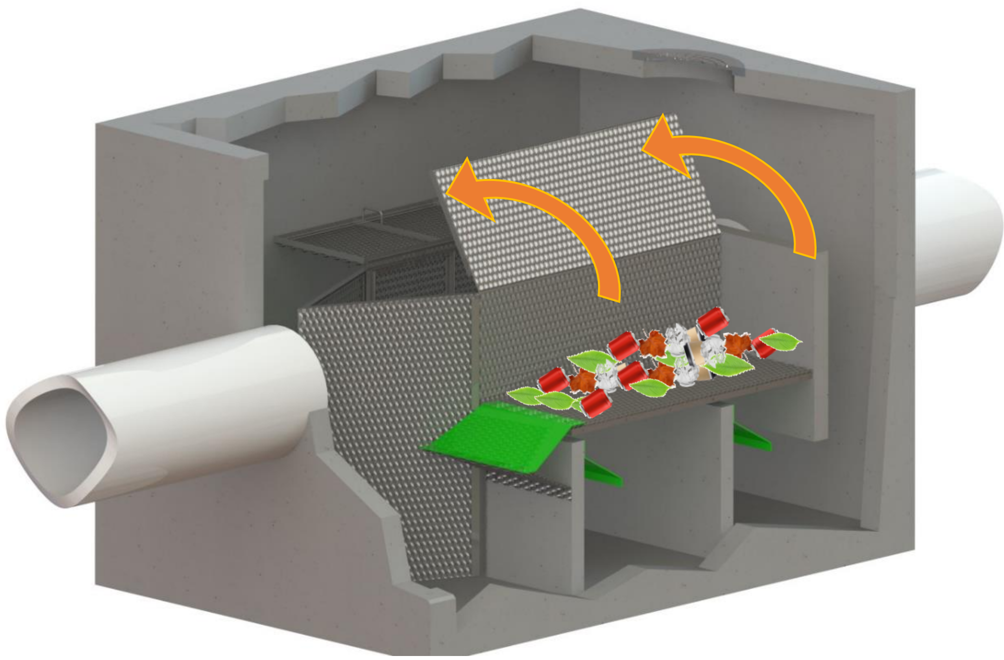


Top view into DSBB. Filtration screens highlighted in yellow without hinged lids.



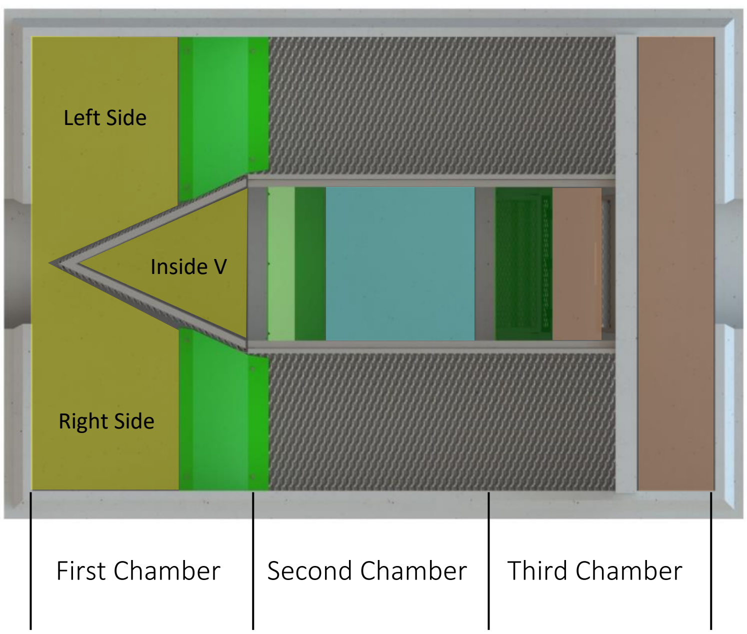
Top view into DSBB. Filtration screens highlighted in turquoise with hinged lids.



Isometric view into the DSBB illustrating the hinged lids of the filtration screens. Lids can hinge up and toward the center up to 180 degrees from closed & locked position for easy access for cleaning and removal of debris.

- Once filtration screens lids are opened (if applicable) the vacuum hose extension is inserted down into the screens for removal of debris. The width of the screen of the smallest model is 9” therefore allowing an standard 8” vacuum hose to be used for all models and sizes. All debris should be removed with the vacuum hose and the pressure washer should be used to spray down and remove all debris on the bottom, side and top screens. Ensure all holes within in the screen are cleared of debris. This is critical to restoring the full hydraulic capacity of the filtration screens. Once completed close and lock lids (if applicable).

- Using an extension on a vacuum truck position the hose over the opened access hatch or hatches leading to the first sediment chamber adjacent to the pipe inlet and includes the splitter screen. Lower vacuum hose into the sediment chamber on the left and right side of the splitter screen. This is where a majority of the larger sediments and heavy debris will accumulate. Remove all floating debris, standing water and sediment from this sediment chamber. Vertical access to the bottom of the sediment chamber is unimpeded. The vac hose can be moved from side-to-side to fully remove sediments at the corners. A power washer can be used to assist if sediments have become hardened and stuck to the walls or the floor of the chamber. The power washer should also be used to spray the splitter screen clean of any accumulated debris. The vacuum hose can also be inserted on the outlet side of the splitter screen (inside the V) to remove any remaining accumulated sediment.



Top view into DSBB illustrating the three sediment chambers.

- The **yellow** highlighted areas show where the vacuum hose should be inserted for cleaning of the **first** sediment chamber.
- The **turquoise** highlighted area show where the vacuum hose should be inserted for cleaning of the **second** sediment chamber.
- The **orange** highlighted areas shows where the vacuum hose is inserted for cleaning of the **third** sediment chamber.

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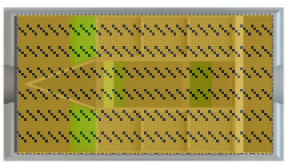
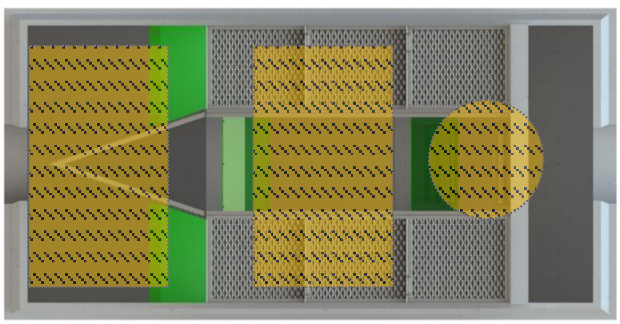
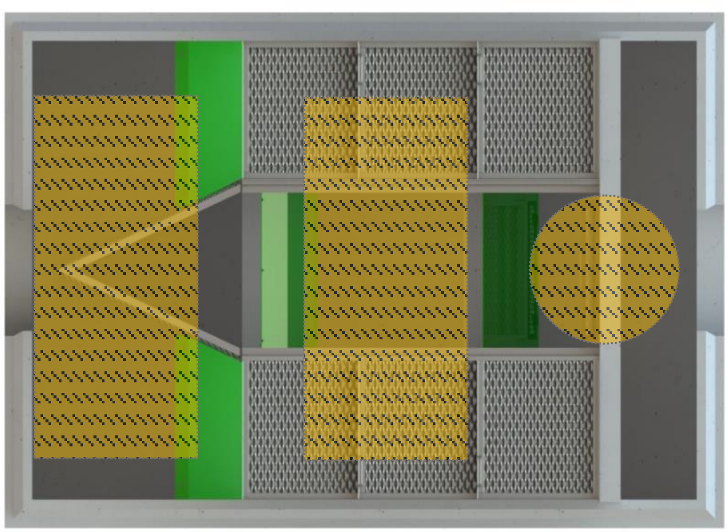
- Repeat the same procedure in the second and third sediment chambers in the locations shown in the above diagrams. Access to these two chambers is in the center of the system unlike the first sediment chamber. The filtration screens cover the sediment chamber along the sides, yet allow for unimpeded access in the middle without requirement to open filtration chamber tops or go through the filtration screens (hinged floor) as found with other baffle box systems. Hatch or manhole size, quantity and location vary based on model size and site specific project constraints. Various access hatch sizes and configurations are available to meet individual project requirements. Larger hatches, open assisted hatches and/or taller ID dimensions to increase headroom are available by request. Below are a few examples of various models and optimal hatch configurations.



A DSBB-2.5-4 is offered with a 2.5-4 access hatch in either parkway, direct or indirect traffic rating. This provides full access. Bolt and pull, hinged or hinged with lift-assisted options offered. *Figures not to scale.*

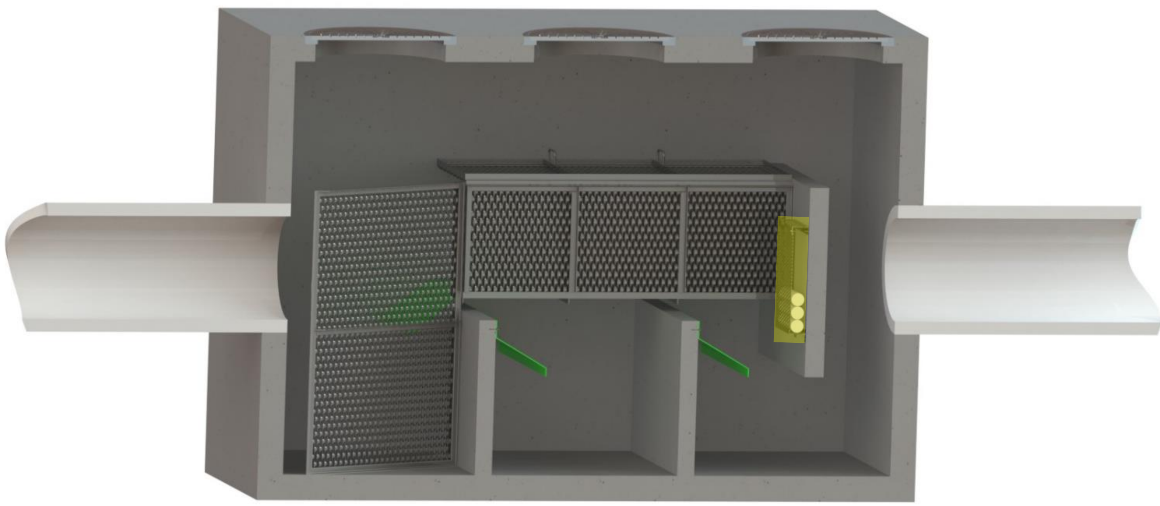


A DSBB-5-10 is offered with two 2.5-4 access hatches in either parkway, direct or indirect traffic rating along with a single 24" diameter manhole for access to the third sediment chamber and hydrocarbon booms. Bolt and pull, hinged or hinged with lift assisted options offered. *Figures not to scale.*

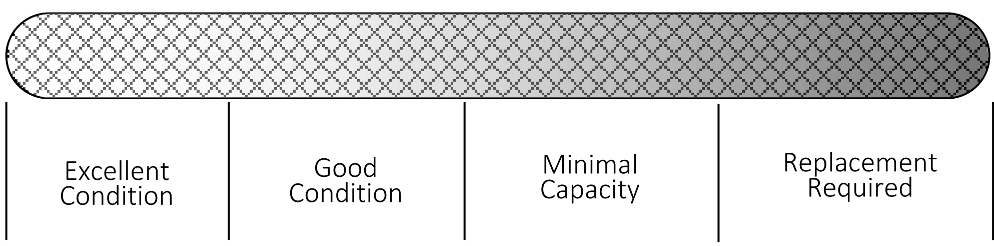


A DSBB-8-12 is offered with two 3-6 access hatches in either parkway, direct or indirect traffic rating along with a single 30" diameter manhole for access to the third sediment chamber and hydrocarbon booms. Bolt and pull, hinged or hinged with lift-assisted options offered. *Figures not to scale.*

- Based on the color of the hydrocarbon booms replacement may be necessary. The booms are housed inside the boom cage which is attached to the influent side of the oil skimmer wall. The cage has a hinged top which is opened allowing access to the hydrocarbon booms. Once old booms are removed new booms can be dropped in and the top closed. See below image.



- Follow is a replacement indication color chart for the hydrocarbon booms:



- **NOTE:** Filtration screens can be cleaned before or after cleaning and removal of sediment for the sediment chambers. Cleaning them before is preferred before removing sediment and standing water from the second and third chamber as debris and water will be deposited on the sediment chamber floors in the process of cleaning the filtration screens over the second and third chamber. Cleaning the first sediment chamber before the filtration screens allows the splitter screen to be fully exposed. Thus the pressure washing of all screens (splitter and filtration) can be done as the same time if needed.
- The last step is to close up and replace all access hatches and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.

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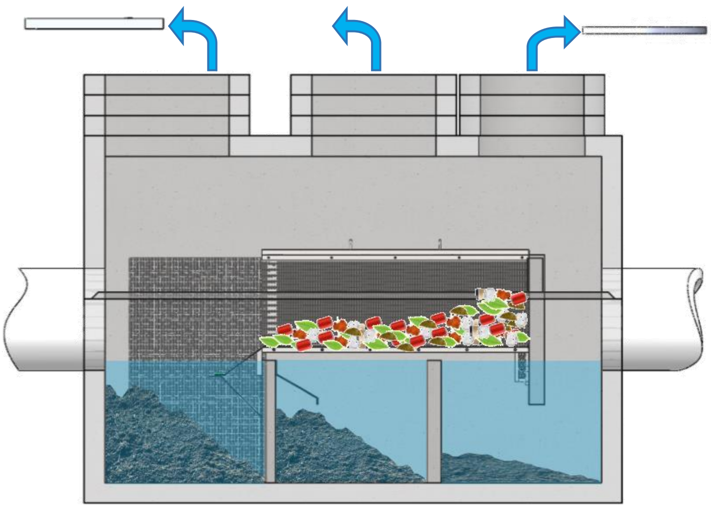
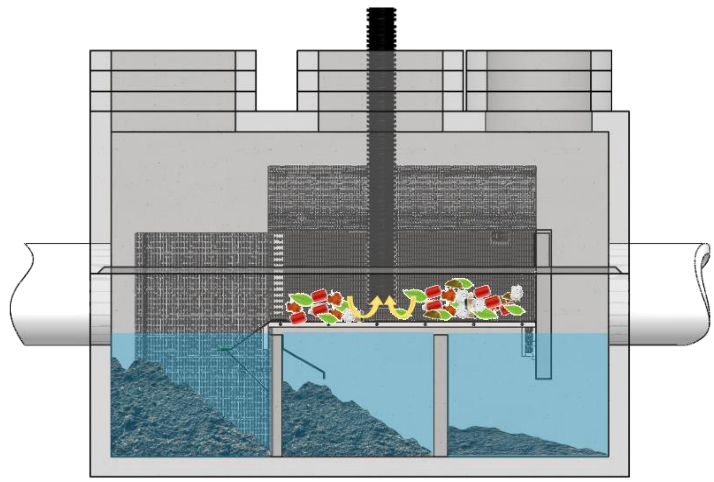
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer.

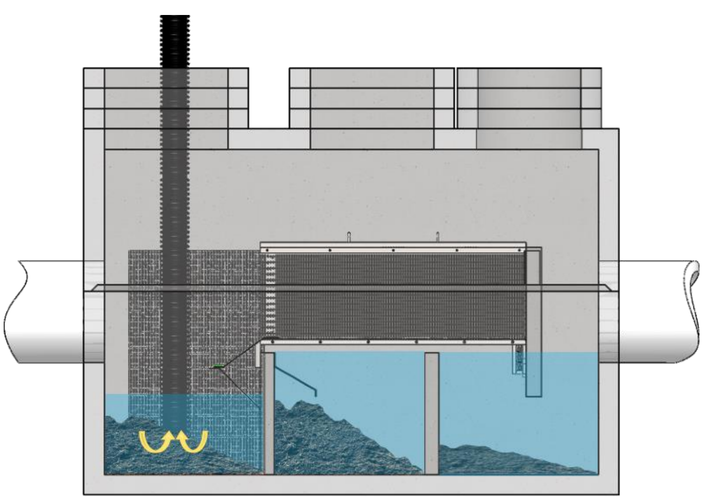
Maintenance Sequence



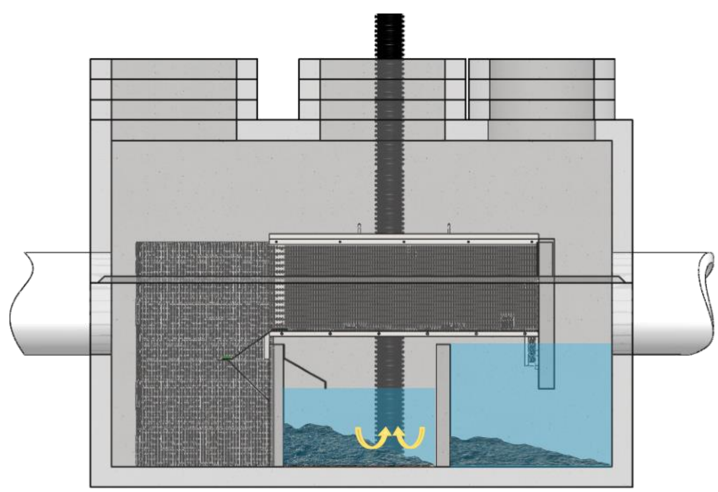
Remove access hatches set up vacuum truck to clean the filtration screens and sediment chamber. Locate positions of filtration screens and first, second and third sediment chambers plus the hydrocarbon boom cage.



Unlock and open filtration screen lids (if applicable, some units will not have lids). Insert vacuum hose into the first filtration screen and clean out trash & debris. Use a pressure washer to remove any debris stuck on the screens.



Insert vacuum hose in the first sediment chamber to remove sediment and debris. The vacuum hose will need to be inserted on the right and left side of the splitter screen to remove all sediment. Once completed use a pressure washer to clean off the splitter screen.



Repeat the above steps for cleaning the second sediment chamber. Compacted sediment can be loosened using a pressure washer.

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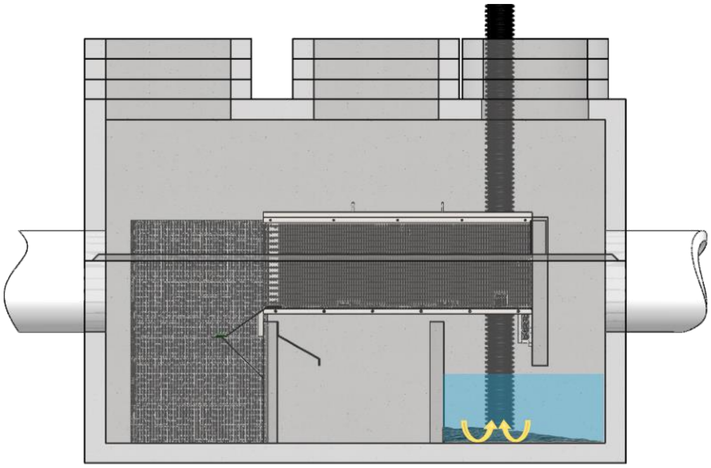
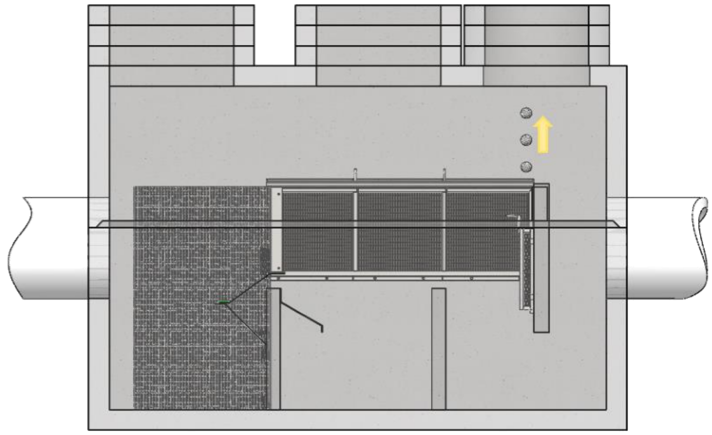
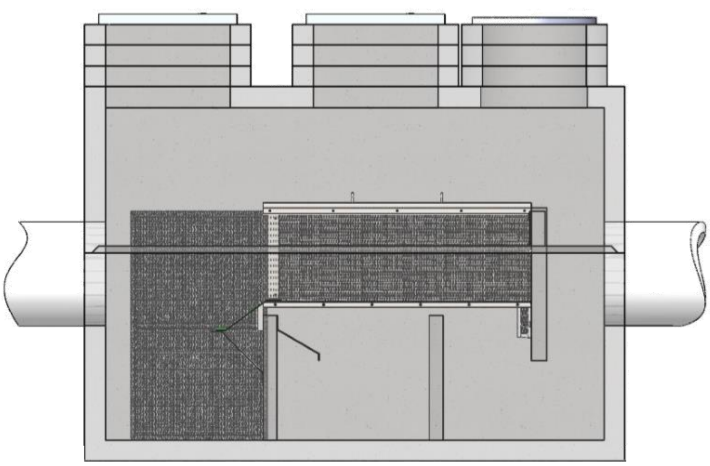


Repeat the above steps for cleaning the third sediment chamber. Compacted sediment can be loosened using a pressure washer.



Once the unit is fully cleaned check the condition of the hydrocarbon booms in the boom cage hanging on the oil skimmer wall. Use color indicator in this manual to decide if replacement is required. If required open boom cage and replace booms.



Once cleaning and maintenance is complete ensure boom cage lid and filtration screen lids are closed and locked. Replace all manhole covers and or access hatches and remove traffic control.

For Maintenance Services or Information Please Contact Us At:
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Or Email: info@biocleanenvironmental.com

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Inspection and Maintenance Report
Bio Clean Debris Separating Baffle Box

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 Vault	Model #	Debris, Trash and Foliage Accumilation Inside Filtration Screens (lbs)	Sediment Accumulation In Sediment Chambers (lbs) & Depth (inches)	Structural Notes	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:					
	Lat: Long:					
	Lat: Long:					

Comments:

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
Source:
http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

☐ Consult proprietors for specific criteria concerning the design and performance.

☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.

☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. Many propretary biotreatment BMPs will not be able to meet the definition of “biofiltration” that applies in South Orange County. See Section III.7 and Worksheet SOC-1.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

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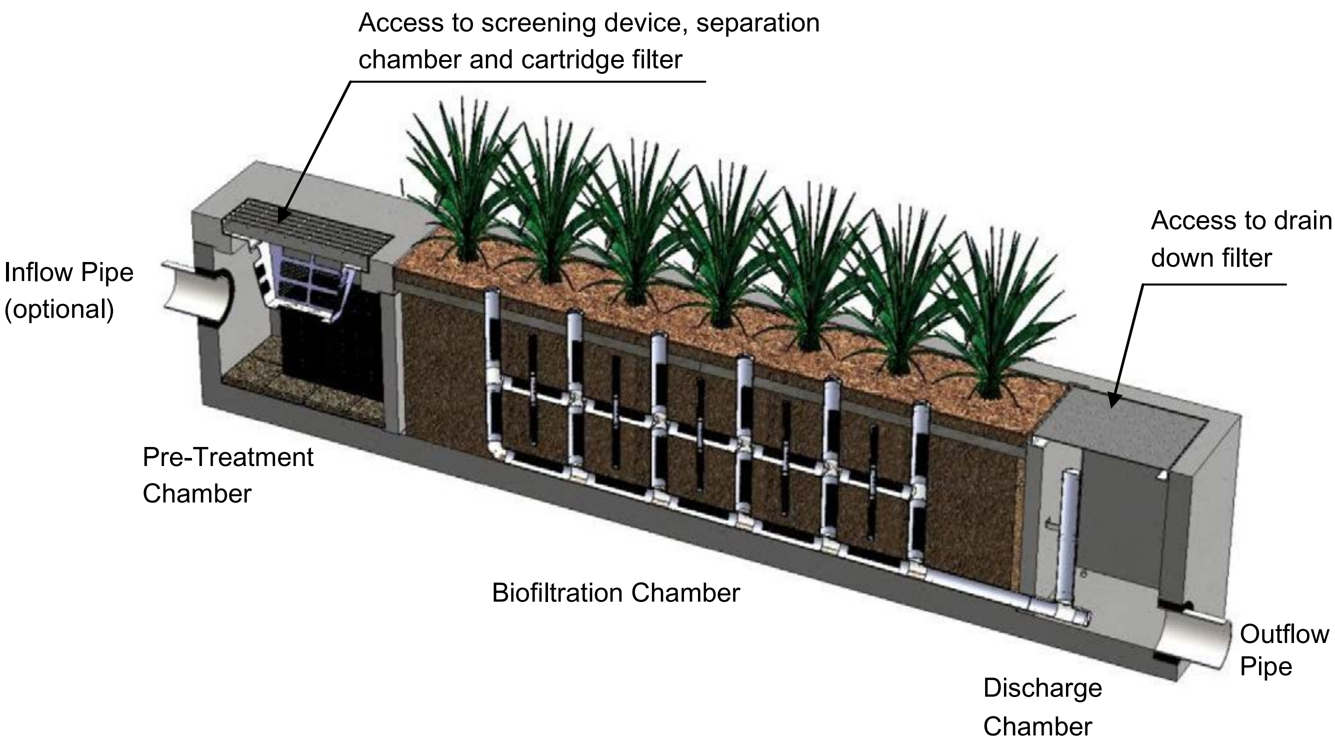
Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



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Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

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Maintenance 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 Chamber.

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 require irrigation.

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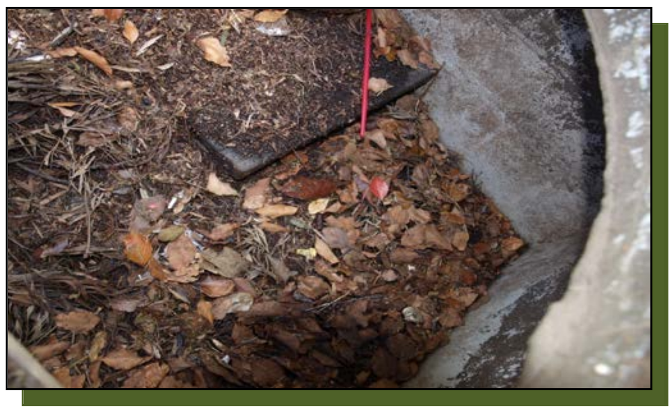
Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

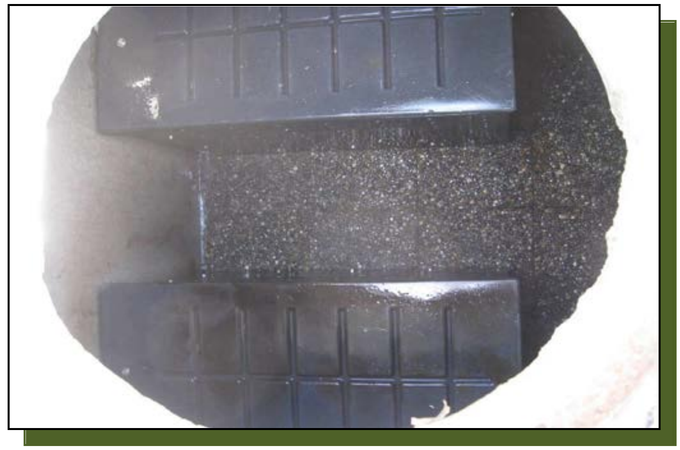
Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.



Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Bio Clean
A Forterra Company

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Bio Clean
P. 855-566-3938
F. 760-433-3176
E. Info@BioCleanEnvironmental.com

Bio Clean
A Forterra Company

Inspection Report
Modular Wetlands System

Project Name ________	For Office Use Only
Project Address ________ (city) (Zip Code)	(Reviewed By)
Owner / Management Company ________	(Date) Office personnel to complete section to the left.

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 ________

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): ________ Size (22', 14' or etc.): ________

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: ________

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A Forterra Company

Maintenance Report

Bio Clean
P. 855-566-3938
F. 760-433-3176
E. Info@BioCleanEnvironmental.com

Bio Clean
A Forterra Company

Cleaning and Maintenance Report
Modular Wetlands 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:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

PSI Pacific Southwest Industries

ENGINEERED - PUMPS/FLUID HANDLING & DISPOSAL SYSTEMS - PACKAGED LIFT STATIONS

LIFT STATION REQUIRED MAINTENANCE

The lift station should be inspected twice a year for proper operation, and should be checked for overabundance of solid matter such as grease and soap buildup.

Proper operation and inspection would include the following:

1) Automatic operation of the system by float activation. One pump starting at lead on levels, second pump starting at high level conditions; manual operation by use of the selector switches.

2) Inspect floats for proper elevation and for proper movement. Correct any obstructions.

3) Check incoming power for proper voltage. Check voltage at motor connections.

4) Check amperage of each motor.

5) Hose down lift station to clean the walls of the wet well, pumps and floats.

MECHANICAL SEAL INSPECTION OF PUMPS

Inspection of the mechanical seals should be done every two years.

The inspection will include the following:

Pull pump out of wet well. Remove oil seal plug and inspect the oil for clarity. Clear oil indicates no water intrusion and chamber is to be topped off with 30 weight turbine oil. If oil is cloudy the mechanical seal and oil needs to be replaced.

PSI recommends that preventive maintenance and service be performed by a qualified technician.

Any question regarding your lift station should be directed to Scott Richardson at 800-358-9095.

P O Box 520 Lake Elsinore, CA 92531 – 18541 Collier Ave., Lake Elsinore, CA 92530
(800) 358-9095 (909) 674-2144 fax (909) 674-9444 CSL #583052
www.psipumps.com Email: info@psipumps.com

ATTACHMENT F
CONDITIONS OF APPROVAL

CITY OF SANTA ANA

Planning and Building Agency
20 Civic Center Plaza ● P.O. Box 1988
Santa Ana, California 92702
www.santa-ana.org

September 30, 2020

PDC OC/IE LLC
Mr. Michael Sizemore
2442 Dupont Drive
Irvine, CA 92612

Subject: Amazon Distribution Building, 625 N. Grand Avenue, DP No. 2020-20 (Master ID No. 2020-160426), ER No. 2020-57, (plans dated 9/22/20)

Dear Mr. Sizemore:

Thank you for your re-submittal for the proposed construction of a new 112,485 square foot warehouse distribution building and delivery station at 625 North Grand Avenue. Your project has met the requirements and conditions of the City's Development Review Committee (DRC) to complete the Development Project Review process and the site plan is approved.

The next step in pursuing your project is to apply for a Building permit. Included in this letter is a detailed list of requirements and/or conditions to apply for a building permit, for issuance of a building permit and issuance of a certificate of occupancy.

Your project approval may include certain fees, dedication requirements, and other exactions. Pursuant to Government Code Section 66020(d), this letter constitutes written notice of the amount of the fees, a description of the dedications, reservations, and other exactions. As a result, the 90-day protest period has commenced from the date of this letter. If you fail to file a protest regarding the fees, dedications, or reservation requirements or other exactions within the protest period, you will be legally barred from challenging the exactions.

Please keep in mind that Development Project Review is valid for one year. Any submittal after the one year time period, or the submittal of a different project at any time, will require the payment of new fees. Feel free to contact me if you have any questions. I can be reached by email at SKelaher@santa-ana.org or by phone at (714) 667-2740.

Sincerely,

Selena Kelaher, AICP
Associate Planner

Enclosures

SK:
M:\Development Projects\DP 2020-20_625 N. Grand Ave_Amazon\2nd Submittal\625 N. Ave - Amazon DRC Letter 9.30.20.docx

Project Overview

Michael Sizemore, representing PDC OC/IE LLC, is proposing demolition an existing approximately 120,000 square foot building to construct of a new 112,485 square foot warehouse distribution building and delivery station at 625 North Grand Avenue. The project proposes construction of one-story 112,485 square foot industrial building with surface parking lots containing 223 vehicular parking spaces, 453 delivery van parking spaces and 26 semi-truck parking spaces on approximately 16 acres. The property is located in the Specific Development No. 21 (SD-21) zoning district, and has a General Plan land use designation of General Commercial (GC).

I. Prior to submittal into Building plan check, complete the following items:

A) Planning Division

1. An at-risk plan check form needs to be submitted if the Defense and Indemnification Agreement has not been executed.

2. A landscape plan, including irrigation, is to be submitted for review and approval. The landscape plan shall conform to the commercial landscape standards, Citywide Design Guidelines and the Water Efficient Landscape ordinance. The plan should include a variety of trees including a specimen tree (60-inchbox minimum), shrubs and hardscape in a decorative design for the approximately 50-foot by 100-foot landscape area along Grand Avenue. The inclusion of public art in the form of a sculpture or water feature is highly encouraged. Collaboration with a local artist or an art piece that is emblematic of the City of Santa Ana is also encouraged.

3. The proposed eight foot wall adjacent to the single-family homes (blue dashed line) shall be split face CMU.

B) Building & Safety Division

1. Project shall comply with the current state building codes adopted by the City of Santa Ana at the time of permit application submittal. Currently they are the 2019 California Building Code (CBC), 2019 California Residential Code (CRC), 2019 California Mechanical Code, 2019 California Plumbing Code, 2019 California Electrical Code, 2019 California Energy Code, 2019 California Green Standards Code (CALGreen) and the Santa Ana Municipal Code (SAMC). Compliance to all applicable state and local codes shall be required prior to issuance of building permits.

2. The Building Safety Division should be consulted for plan check design and submittal requirements. Electrical, plumbing, mechanical, fire sprinkler systems, and grading work requires separate plans, applications, fees and permits. Compliance shall be made with the California Code of Regulations, Title 24, Part 6 requirements for energy conservation. For submittal requirements, please call (714) 647-5800 and ask for a Permit Technician. Appointments can be made between 8 a.m. and 12 noon to submit plans.

3. A separate grading permit shall be required for this project. The project applicant should contact the Public Works Agency at (714) 647-5039 for grading plan submittal and processing requirements.

4. A geotechnical report shall be required for this project. The report must address the potential for seismically induced soil liquefaction and soil instability.

C) Police Department

1. Submitted plans must indicate that all structures and parking lots comply with the provisions of Chapter 8, Article II, Division 3 of the Santa Ana Municipal Code (Building Security Ordinance). All applicable sections must be printed verbatim on your submitted set of plans. See Exhibit A.

2. The assigned DP number from Site Plan Review (DP No. 2020-20) must be located on the cover sheet of all plans submitted into plan check. This is in addition to your permit number.

3. Submit a full set of electrical plans to the Police Department; at the time you submit your architectural plans. This is to verify exterior door lighting placement and parking lot illumination levels.

4. Photometric foot-candle calculations (three sets) of all parking lots, stairwells, and all interior and exterior walkways must be submitted to the police department and included in your architectural plans. This is prior to pulling electrical permits. Photometric calculations must be superimposed on a scaled site plan of the project. White light source must originate from overhead; no bollard lighting allowed to achieve minimum maintained 1 fc at ground level on parking surface.

II. Prior to issuance of a building permit, complete the following:

A) Planning Division

1. Conduct outreach with the Saddleback View neighborhood and single-family homes immediately adjacent to the east and south property lines. Outreach should include but is not limited to an overview of the project, anticipated construction schedule and a point of contact (name, phone number, email) during construction, and a point of contact (name, phone number, email) for daily warehouse and distribution operations (once operational). Please contact your case planner to coordinate a meeting.

2. The Defense and Indemnification Agreement shall be executed.

3. A landscape plan, including irrigation, must be approved. The landscape plan shall conform to the commercial landscape standards, Citywide Design Guidelines and the Water Efficient Landscape ordinance.

B) Building and Safety Division and Orange County Fire Authority

1. The applicant proposes to obtain a no-build and access easement from the adjacent property located west of the proposed project site. This easement is required to achieve the minimum 60 feet open yard, measured from the edge of the canopy roof located on the western side of the new building, in accordance with the 2019 California Building Code, Section 507 for the unlimited building area requirement. The no-build and access easement area is an open space unobstructed from the ground to the sky.

   The following conditions are required prior to building permit issuance:
   (A) Obtain approval of alternate material and methods application from Building Safety Division;
   (B) Obtain approval of alternate material and methods application from Orange County Fire Authority; and
   (C) Recordation of the City approved no-build and access easement with the following minimum provisions:

   1) Statement of purpose for easement: No-build and access easement to provide clear and unobstructed 60 feet minimum open yard for the new proposed building and canopy at 625 N. Grand Avenue, as required by the 2019 California Building Code, Section 507 for Unlimited Area Buildings.

   2) Maintenance of easement: Provision for area to remain in good condition and repair and to support the imposed loads of fire apparatus.

   3) City release requirement: "This easement shall continue in effect until released by the authority of the Building Official of the City of Santa Ana upon submittal of request, applicable fees, and evidence that this easement is no longer required by law."

III. <u>Prior to release of utilities or certificate of occupancy, address the following items:</u>

A) Planning Division

1. The applicant shall contact the case planner to set up a final field inspection appointment. A three-day notice is required. The project must be completed before final approval can be given. The case planner must sign the building permit field card before the Building Division will finalize any project.

MEMORANDUM

To: Selena Kelaher
Planning & Building Agency

Date: August 31, 2020

Nasser Rizk
From: Public Works Agency

NPDES PRIORITY PROJECT

Subject: **DP #2020-20 AT 625 GRAND AVENUE; AP #398-061-36, 37, 38, 39, 40, 41 & 398-111-31, 32 & 398-391-18, 29, 30**

PURPOSE: THE APPLICANT IS PROPOSING TO DEMOLISH AN EXISTING APPROXIMATELY 120,000 SF BUILDING AND TO CONSTRUCT A NEW 112,485 SQUARE FOOT BUILDING WITH NEW SURFACE LEVEL PARKING.

PROJECT: AMAZON DISTRIBUTION

The Public Works Agency has reviewed the proposed project. To ensure that the requirements of the Santa Ana Municipal Code are met, the developer must obtain approvals from the Public Works Agency at four different phases of the development process – **A) Prior to Site Plan Approval; B) Prior to Submittal into Building plan check; C) Prior to Issuance of a Building Permit; and D) Prior to release of utilities or a certificate of occupancy.** The details of all approvals are as follows:

A. <u>Prior to site plan approval, complete the following:</u>

1. If applicable and requested herein as a requirement for Site Plan Approval, submit Public Works Agency (PWA) requested documents, including WQMP, preliminary grading plan, drainage study, and hydrological study directly to PWA Development Engineering. Pay all related plan checking deposits for such documents at the Public Works counter at the time of submittal.

2. Revise the site plan to depict and dimension all existing topography, within the public right-of-way, along the property frontage (i.e., trees, driveway approach, street signs, street lights, etc.).

3. Separate the site plan into: one grading plan & WQMP, one on-site & off-site utility plan, and one street improvement plan.

4. If subdivision is proposed, submit a Tentative Map. On the tentative map, address the requirements of Article V, Sec. 34-122 “Data to be shown” and depict and note the following requirements on the tentative map as well as the site plan. A copy of Article V, Sec. 34-122 is attached for your convenience. (see Exhibit A).

If there is no subdivision is proposed in this project, add a note on the site plan to read **"No subdivision is proposed as part of this project."**

5. Revise the site plan to note the conversion of all existing overhead utility lines and power poles along the property frontages Street to underground facilities. (Santa Ana Municipal Code, Section 34-82).

6. Revise the site plan to depict and note the approximate location for all existing and new wet and dry utilities (i.e. electric, gas, water, fire, sewer).

7. Revise the site plan to depict and note the installation of all public utilities required to service the project site (i.e., sewer, water, and storm drain).

8. Revise the site plan to depict and note the locations and sizes of the water, sewer, and storm drain mains on all streets surrounding the project frontages.

9. Revise the site plan to depict and note the construction of a Grease Interceptor, if the proposed project is to include a food service establishment. If no food service establishment is proposed at this time, add a note on the plans to read, "NO FOOD SERVICE ESTABLISHMENT IS BEING PROPOSED. IF A FOOD ESTABLISHMENT IS PROPOSED IN THE FUTURE, IT MUST COMPLY WITH THE CITY'S ORDINANCE NO. NS 26-70".

   NOTE: All new food service establishments shall comply with the City's Ordinance No. NS-26-70, for Fat, Oil, and Grease (FOG) control program, and its subsequent requirement for construction of a gravity grease interceptor. Developer shall contact City's Planning and Building Department to incorporate design of the required grease interceptor of adequate size, into the project's plumbing plans, and to determine an appropriate location for it within the project site

10. Revise the site plan to depict a 15' x 15' sight distance triangle area at the vehicular site access locations (See Exhibit B).

11. Revise the site plan to depict the proposed southernmost driveway to be designed, per City Standard 1112, (W= 28', A= 38' min., X=4'). The driveways must be located a minimum of 10' away from any utility facility, such as power poles, streetlights, catch basins, etc. All driveways must allow for two way traffic, no one way driveway is allowed.

12. Revise the site plan to depict and note the relocation of any and all utility to be 10' minimum away from the driveways top of the "X".

13. Revise the site plan to depict any proposed gates on driveways. Proposed gates to be set back at least 60 feet from the property line to accommodate entering vehicles waiting to open the proposed gate. Also, provide space for a 3-point turn east of any proposed gate (No backing into the street is allowed). If no gates are proposed, add note on the plans to read "No gates are proposed in this project. Any proposed gate will be subject to additional review and comments".

14. Add the following note on the tentative map under the title heading of "PROPOSED IMPROVEMENTS": "All improvement as shown hereon to be constructed and installed by the developer, and/or the developer expense in accordance with the City design standards and specifications, the Santa Ana Municipal Code, approved street improvement plans and the requirements of the State Subdivision Map Act.

15. Revise the site plan to depict the proposed driveway approach at the intersection of Grand Avenue and O.C. Register Street to be a minimum of 36' driving width (proposed is 30') to be designed, per City Standards. The driveways must be located a minimum of 10' away from any utility facility, such as power poles, streetlights, catch basins, etc. All driveways must allow for two way traffic, no one way driveway is allowed.

16. Revise the site plan to depict and note a 17' x 17' corner cut-off dedication at the northeast and southeast corners of Grand Avenue and O.C. Register Street and along the crosswalk on O.C. Register Street.

17. Revise the site plan to depict and note a dedication of the bus turnout on Grand Avenue north of the intersection at O.C. Resister Street intersection. Add note to read: "Bus turnout right-of-way dedication to the City of Santa Ana for street purposes". Label existing and future property lines.

18. Revise the site plan to depict and note the construction of the bus turnout on Grand Avenue north of the intersection at O.C. Resister Street intersection. Add note to read: "Construct Bus turnout on Grand Avenue per City Standards and approve plans."

19. Revise the site plan to depict and note the reconstruction of new 25' radius curb returns at the northeast and southeast corners of Grand Avenue and O.C. Register Street.

20. Revise the site plan to depict, note and dimension the construction of new curb ramps at the northeast and southeast corners of Grand Avenue and O.C. Register Street, including the 17' x 17' corner cut off, per City Standards and approved Street Improvement plans.

21. Revise the site plan to depict and note the construction of new traffic signal at the intersection of Grand Avenue and O.C. Register Street and restripe the crosswalks at the intersection.

22. Revise the site plan to depict and note on Grand Avenue grinding and capping minimum of 2" of the existing AC pavement from the street centerline to the gutter lip edge.

23. Revise the site plan to depict and note on Fruit Street the construction of full depth asphalt concert for the entire street width from the Grand Avenue to the end of the cul-de-sac.

30. Submit a preliminary evaluation of surface drainage showing the direction and means of flow to the adjacent streets and/or on/off site storm drain facilities. Include the estimated volumetric flow (Q) in each direction.

31. Submit two copies of the preliminary WQMP for review and approval to the Public Works Agency. Go to www.santa-ana.org/pwa/stormdrain/WaterQualityManagementPlanTemplates.asp for information on preparation of WQMPs.

    a. Preliminary Water Quality Management Plan (WQMP)/surface drainage/utility plan should depict all applicable "Site Design," structural "Source Control," and "Treatment Control" Best Management Practices (BMPs) in accordance with the most current Orange County Drainage Area Management Plan (DAMP) and the City of Santa Ana Local Implementation Plan (LIP)

    b. The site plan shall incorporate improvements as determined by the Public Works Agency from the review of the preliminary WQMP and surface drainage plan.

    c. The site plan to incorporate construction of any proposed "Site Design", BMPs, (such as walkways with open joints, sidewalks and parking lot aisles with minimum widths, draining sidewalks into adjacent landscaping, incorporating the landscape area into drainage system, etc.) to minimize the impervious areas and to maximize permeability and natural areas. Reference the most current Orange County DAMP and the LIP.

    d. Any proposed "Treatment Control" BMPs using the Best Available Technology (such as biofilters, dry or wet detention basins, landscape detentions, wet ponds or wetlands, drainage inserts, filtration basins, etc.) and recommended sizing calculations near pollutant source, so as to infiltrate and filter the pollutants of concern in post development runoff flow prior to its discharge into any receiving body of water or urban storm drain. Reference the most current Orange County DAMP and the City of Santa Ana LIP.

    e. All new developments and significant redevelopments require preparation of a NPDES post-construction storm water management plan in accordance with the most current Orange County DAMP and the City of Santa Ana LIP that includes all applicable BMPs for this "Priority Project."

    f. Add a note to the site plan and the tentative map to read "The BMPs, shown on the approved site plan are only preliminary and will be revised or modified as necessary upon completion of the WQMP. Prior to the issuance of the grading permit, the approved grading/utility plan shall incorporate all required Structural BMPs. For assistance and an informational handout (including a WQMP template),"

32. Revise the site plan to add the note "This site will be designed and constructed in accordance with the California Regional Water Quality Control Board Santa Ana Region Order No. R8-2009-0030 discharge requirements (MS4 Permit)."

33. Revise the site plan to allow for the safe and efficient access of trash vehicles to trash receptacles. The following are the guidelines and the minimum requirements:

    - Depict and note the exact location(s) of the trash and recycling receptacles.

- Minimum 40’ x 16’ wide staging area shall be available on service days from 6 a.m. to 6 p.m.
- Minimum vertical clearance of 25’ at the staging area for bin service clearance
- Minimum 13’ vertical clearance for scout truck.
- All staging areas are to be onsite. No street staging is permitted.
- All driveway and staging areas must be able to sustain a minimum gross weight of 60,000 lbs. per vehicle.
- Maximum size of bin shall be 4 cubic yards.
- Maximum number of pick-ups is 2 times per week for residential projects only.
- All items must be noted on the final site plan.
- Depict the trash trucks’ turning radius at all proposed internal corners.
- Provide complete circulation for trash trucks, backing up into the streets is not allowed for safety reasons.

Provide a copy of an approval letter obtained from Waste Management, Inc. Contact Walter Roberts at (714) 371-6747 or wrobert1@wm.com

34. Any street tree removal within the public right-of-way is subject to approval by the Environmental and Transportation Advisory Committee (ETAC). Therefore, provide to the City of Santa Ana a letter requesting the removal of existing street tree(s) that conflict with the proposed improvements. The City will present the information to the ETAC committee for action (see Exhibit C).

35. **The following are Water Department Comments. For questions or clarification of any of the following requirements, contact Water Division, at (714) 647-3320, for assistance:**

GENERAL ITEMS

1. Revise the site plan to depict and note the locations, sizes and materials of the water, sewer, and storm drain mains on all streets surrounding the project frontages.

2. Revise the site plan to depict and note the locations, sizes and materials of the water services and sewer laterals intended to support the project.

WATER ITEMS

1. The site plan shall depict construction of a **new private water main** (8” diameter minimum) and appurtenances to connect the proposed project to the existing and/or new public water main. Design subject to the review and approval of the Water Resources Manager or his designee (refer to the City’s Design Guidelines for Water & Sewer Facilities https://www.santa-ana.org/pw/engineering-services).

2. The site plan shall depict construction of public fire hydrants at 300’ intervals within the development as required by the Orange County Fire Authority.

3. The site plan shall depict the installation of separate individual public domestic water meters for every residential dwelling unit, multi-tenant industrial/commercial centers, mixed use developments and individual parcels subject to the review and approval of the Water Resources Manager or his designee. Developments that include landscaped areas with need for irrigation water and common area amenities such as rental offices, clubhouses, picnic areas, drinking fountains, exercise rooms, swimming pools, and spas are required to have dedicated irrigation and or common area public meters.

4. Revise the site plan to depict and add a note on the plans to read, appropriate private Back Flow Preventer required for all fire service, domestic and landscape water meter per grading and street improvement plans (as applicable).

SEWER ITEMS

1. The site plan shall depict construction of a **new private sewer** (8" diameter minimum) and appurtenances within the site, to connect the proposed project to the existing and/or new public sewer main. Design subject to the review and approval of the Water Resources Manager or his designee (refer to the City's Design Guidelines for Water & Sewer Facilities https://www.santa-ana.org/pw/engineering-services).

The site plan shall depict the installation of separate sewer lateral for each individual parcel/unit subject to the review and approval of the Water Resources Manager or his designee (refer to the City's Design Guidelines for Water & Sewer Facilities https://www.santa-ana.org/pw/engineering-services)

B. <u>Prior to Submittal into Building plan check, complete the following:</u>

Begin review process of surface drainage/grading/utility plans, erosion control plan, water quality management plan, street improvement plan, lot merger application, and dedication mapping as described below under "Section C. Prior to issuance of building permit", by making the initial submittal of the listed plans and maps, and paying the required fees.

C. <u>Prior to issuance of a building permit, complete the following:</u>

1. A landscape and maintenance agreement will be required. The developer shall maintain sidewalk and trees in the public right-of-way.

2. Provide proof of coverage under NPDES "General Construction Activity Storm Water Permit" which includes:

   a. Copy of the project's permit number. (WDID No.)

   b. Two copies of the "Storm Water Pollution Prevention Plan". Go to www.santa-ana.org/pwa/stormdrain/WaterQualityManagementPlanTemplates.asp for info on plan preparation.

   NOTE: This project involves in construction activities that result in a land disturbance of 1 or more acres. Project owners, including the landowner and involved developers, must obtain coverage from the State Water Resource Control Board under the General Construction Storm Water Permit to discharge storm water associated with construction activity.

Contact:

State Water Resource Control Board
Division of Water Quality
P.O.BOX 1977
Sacramento, CA 95812-1977
Attention: Storm Water Permit Unit

For an informational package containing a copy of storm water permit regulations, blank Notice of Intent form and instructions for filling and submitting the form.

3. Provide two copies of the WQMP that include the following:

   a. Site Assessment.

   b. Site Design BMPs.

   c. Applicable Routine Source Control BMPs.

   d. Selection and sizing of the Treatment Control BMPs.

   e. Mechanism(s) by which funding for long-term operation and maintenance of all Structural BMPs will be provided.

   f. Operation and Maintenance (O&M) Plan to describe the long-term operation and maintenance requirements of all applicable Structural BMPs and to identify the entity in charge of implementation.

   NOTE: All new developments and existing facilities with significant redevelopment, irrespective of their size or category (Priority or Non-priority) shall provide and have approved a WQMP prior to the issuance of a grading permit. The WQMP document shall describe all applicable BMPs consistent with the approved surface drainage/grading plan.

4. Submit, for review and approval, a surface drainage/grading/ erosion control plan, prepared by a registered civil engineer, showing the direction and means of flow to the adjacent street. The plan is to include existing and proposed elevations at and adjacent to all property lines. Drainage routed to the street must be directed beneath the sidewalk and through the curb. The plan shall depict all applicable "<u>Site Design</u>," structural "<u>Source Control</u>," and "<u>Treatment Control</u>" BMPs in accordance with the Orange County DAMP and the City of Santa Ana (LIP).

5. Submit, for review and approval, street improvement plans prepared by a registered civil engineer, for wheel chair ramps, sidewalk, utilities connections, driveway approaches, catch basins, parkway landscape, etc., and all work to be constructed in the public right-

of-way, on Fruit Street and Grand Avenue. Contact Behrooz Sarlak at (714) 647-5020 for assistance.

6. Obtain permit for work in the right of way.

7. File, process, and record the following:

   a. A lot merger, if required by Planning and Building Agency.

   b. Dedications.

8. Construct sidewalk, utilities connections, new 8” PCC driveway approaches, undergrounding of utilities along project frontage, and all other work to be constructed in the public right-of-way, on all the Streets surrounding the project as noted on the site plan and/or the tentative map and as listed above, per City Standards and approved plans.

9. Install Traffic signal, signage and striping at the intersection of Grand Avenue and O.C. Register Street.

10. Construct bus turnout on Grand Avenue.

11. On Grand Avenue, grind and cap minimum of 2” of the existing AC pavement from the street centerline to the gutter lip edge.

12. On Fruit Street, construct full depth asphalt concert for the entire street width from the Grand Avenue to the end of the cul-de-sac.

13. Pay the required fees as follows:

    a. Plan Check Fee (WQMP, final map, CC&Rs, grading, dedication, and street improvement).

    b. Sewer Connection Fee - based on the number of plumbing fixture units. The Public Works Agency will require a set of both plumbing and floor plans showing all existing and new plumbing fixtures.

    c. Transportation System Improvement Area (TSIA) Fee.

    d. Orange County Sanitation District (OCSD) No. 15.

    e. Drainage Assessment Fee (DAF).

    f. Transportation Corridor Fee.

    g. Transportation System Improvement Area (TSIA) Fee.

    h. Transit Zoning Code Traffic Impact Mitigation Fairshare.

i. Metro East Use Overlay District Traffic Impact Mitigation Fair share.

NOTE: See the Public Works Counter for current fees. The applicant must pay the prevailing rate at the time payment is made. Federal Clean Water Protection Enterprise Fee Surcharge of 26% added to public improvement plan check, sewer lateral/water service, street work permit, and grading permit fees.

14. Street work shall be required to be performed by a licensed contractor. The contractor must provide the following prior to issuance of the street work permit.

    a. A City of Santa Ana business license.

    c. A Certificate of Insurance of general liability containing requirements as set forth by the City Attorney.

    d. A Contractors license (with approved classification).

    e. Proof of Worker's Compensation Insurance.

    f. Two (2) sets of the approved street improvement plans.

    g. If there are any new connections to the City's Water Main, provide an approved application for installation of Water Service. For an application, contact Phillip Vakili at (714) 647-5038.

15. Should the developer seek a building permit release prior to completing the off-site improvements, the developer must provide a cash deposit in an amount specified by the City of Santa Ana upon approval of all improvement plans and unit quantities. This cash deposit shall guarantee the construction of all necessary improvements. The cash deposit shall be released approximately 135 days after all related permits are signed off by the City's Construction Inspector, approval by the City of Santa Ana, and the passage of any lien periods. In the event the work is not completed within one year of the date that a street work permit is signed, applicant agrees that the City may apply the cash deposit to the cost of completing the work and such work may be completed at the sole convenience of the City of Santa Ana. The deposit amount will be determined based upon the surface drainage and street improvement plans.

16. Install, if not existing, all public utilities required to service the project site (i.e., sewer, water, and storm drain).

17. Construct/install any required mitigation measures associated with bus parking management plan and for bus layover parking for buses

18. Complete construction of the proposed Grease Interceptor for the new restaurant.

NOTE: All new food service establishments shall comply with City's Ordinance No. NS-26-70, for Fat, Oil, and Grease (FOG) control program, and its subsequent requirement for construction of a gravity grease interceptor.

Developer shall contact City's Planning and Building Department to incorporate design of the required grease interceptor of adequate size, into the project's plumbing plans, and to determine an appropriate location for it within the project site.

19. **The following are Water Department Comments. For questions or clarification of any of the following requirements, c<u>ontact Water Division, at (714) 647-3320, for assistance:</u>**

1. Submit and receive approval of Water and Sewer Improvement Plans, prepared by Registered Civil Engineer for construction of all new public water mains, public sewer mains and appurtenances for the proposed site. These plans shall be specific to the project and shall reflect consistency with the City's Sewer and Water Master Plans, City Standards and codes, and the City water and sewer standards and specifications and Design Guidelines (https://www.santa-ana.org/pw/engineering-services). Plans shall be subject to the review and approval of the Water Resources Manager or his designee.

   a. Demand calculations in gallons per minute to verify appropriate sizing of all water services and fire services necessary to support the proposed development.

General Items

1. Process and record a CC&Rs for maintenance and cost sharing responsibility of common utility facilities to be serving all parcels, including but not limited to domestic water, irrigation, fire protection and sewer system as necessary.

2. Pay the required fees as follows:

   a. Sewer Charges, Fees and Assesments - As listed in the City's Schedule of Miscellaneous Fees. The Public Works Agency will require a set of both plumbing and floor plans showing all existing and new plumbing fixtures.

   b. Orange County Sanitation District (OCSD) No. 1 - Connection fees for the proposed project in accordance with currently adopted OCSD fees as listed on their website at: https://www.ocsd.com/about-us/transparency/financials/financial-information-and-forms/

   c. Water Main Charges, Water Service Fees, Meter Fees and Assessments – As listed in the City's Schedule of Miscellaneous Fees

3. Apply for and receive a Public Works Encroachment Permit for all public water and sewer work required of the project. Deviation to this requirement will be subject to approval of the Water Resources Manager.

4. Apply for, pay applicable fees and receive an approved water service application for each individual water meter, fire service and reclaimed water meter.

Water Items

1. The Developer shall construct all public water mains, public sewer mains and appurtenances for the proposed site per approved Water and Sewer Improvement Plans subject to applying for and receiving a Public Works Permit. Demand calculations in gallons per minute for size determination are required for all meters. All works of improvement shall be subject to the inspection and approval of the Water Resources Manager or his designee

2. The Developer shall install new, relocate, or upgrade existing domestic or irrigation **Water Services** per City Standards and approved plans, following the completion of a water meter application and the issuance of a Public Work's Encroachment Permit. The water services shall be installed by a licensed contractor that possesses either an "A" or "C–34" California Contractor's license.

   a. The Developer shall abandon all non-used existing water services and meters at the main, per City Standards. The developer shall **contact City's Municipal Utility Services Department at (714) 647-5454 for meter service close out and removal.** Protect the service and meter in place until the City staff removes the service(s).

   b. All non-residential irrigated landscapes of 1,000 square feet and residential irrigated landscapes of 5,000 square feet or more require a separate landscape irrigation water meter & service of proper size to supply the project's landscape irrigation system.

   c. The City of Santa Ana requires that water conservation irrigation systems be installed for all landscaping where water is required. All systems shall be subject to the review and approval of the Water Resources Manager or his Designee for approved conservation requirements. All systems will be subject to review and approval by the Building Official for plumbing requirements.

3. The Developer shall install new, relocate, or upgrade existing **Fire Protection Facilities** as required by the Orange County Fire Authority (OCFA), City Standards and approved plans, following the completion of a water service application, issuance of a Public Works Encroachment Permit and issuance of a Building Permit. The fire protection facilities shall be installed by a licensed contractor that possesses either an "A" or "C–34" California Contractor's license. **Contact OCFA Plan Check at (714) 573-6126 for assistance.**

SEWER ITEMS

1. The Developer shall install new **sewer lateral(s)** per City Standards and approved plans, following the issuance of a Public Works Encroachment Permit. The sewer

lateral shall be installed by a licensed contractor that possesses either an "A", "C-34", or "C-36" California Contractors license.

a. Any existing and unused sewer lateral(s) connected the project site shall be properly capped and abandoned at the point of connection with the sewer main subject to inspection and approval of the Water Resources Manager or his designee.

D. Prior to release of utilities or a certificate of occupancy, complete the following:

1. Complete construction of all the required improvement in the public right-of-way and provide a copy of the signed off street work permit.

2. **The following are Water Department Comments. For questions or clarification of any of the following requirements, contact Water Division, at (714) 647-3320, for assistance:**

WATER ITEMS

1. Prior to activation of water meters (domestic and irrigation) and/or fire services, the Developer shall arrange for installation, **testing and certification of all needed backflow protection devices**, whether such devices are shown on the project plans or not immediately after installation. Approved backflow devices will be installed by the Developer in conformance with the code regulations and City requirements.

    a. The Developer shall also ensure that this written test report is provided to the City Water Resources Division certifying that the backflow devices and fire detector assemblies are operating properly pursuant to the code of regulations and City requirements **annually**.

2. The Developer shall submit a copy of the final recorded easements, Tract Map/Parcel and any deeds for water purposes in favor of the City to the Water Resources Division.

3. The Developer shall provide a complete set of "As-Built" mylars and electronic copy of CAD drawings for all Water facilities.

SEWER ITEMS

1. The Developer shall submit a copy of the final recorded easements, Tract Map/Parcel and any deeds for sewer purposes in favor of the City to the Water Resources Division.

2. The Developer shall provide a complete set of "As-Built" mylars and electronic copy of CAD drawings for all Sewer facilities.

3. The Developer shall install a sewer backflow prevention valve on all sewer connections in which the property being served is connected to an existing sewer 12" in diameter or greater or if deemed necessary by the Water Resources Manager or his

designee. Installation of the backflow device shall comply with all requirements of the City Plumbing Code.

4. The Developer shall submit a video inspection (CCTV) report of the sewer project in digital format. The video of the sewer facilities shall be conducted, at the City's option, in the presence of the City inspector, and will be in conformance with the City Design Guidelines.

General requirements:

1. Above ground water system appurtenances such as fire hydrants, backflow prevention devices, fire connection standpipes and above ground meters shall be painted as follows:
   a. Public fire hydrants – WHITE
   b. Private fire appurtenance – RED
   c. Irrigation appurtenances – GREEN
   d. Domestic appurtenances – BLUE

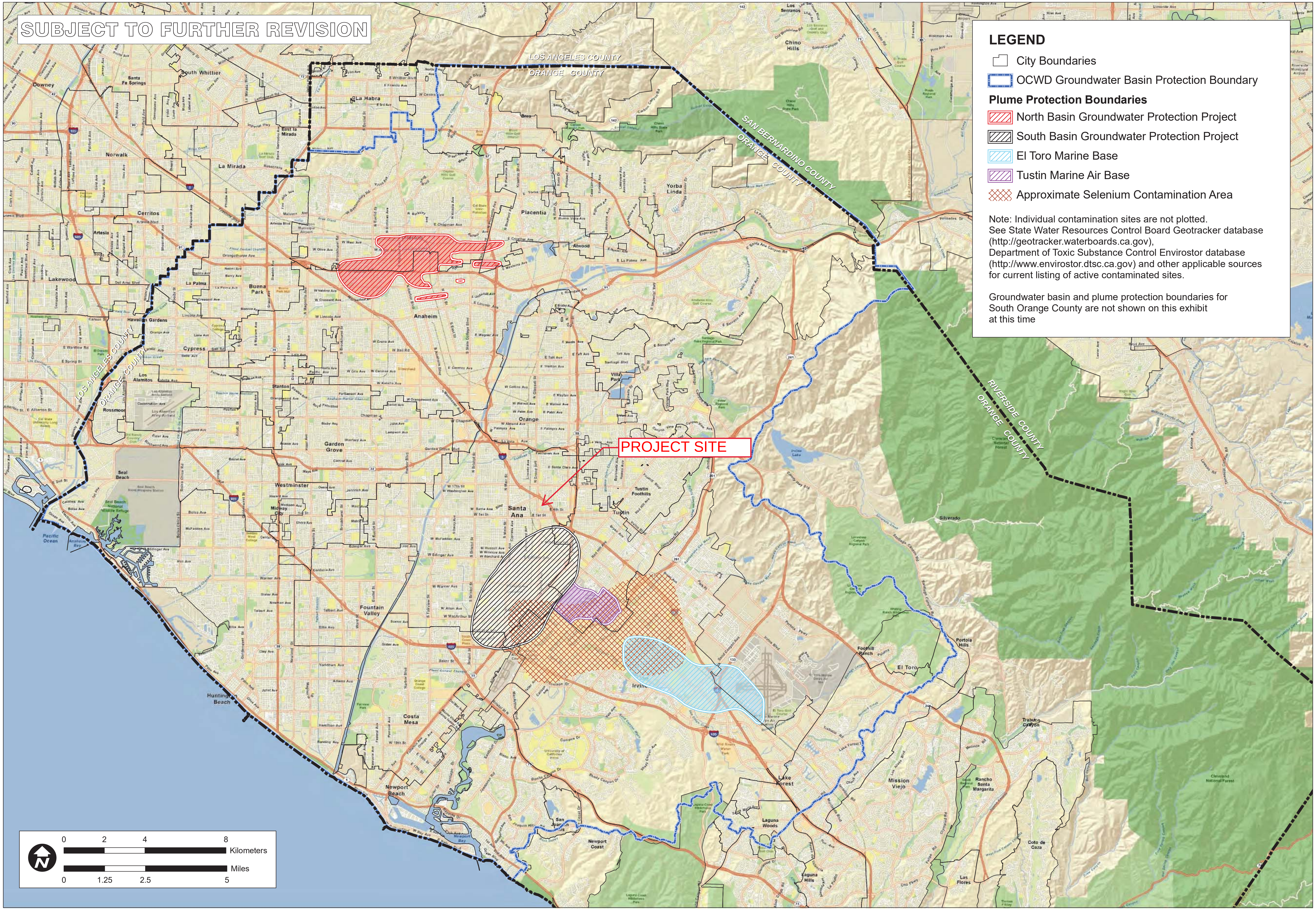
2. Fire flow tests, when necessary, shall be performed by a certified fire protection professional. An application shall be submitted for test to be witnessed by City staff. Fire flow witness test fees shall be paid as listed in the City's Schedule of Miscellaneous Fees.

3. Non-residential tenant improvement projects valued at $50,000 or more shall upgrade their fire protection service backflow device to current City standards. **Contact the Water Resources Division at 714-647-3320 for assistance.**

4. Recycled water service, if available, shall be used in accordance with section 39-38 of the City's Municipal Code. **Contact the Water Resources Division at 714-647-3320 for assistance.**

Please contact Nasser Rizk at (714) 647-5039 for assistance regarding the above requirements.

ATTACHMENT G
GROUNDWATER PROTECTION MAP



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TITLE
NORTH ORANGE COUNTY GROUNDWATER PROTECTION AREAS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

SCALE 1" = 1.25 miles
DESIGNED TH
DRAWING TH
CHECKED BMP
DATE 04/22/10
JOB NO. 9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2f