ANAH-WQMP2025-01557

City of Anaheim Priority Project
Water Quality Management Plan (WQMP)

☐ **Preliminary** ☒ **Final** ☐ **Verified Final**

Project Name:

OCVIBE – Parking Deck A
1715 S. Douglass Road
Anaheim, CA 92806
Parcel 2 of P.M.B. 106/12-13
Parcel A of PTR 3
APN 232-071-02 and 232-071-03

Prepared for:
Anaheim Real Estate Partners, LLC
2101 E Coast Highway, Suite 230
Corona del Mar, CA 92625
949-760-4300

Prepared by:

Edward Perez, P.E.
Stantec Consulting Services Inc.
38 Technology Drive, Suite 200
Irvine, CA 92618
949-923-6000

Final WQMP Submittal Dates

1st Submittal:	8/11/2025
2nd Submittal:	10/27/2025
3rd Submittal:	

Project Owner's Certification			
Planning Application No. (If applicable)	ANAH-WQMP2025-01557	Grading Permit No.	
Tract/Parcel Map and Lot(s) No.	Parcel 2 of P.M.B. 106/12-13 and Parcel A of PTR 3	Building Permit No.	
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			1715 S. Douglas Road, Anaheim, CA 92806; APN 232-071-02 & 232-071-02

This Water Quality Management Plan (WQMP) has been prepared for Anaheim Real Estate Partners, LLC by Stantec Consulting Services 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: Anaheim Real Estate Partners, LLC			
Name	Joe O'Toole		
Title	Senior Vice President		
Address	2101 E Coast Highway, Suite 230, Corona Del Mar, CA 92625		
Email	jotoole@ocvibe.com		
Telephone #	949-760-4300		
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		Date	

Preparer (Engineer): Edward Perez, PE			
Title	Project Manager	PE Registration #	67379
Company	Stantec Consulting Services Inc.		
Address	38 Technology Drive, Suite 200		
Email	edward.perez@stantec.com		
Telephone #	949-923-6000		
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	8/11/2025
Place Stamp Here			

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Attachments

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

Project Infomation			
Permit/Application No. (If applicable)	ANAH-WQMP2025-01557	Grading or Building Permit No. (If applicable)	
Address of Project Site (or Tract Map and Lot Number if no address) and APN	1715 S. Douglas Road, Anaheim, CA 92806 Parcel 2 of P.M.B. 106/12-13 & Parcel A of PTR 3 APN 232-071-02 & 232-071-03		

Water Quality Conditions of Approval or Issuance	
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	Prior to the issuance by the City of Anaheim of a grading permit, building permit and/or conditional use permit for any new development or significant redevelopment, the property owner shall submit to and obtain the approval of the Public Works Department of a water quality management plan. If the new development or significant redevelopment will be approved without application for a grading permit, building permit or conditional use permit, the property owner shall submit to and obtain the approval of the Public Works Department of a water quality management plan prior to the issuance of a discretionary land use approval or, at the City's discretion, prior to recordation of a subdivision map.

Conceptual WQMP	
Was a Conceptual Water Quality Management Plan previously approved for this project?	*Yes. A preliminary WQMP (OTH2021-01370) was prepared for the overall larger development of OCVIBE, which included Parking Deck A. The project has since been refined. Therefore, this report serves as the preliminary WQMP for the project to include updated exhibits and calculations.*
Watershed-Based Plan Conditions	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	*None.*

Section II Stormwater Credit Program

The City of Anaheim Stormwater Credit Program (Credit Program) allows eligible projects to purchase stormwater Credits, if available, in lieu of installing flow through BMPs**. Note that Credits can only be used where retention with infiltration or stormwater capture and use is infeasible.**

Is this project purchasing Stormwater Credits per the Stormwater Credit Program?
☐ Yes, for the entire Project Site's Design Capture Volume (DCV).
☐ Yes, for a portion of the Project Site's DCV.
☒ No.

Section III Project Description

III.1 Project Description

The proposed project is part of a larger development known as the OCVIBE that encompasses approximately 95-acres in the City of Anaheim. The project site is approximately 3.2 acres and is bounded by the Ayres Hotel Anaheim to the north, Douglass Road to the east, Orange Freeway (State Route 57) to the west and south. A Vicinity Map is included in Section VII. This Final WQMP is for the development of a new 7-story parking structure, digital billboard, and pedestrian bridge with associated landscape and hardscape known as the Parking Deck A project. The objectives are to identify the required volumes and primary stormwater LID BMPs to meet local permit requirements.

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	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. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discussed in Section 7.II-2.0 only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development.			
Project Area (ft^2): 140,917 SF	Number of Dwelling Units: Not applicable.		SIC Code: 7521	
Project Area	Pervious		Impervious	
	Area (sq ft)	Percentage	Area (sq ft)	Percentage
Pre-Project Conditions	19,461	13.8%	121,456	86.2%
Post-Project Conditions	25,942	18.4%	114,973	81.6%

Drainage Patterns/Connections	In the existing condition, the site consists of six (6) office buildings with parking stalls, drive aisles, hardscape and landscaped areas. The parking lot is relatively flat, with slopes ranging from 0.2 percent to 1 percent. Roof downspouts along with sidewalks and planter areas surface flow towards the drive aisles to a series of v-gutters. The v-gutters drain in a north to south direction to a low spot at the southeast corner of the property where it is captured by an existing grate inlet. The grate inlet discharges into an 18-inch reinforced concrete pipe (RCP) that connects to a 48-inch RCP that traverses through the project within a 20-foot wide Caltrans drainage easement. The 48-inch storm drain continues downstream in a southeasterly direction crossing Douglass Road, ARTIC property, Lot B Office project and into the Caltrans right-of-way where it eventually discharges into the Santa Ana River. In the proposed condition, the most southerly building will remain, and all other buildings removed for the construction of a parking structure. The project will maintain existing drainage patterns. The site will drain in a north to south direction where flows are captured by catch basins and a new storm drain system. Captured flows are then directed to a Modular Wetland System unit for pretreatment prior to discharging flows into the proposed underground infiltration basin. Flows exceeding the capacity of the underground infiltration basin will drain to a riser outlet pipe that connects to an existing junction structure located near the southerly entry of the parking structure. Flows continue downstream through an existing 18-inch RCP and 48-inch RCP. The 48-inch RCP eventually discharges directly into the Santa Ana River. There are no offsite areas that drain into the site. The proposed underground infiltration basin will retain the required Design Capture Volume (DCV) for the proposed project.

Narrative Project Description: (Use as much space as necessary.)	The proposed project is part of a larger development known as the OCVIBE that encompasses approximately 95-acres in the City of Anaheim. The project site is approximately 3.2 acres and is bounded by the Ayres Hotel Anaheim to the north, Douglass Road to the east, Orange Freeway (State Route 57) to the west and south. A new 7-story parking structure, digital billboard, and pedestrian bridge will be constructed with associated landscape and hardscape. Vehicular access into the site is provided by two driveway entries for the parking structure off Douglass Road. The project proposes work in the adjacent public right-of-way to replace landscaping, sidewalk, curb ramps, and driveway aprons.

III.2 Potential Stormwater Pollutants

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 ☐	
Nutrients	E ☒	N ☐	
Heavy Metals	E ☒	N ☐	
Pathogens (Bacteria/Virus)	E ☒	N ☐	
Pesticides	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Toxic Organic Compounds	E ☒	N ☐	
Trash and Debris	E ☒	N ☐	

III.3 Hydrologic Conditions of Concern

☒ No – Show map

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

According to Figure XVI-3 within the Technical Guidance Document, the proposed project falls within an area not susceptible to hydromodification impacts. All runoff is conveyed by a hard lined system that ultimately drains to the Santa Ana River, which is a stabilized channel maintained by the Orange County Flood Control District (OCFCD). A copy of Figure XVI-3 is included in Attachment A.

III.4 Post Development Drainage Characteristics

Project flows are conveyed by an existing 48-inch RCP that discharge directly into the Santa Ana River located near the property. Flows continue downstream in Santa Ana River which is a stabilized channel consisting of earthen and concrete lined sections until it drains out into the Pacific Ocean approximately 5.0 miles from the project site.

III.5 Property Ownership/Management

The property is currently owned by OCVIBE. A land swap between OCVIBE and the City of Anaheim will take place, and the parking structure will be owned and managed by the City of Anaheim. The City will then be responsible for long-term funding and maintenance of BMPs. Inspection and maintenance responsibilities are outlined in Section V of this report.

Section IV Site Description

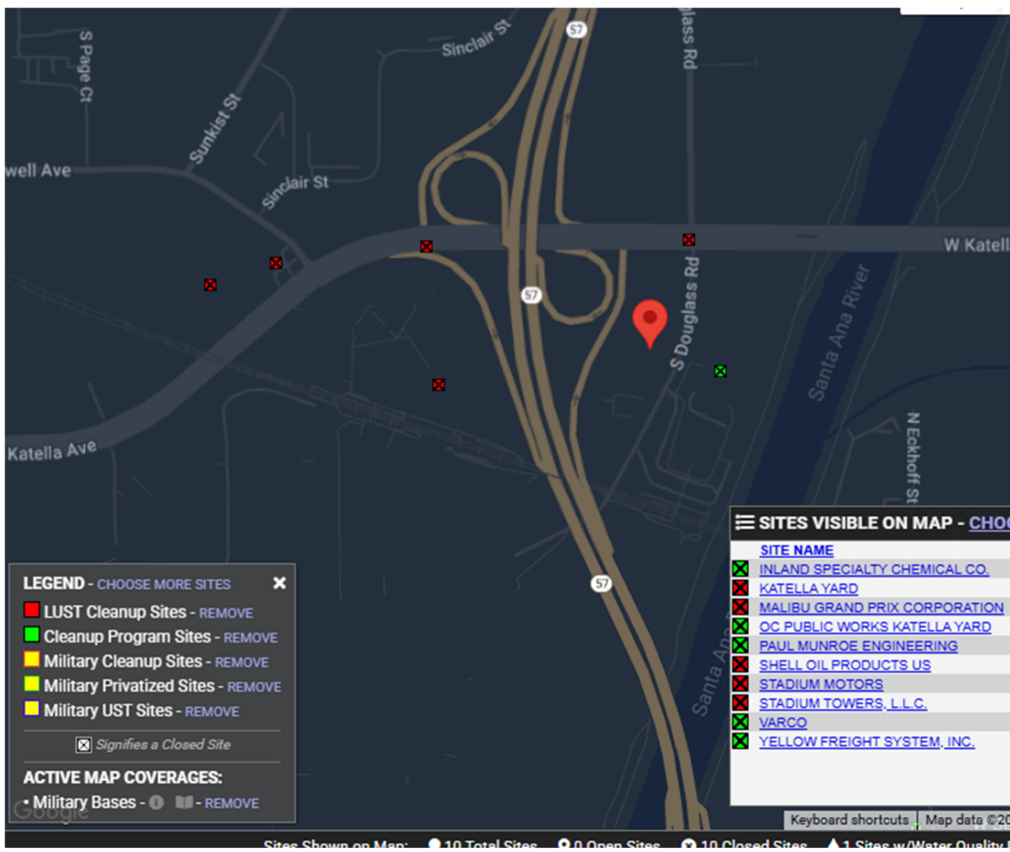
IV.1 Physical Setting

Name of Planned Community/Planning Area (if applicable)	OCVIBE
Location/Address	1715 S. Douglas Road, Anaheim, CA 92608
General Plan and Land Use Designation	MU UC (Mixed -Use Urban Core)
Zoning	I (Industrial)
Acreage of Project Site	3.2 AC
Predominant Soil Type	B

IV.2 Site Characteristics

Site Characteristics	
Precipitation Zone	0.85 inches
Topography	The project site is relatively flat.
Drainage Patterns/Connections	See Section III.1 for a complete description of existing and proposed drainage patterns and connections.

<table>
<tr><td>Soil Type, Geology, and Infiltration Properties</td><td>Based on the soils exhibit provided in Attachment A, the project is located within Soil Type B. The geotechnical report prepared for the ARTIC, found that soil at a depth of 10 feet has an infiltration rate of greater than 10 inches an hour.</td></tr>
<tr><td>Hydrogeologic (Groundwater) Conditions</td><td>As discussed in the approved ARTIC WQMP, groundwater was measured at the depth of 34 feet near the intersection of Katella Avenue and Douglass Road. However in 2001 an evaluation of the historically shallow west groundwater levels was conducted by CGS (Greenwood and Pridmore, 2001) for the area which included the site. They determined the highest historical groundwater to be approximately 20 feet deep for the project site. (Ref. Preliminary Geotechnical Data Report by Kleinfelder dated June 3, 2009).</td></tr>
<tr><td>Geotechnical Conditions (relevant to infiltration)</td><td>There are no active GeoTracker sites within 250' of the project site. See screenshot below.


</td></tr>
<tr><td>Off-Site Drainage</td><td>There are no offsite areas that drain into the site.</td></tr>
<tr><td>Utility and Infrastructure Information</td><td>Dry and wet utilities are proposed for the project and will be coordinated with infiltration areas to ensure they are a located an adequate distance away.</td></tr>
</table>

IV.3 Watershed Description

Receiving Waters	Santa Ana River Reach 2, Santa Ana River Reach 1, Huntington Beach State Park, Pacific Ocean
303(d) Listed Impairments	Santa Ana River Reach 2: None Santa Ana River Reach 1: None Huntington Beach State Park: PCBs (Polychlorinated biphenyls)
Applicable TMDLs	None.
Pollutants of Concern for the Project	Suspended Solids/Sediment, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease, Toxic Organic Compounds, Trash & Debris
Environmentally Sensitive and Special Biological Significant Areas	Not applicable.

Section V Best Management Practices (BMPs)

V.1 Project Performance Criteria

(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.	Not applicable.	

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Not applicable.

List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	The project shall retain the required Design Capture Volume (DCV) for the 85th percentile, 24-hour storm event. See Attachment A for rainfall zone exhibit.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	The project will retain the required Design Capture Volume (DCV) through infiltration for the 85th percentile, 24-hour storm event. A propriety unit (Modular Wetland System) is proposed at the upstream end of the infiltration basin for pretreatment.
Calculate LID DCV for Project.	DCV = C x d x A x 43560 sf/ac x 1/12 in/ft DMA1 Where: C = 0.75 x imp + 0.15 = 0.75 x 0.816 + 0.15 = 0.762 d = 0.85 A = 3.23 AC DCV = 0.762 x 0.85 x 3.23 x 43560 x 1/12 = 7,594 CF DMA1 for Parking Structure Area with Wind-Driven Rain Where: C = 0.75 x imp + 0.15 = 0.75 x 1.000 + 0.15 = 0.900 d = 0.85 A = 0.29 AC DCV = 0.900 x 0.85 x 0.29 x 43560 x 1/12 = 805 CF **TOTAL DCV = 7,594 CF + 805 CF = 8,400 CF** Refer to Section IV.2.2 for specific Drainage Manage Area (DMA) breakdown and Appendix A for detailed calculations.

V.2 Site Design and Drainage

The project proposes a new onsite storm drain system and underground infiltration basin. The onsite storm drain system includes catch basins located throughout the site that are conveyed by underground storm drain pipes. Drainage from the parking structure connects to the underground storm drain towards the rear of the property where flows are then directed to a proprietary BMP treatment unit (Modular Wetland System). Tributary drainage area includes the parking structure areas with openings to account for wind-driven rain. The MWS unit is used for the pretreatment of runoff prior to draining into the underground infiltration basin located beneath the exterior asphalt concrete access road. Due to site and utility constraints, it is infeasible to provide vegetated swales for the pretreatment of runoff. The new road located behind the parking structure is designed using minimum turning radii with electrical facilities (two transformers, PME, and generator) located in the planter areas. The infiltration basin consists of perforated corrugated metal pipes, which will fill up to a volume equal to the required design capture volume (DCV). The captured volume will be retained onsite and slowly infiltrate into the surrounding soil. Storm flows exceeding the volume of the underground infiltration basin will drain through an overflow outlet pipe connected to an existing junction structure for an 18” RCP where it continues downstream and flows into the 48” RCP. The existing 48” RCP discharges directly into the Santa Ana River. See DMA1 shown in Section VII WQMP exhibit.

The project proposes parkway improvements along the public right-of-way of Douglass Road to include landscaping, sidewalk, curb ramp and driveway aprons. There is an existing Filterra unit that will be protected in place, which is located next to the southerly entry of the parking structure. The existing Filterra unit (per WQMP OTH2010-00586) will treat for the disturbed areas within the public right-of-way.

See below for DMA summary, DCV, and infiltration basin sizing calculations.

BMP SIZING SUMMARY

AREA SUMMARY:

	AREA (SF)	AREA (AC)
DMA1	140,915	3.23
DMA1*	12,813	0.29

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN.

PERVIOUS & IMPERVIOUS SUMMARY:

	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (SF)	PERVIOUS RATIO	IMPERVIOUS RATIO	RUNOFF COEFFICIENT	DESIGN STORM DEPTH (IN)	DCV (CF)
DMA1	25,942	114,973	140,915	0.184	0.816	0.762	0.85	7,594
DMA1*	0	12,813	12,813	0.000	1.000	0.900	0.85	805
							TOTAL DCV (CF):	8,400

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN.

INFILTRATION BASIN SIZING CALCULATIONS:

REQUIRED DESIGN CAPTURE VOLUME (DCV):	8,400 CF
AREA OF 5' DIAMETER PERFORATED CMP:	19.625 SF
LENGTH OF 5' DIAMETER PERFORATED CMP REQUIRED TO RETAIN DCV:	428 LF
LENGTH OF 5' DIAMETER PERFORATED CMP PROVIDED:	430 LF

NOTE: MWS UNIT LOCATED UPSTREAM OF INFILTRATION BASIN FOR PRETREATMENT.

V.3 LID BMP Selection and Project Conformance Analysis

V.3.1 Hydrologic Source Controls (HSCs)

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:	☐
Other:	☐
Other:	☐
Other:	☐

V.3.2 Infiltration BMPs

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:	☐

See below for DMA summary, DCV, and infiltration basin sizing calculations.

BMP SIZING SUMMARY

AREA SUMMARY:

	AREA (SF)	AREA (AC)
DMA1	140,915	3.23
DMA1*	12,813	0.29

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN.

PERVIOUS & IMPERVIOUS SUMMARY:

	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (SF)	PERVIOUS RATIO	IMPERVIOUS RATIO	RUNOFF COEFFICIENT	DESIGN STORM DEPTH (IN)	DCV (CF)
DMA1	25,942	114,973	140,915	0.184	0.816	0.762	0.85	7,594
DMA1*	0	12,813	12,813	0.000	1.000	0.900	0.85	805
							TOTAL DCV (CF):	8,400

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN.

INFILTRATION BASIN SIZING CALCULATIONS:

REQUIRED DESIGN CAPTURE VOLUME (DCV):	8,400 CF
AREA OF 5' DIAMETER PERFORATED CMP:	19.625 SF
LENGTH OF 5' DIAMETER PERFORATED CMP REQUIRED TO RETAIN DCV:	428 LF
LENGTH OF 5' DIAMETER PERFORATED CMP PROVIDED:	430 LF

NOTE: MWS UNIT LOCATED UPSTREAM OF INFILTRATION BASIN FOR PRETREATMENT.

V.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Not applicable.

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

V.3.4 Credits Purchased in Lieu of Biotreatment BMP

Not applicable.

Credit Summary						
DMA ID[1]	**Area (ft^2)**	**DCV (ft^3)** from Section V.2	**Land Use**[2]	**PLM**[3]	**Purchased Credits to be Utilized**	**Other Structural Treatment Control BMPs**[4]

[1] DMA labels must match on site plan(s) that show DMAs. They must be consistent throughout this WQMP.

[2] Choose one of the following land uses:

- Commercial
- Education
- Industrial
- Transportation
- Single Family Residential
- Multi-Family Residential
- Vacant / Open Space

[3] The PLM is found within the Stormwater Credit Application, which is to be attached to this WQMP if stormwater Credits are used. The Stormwater Credit Application does not necessarily show the DMAs and their respective land uses and resulting PLMs for each DMA. The application shows, at a minimum, the entire project site, it's percent impervious surface, and the percent land uses the site is to be developed to. In the WQMP, each DMA is to be assigned a land use (Section III.1). The land use will have a resulting PLM as described in the Stormwater Credit Application. Place that PLM here for calculation of Credits to be utilized by each DMA. If a DMA has multiple land uses, present the percent of each land use within the DMA and the resulting Credits following the Credit calculation procedures in the Stormwater Credit Application Instructions.

[4] In certain instances, some DMAs may have Credits and structural treatment control BMPs. If this is pursued, applicant must describe project site specific approach in relevant sections. If not applicable, applicant to write N/A.

V.3.5 Biotreatment BMPs

Not 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:	☐

V.3.6 Hydromodification Control BMPs

Not applicable.

Hydromodification Control BMPs	
BMP Name	**BMP Description**

V.3.7 Regional/Sub-Regional LID BMPs

Not applicable.

Regional/Sub-Regional LID BMPs

V.3.8 Treatment Control BMPs

Not applicable.

Treatment Control BMPs	
BMP Name	**BMP Description**

V.3.9 Trash Provisions

The onsite storm drain system is directed to the proposed MWS unit for pretreatment. The unit has an overflow weir wall for high flows. The outlet pipe will be fitted with a Connector Pipe Screen (CPS) to comply with the City's Full Trash Capture requirement.

V.3.10 Non-structural Source Control BMPs

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 industrial land uses proposed.
N6	Local Industrial Permit Compliance	☐	☒	The City of Anaheim does not issue water quality permits.
N7	Spill Contingency Plan	☐	☒	Not applicable. Hazardous materials will not be stored on-site.
N8	Underground Storage Tank Compliance	☐	☒	Not applicable. No underground storage tanks proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Not applicable. No hazardous materials stored on site.
N10	Uniform Fire Code Implementation	☐	☒	Not applicable. Hazardous materials will not be stored on-site.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	Not applicable. No loading docks are proposed.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Not applicable. No retail gasoline outlets proposed.

V.3.11 Structural Source Control BMPs

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 material storage areas proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	Not applicable. No trash and waste storage areas proposed.
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 required for protection.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☒	☐	
S6	Dock areas	☐	☒	Not applicable. No dock areas proposed.
S7	Maintenance bays	☐	☒	Not applicable. No maintenance bays are proposed.
S8	Vehicle wash areas	☐	☒	Not applicable. No vehicle wash areas are proposed.
S9	Outdoor processing areas	☐	☒	Not applicable. No outdoor material storage areas are proposed.
S10	Equipment wash areas	☐	☒	Not applicable. No equipment wash areas are proposed.
S11	Fueling areas	☐	☒	Not applicable. No fueling areas are proposed.
S12	Hillside landscaping	☐	☒	Not applicable. Project is not located on a hillside.
S13	Wash water control for food preparation areas	☐	☒	Not applicable. Project is not proposing any food prep areas.
S14	Community car wash racks	☐	☒	Not applicable. No community car was racks are proposed.

V.4 Alternative Compliance Plan (If Applicable)

Not applicable.

V.4.1 Water Quality Credits

Not applicable.

<table>
<tr><th colspan="7">Description of Proposed Project</th></tr>
<tr><td colspan="7">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="4">☐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="3">☐ 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 colspan="2">☐ 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>
<tr><td colspan="2">Calculation of Water Quality Credits
(if applicable)</td><td colspan="5">Not applicable. Water quality credits will not be applied for the project. LID BMPs will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.</td></tr>
</table>

V.4.2 Alternative Compliance Plan Information

Not applicable.

Section VI Inspection/Maintenance Responsibility for BMPs

BMP Inspection/Maintenance			
BMP	**Responsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
N1 Education for Property Owners, Tenants and Occupants	City of Anaheim	Provide all members with environmental awareness education materials (made available by municipalities).	Upon initial leasing or sale of property to occupants and/or tenants, and annually thereafter
N2 Activity Restrictions	City of Anaheim	Provide all occupants / tenants with conditions, covenants, and restrictions for surface water quality protection.	Monthly verification of compliance with WQMP or per local standards.
N3 Common Area Landscape Management	City of Anaheim	Manage landscaping in accordance with applicable ordinances and with management guidelines for use of fertilizers and pesticides.	Every two weeks and when new field landscaping personnel are hired.
N4 BMP Maintenance	City of Anaheim	Inspection, maintenance activities, and records to be performed per Attachment B – O+M plan.	Ongoing
N11 Common Area Litter Control	City of Anaheim	Inspect for, remove, and properly dispose of litter.	Daily

N12 Employee Training	City of Anaheim	Consisting at a minimum of the distribution of educational materials contained herein and material made available by municipalities.	Training every two years and when new employees are hired.
N14 Common Area Catch Basin Inspection	City of Anaheim	Drainage facilities, including catch basins, trash capture screen devices within side opening catch basins, area drains, and open drainage channels must be cleaned and maintained.	Post construction: monthly inspection and, if necessary, cleaned and more frequently during the rainy season (October 1 – April 30). Cleaned at a minimum once a year prior to the rainy season, no later than October 1st of each year.
N15 Street Sweeping Private Streets and Parking Lots	City of Anaheim	Sweep/vacuum streets and parking lots.	A typical weekly sweeping program will be developed for the property.
S1 Provide Storm Drain System Stenciling and Signage	City of Anaheim	Assure that stenciling is legible but re-stencil once every five years at minimum.	Maintain twice a year and no later than October 1st of each year.
S4 Efficient Irrigation Systems and Landscape Design	City of Anaheim	Verify that runoff minimizing landscape design continues to function by checking that water sensors are functioning properly, that irrigation heads are adjusted properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather and day or nighttime temperatures.	Weekly maintenance.

		Inspections	
1 Contech Modular Wetlands System (MWS-L_18-12)	City of Anaheim	Observe the inside of the system through access covers. Look for any out of the ordinary obstructions in the inflow pipe, pretreatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in the pre-treatment chamber. Record this depth on the inspection form. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes. Look for any plants that are dead or showing signs of disease or other negative stressors. The discharge chamber houses the control riser. Check to ensure the orifice is in proper operating condition and free of any obstructions.	Inspections shall be performed multiple times during the first year to assess the site-specific loading conditions. The first year of inspections shall be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. At minimum, inspections shall be done annually and before October 1st of each year.
		Maintenance	
		Upon determining that the vault is safe for entry, remove all access covers and position the vacuum truck accordingly. With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any	The first year of inspections shall be used to set maintenance intervals for subsequent years to ensure appropriate

		accumulated sediment from the pre-filter cartridges. Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the floor is visible and clean. After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lids from the pre-filter cartridges by removing the two thumb screws. Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge. Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.	maintenance is provided.

		In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones. Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed. Once maintenance is complete, replace all access covers.	
		Corrective Maintenance Repair	
		REPLACING BIOFILTRATION MEDIA IF REQUIRED VACUUM EXISTING BIOFILTRATION MEDIA: Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer. INSTALLING NEW BIOFILTRATION MEDIA: Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cages. Media will be provided in super sacks for easy	As needed. General life of media is 10 to 20 years depending on site specific conditions and pollutant loading.

		installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cages up to the same level as the old media. REPLANT VEGETATION: Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media.	
2 Hydra TMDL Systems Connector Pipe Screen (CPS)	City of Anaheim	Inspections	
		Inspect catch basins and CPS devices. Remove manhole or access port and identify trash accumulation within catch basin and trash screen system. Documentation required includes photos of accumulation of debris (ensure date stamp) and document accumulation percent.	1x/yr in the months of August or September. If trash accumulation exceeds 40% of device capacity, increase frequency of inspection and maintenance to 2x/yr
		Maintenance	
		Within 1 week of inspection, remove all trash and debris in catch basins. Remove	1x/yr; sites with large amounts of

		trash and any accumulated debris and vegetation growing across or blocking catch basin opening. Remove debris that covers the perforated openings of the CPS. Ensure there is no standing water inside of catch basin, which would indicate that the device may not be draining properly. Documentation required includes photos of removed trash and debris (ensure date stamp), cleaned interior and screen (ensure date stamp) and list of staff and vendor (if applicable) involved in cleaning activity, a description of activities completed, and date the work was performed.	foliage, high sediments load, or small CPS devices might need to be cleaned more frequently as identified above.
		Corrective Maintenance Repair	
		If CPS is damaged (e.g., broken, obstructed, not attached properly, or otherwise not functioning as originally intended), repair or replace within 1 month. Documentation required includes photos of damaged and repaired items (ensure date stamp), details of damage and repair, including date of identified efficiency and repair date, as well as staff and vendor (if applicable) involved in repair work.	As needed. Repairs must be implemented within 1 month of any damages or failure of the CPS.
3 Underground Infiltration Gallery (5' Diameter Perforated CMP)	City of Anaheim	Inspections	
		Inspect inlet and equalizer pipes for damage and clogging. Inspect infiltration CMP for deflection, cracks or corrosion. Inspect pipe joint connections for separation. Record depth of sediment buildup.	Inspections should be completed quarterly.
		Maintenance	
		Vacuum out infiltration gallery and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the infiltration gallery until the invert of the CMP is visible and clean.	Remove sediment from gallery when average depth of sediment exceeds 3 inches.

		If maintenance is not performed as recommended, sediment and trash may accumulate and block perforations to provide proper infiltration and drawdown. Manhole covers should be securely seated following cleaning activities.	CMP infiltration systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice.
		Corrective Maintenance Repair	
		Remove and replace CMP showing excessive deflection, cracking and joint separation to prevent failure of facility and caving. Contact Contech for guidance and/or product replacement.	Repairs shall be completed immediately.

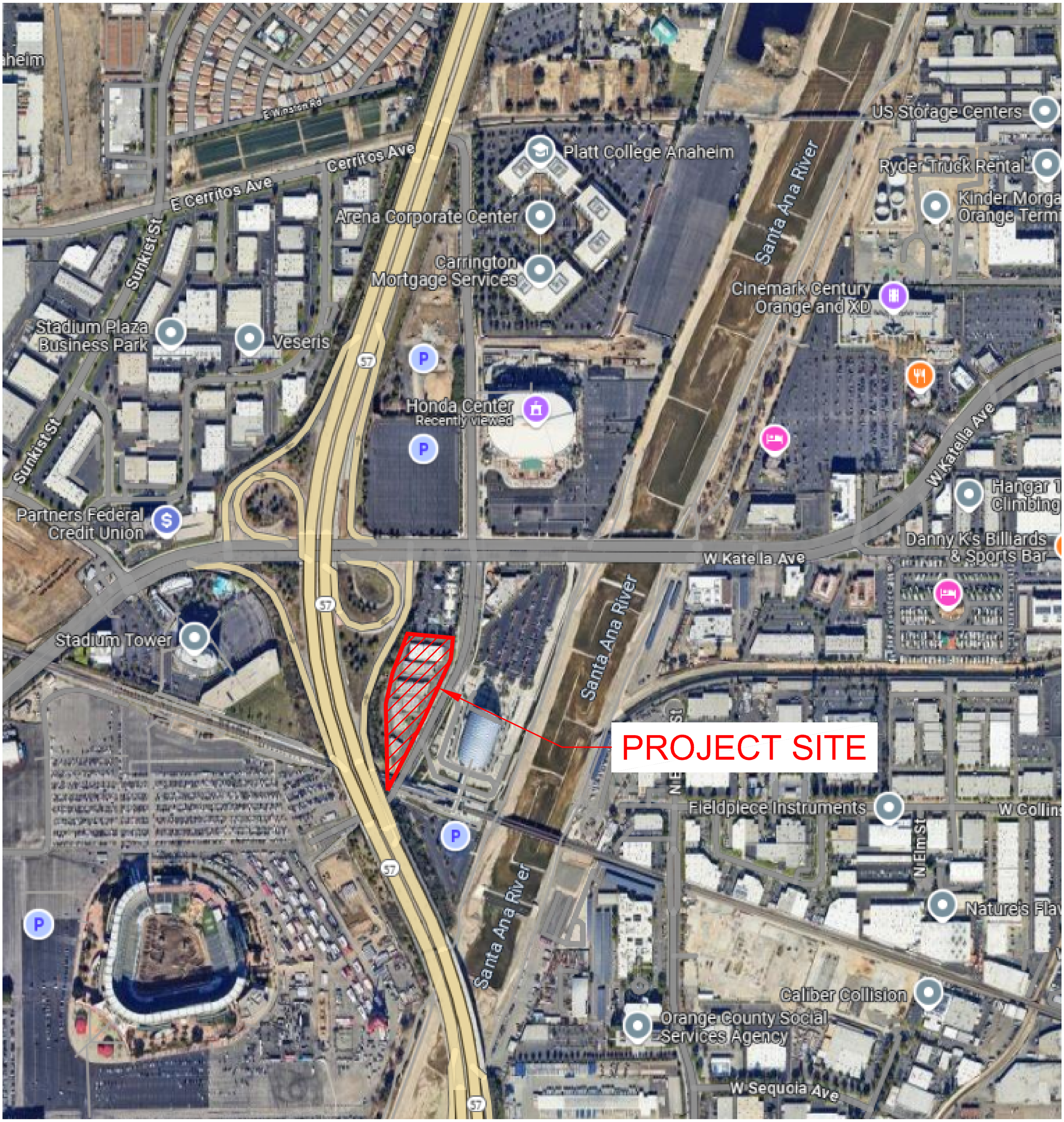
Section VII BMP Exhibit (Site Plan)

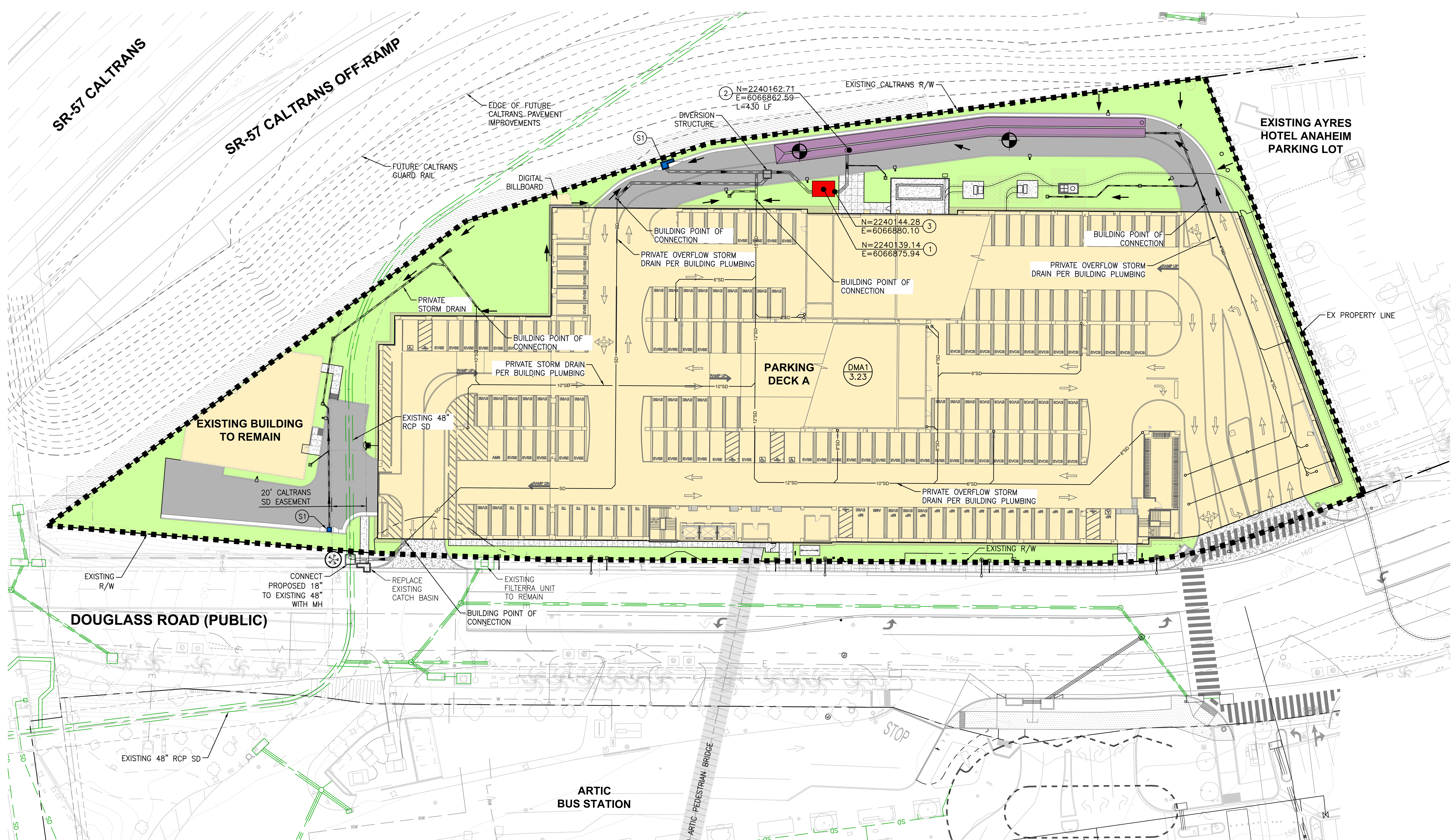
VII.1 BMP Exhibit (Site Plan)

See following sheets for the exhibits listed below.

- Vicinity Map
- WQMP Exhibit

VICINITY MAP





BMP SIZING CALCULATIONS

AREA SUMMARY:

	AREA (SF)	AREA (AC)
DMA1	140,915	3.23
DMA1*	12,813	0.29

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN. SEE NEXT PAGE FOR CACULATING EXPOSED AREA.

PERVIOUS & IMPERVIOUS SUMMARY:

	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (SF)	PERVIOUS RATIO	IMPERVIOUS RATIO	RUNOFF COEFFICIENT	DESIGN STORM DEPTH (IN)	DCV (CF)
DMA1	25,942	114,973	140,915	0.184	0.816	0.762	0.85	7,594
DMA1*	0	12,813	12,813	0.000	1.000	0.900	0.85	805
							TOTAL DCV (CF):	8,400

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN. SEE NEXT PAGE FOR CACULATING EXPOSED AREA.

INFILTRATION BASIN SIZING CALCULATIONS:

REQUIRED DESIGN CAPTURE VOLUME (DCV):	8,400 CF
AREA OF 5' DIAMETER PERFORATED CMP:	19.625 SF
LENGTH OF 5' DIAMETER PERFORATED CMP REQUIRED TO RETAIN DCV:	428 LF
LENGTH OF 5' DIAMETER PERFORATED CMP PROVIDED:	430 LF

NOTE: MWS UNIT LOCATED UPSTREAM OF INFILTRATION BASIN FOR PRETREATMENT.

STRUCTURAL BMP LEGEND

- S1 — STORM DRAIN SYSTEM STENCILING AND SIGNAGE (IF NOT PRESENT)
- S4 — EFFICIENT IRRIGATION SYSTEMS AND LANDSCAPE DESIGN
- 1 — MWS UNIT
- 2 — UNDERGROUND INFILTRATION GALLERY (60" DIA. PERFORATED CMP)
- 3 — FULL TRASH CAPTURE SCREEN

PROJECT ADDRESS:
1715 S. DOUGLASS ROAD, ANAHEIM, CA 92806

LEGEND:

- EXISTING RIGHT OF WAY
- EXISTING LOT LINE
- DRAINAGE MANAGEMENT AREA (DMA) BOUNDARY
- EXISTING STORM DRAIN
- PROPOSED UNDERGROUND STORM DRAIN
- SURFACE FLOW DIRECTION
- STORM DRAIN FLOW DIRECTION
- CONNECTION TO EXISTING PIPE
- DMA1 3.23 — DRAINAGE MANAGEMENT AREA (DMA) AND ACREAGE
- PROPOSED BUILDING
- PROPOSED LANDSCAPING (N3, S4/SD-12)
- PERCOLATION TEST LOCATION

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

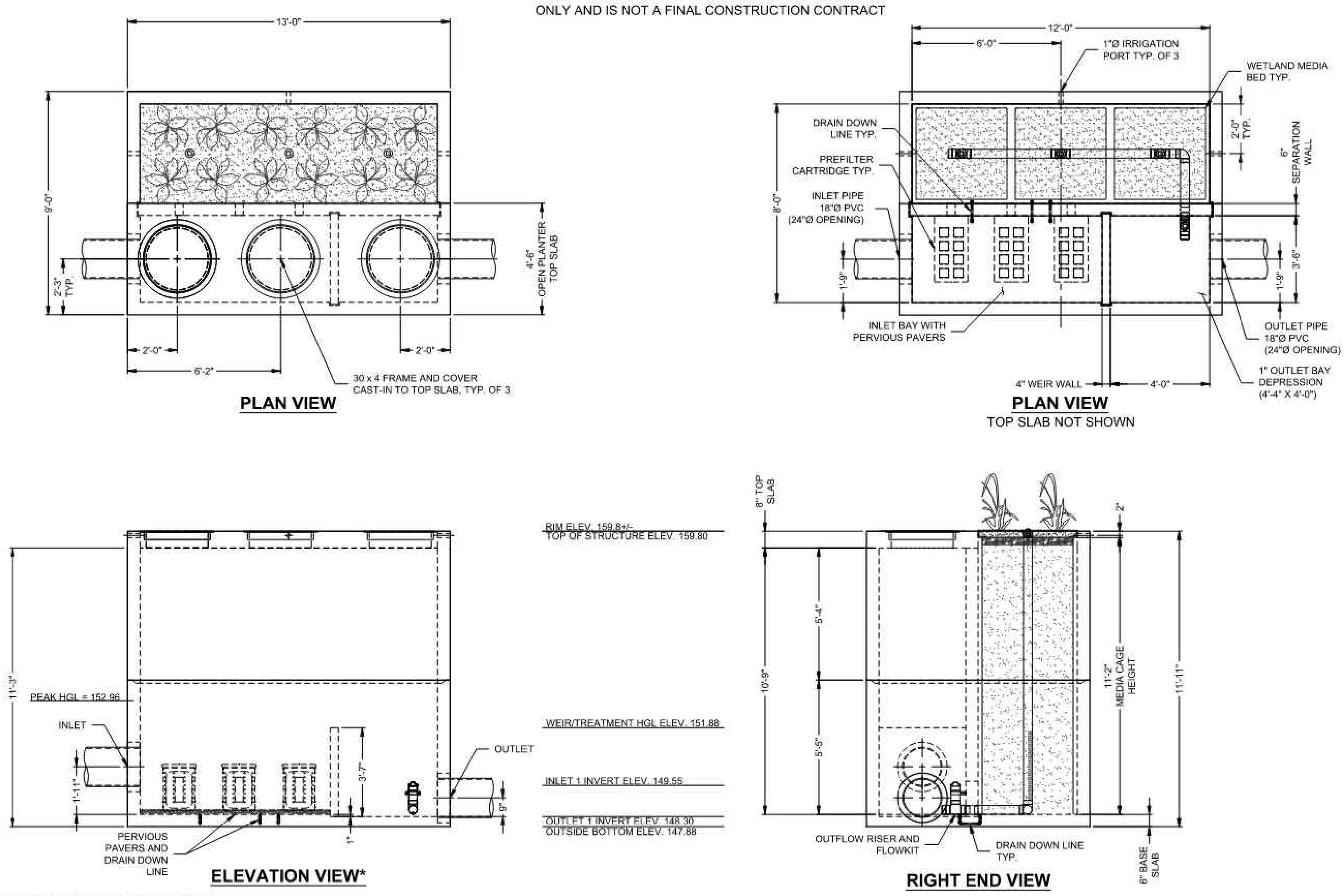
PREPARED BY:
Stantec
38 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

OCVIBE
PARKING DECK A
FINAL WQMP EXHIBIT
ANAHEIM, CA

DATE: 10/27/2025
SHEET 1 OF 3
JOB NO. 2042682200

DRAWING: c:\users\tifnguyen\dc\accdocs\stantec consulting\2042682200_ocvibe\project files\drawing\exhibit\682200--ex7023.dwg PLOTTED: 10/29/2025 4:51 PM BY: Nguyen, Tiffany

THIS DOCUMENT IS FOR INFORMATIONAL PURPOSES
ONLY AND IS NOT A FINAL CONSTRUCTION CONTRACT



SITE DESIGN DATA	
WATER QUALITY FLOW (CFS)	0.34
PEAK FLOW RATE (CFS)	13.02
RETURN PERIOD (YRS)	100
MAXIMUM POLLUTANT DENSITY (PREFILTER) (GPM/SF)	2.1
PREFILTER LOADING RATE (GPM/SF)	1.99
WETLAND MEDIA LOADING RATE (GPM/SF)	1.00
MEDIA OPERATING HEAD (FT)	3.34
SURFACE LOADING	PEDESTRIAN
GROUNDWATER ELEVATION*	84.8

*GROUNDWATER ELEVATION IS ASSUMED. EOR TO PROVIDE IF KNOWN

STRUCTURE DETAILS	
NUMBER OF DELIVERED PIECES (RISERS TO GRADE NOT NEEDED)	2
MAXIMUM FOOTPRINT	9.00' x 13.00'
DELIVERED HEAVIEST PICK*	37725 LB.
TOP SECTION WITH CASTING FRAMES CAST-IN	24075 LB.
BASE SECTION	26000 LB.
SEPARATION WALL	9925 LB.
WEIR WALL	650 LB.
INTERNAL COMPONENTS	1150 LB.

* HEAVY PICK WEIGHT IS COMPRISED OF BASE SECTION WITH WALLS AND INTERIOR COMPONENTS INSTALLED

RVRSD
6505 / 000000
LAYOUT 4
MWS-L-8-12-L
22.95 TS
5.10 TIW

CONTECH ENGINEERED SOLUTIONS A QUIKRETE® COMPANY
12901 SE 97th Avenue, Clackamas, OR 97015
800-548-4667 503-240-3393 800-561-1271 FAX

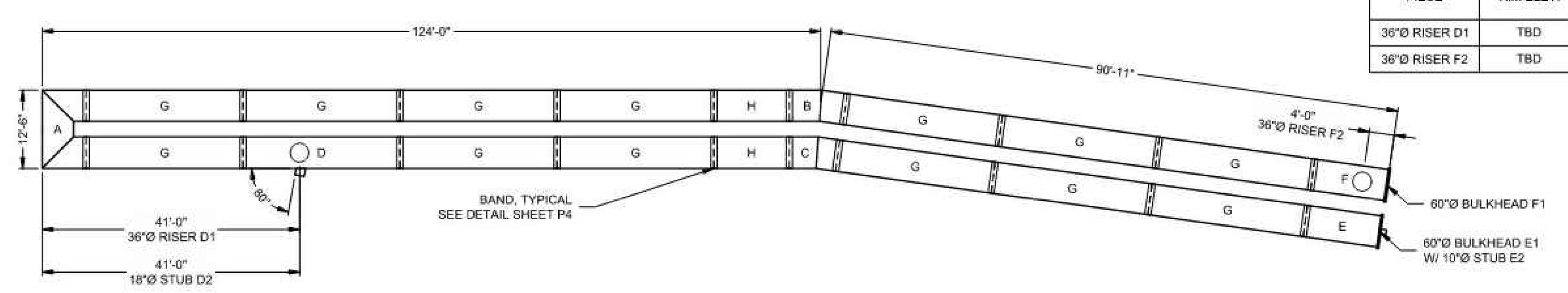
CONTECH PROPOSAL DRAWING

MODULAR WETLANDS MWSL0812OP - 841063-10
OC VIBE - OC VIBE - PARKING DECK A
ANAHEIM, CA
SITE DESIGNATION: MWSL0812

PROJECT No.: 841063	SEQ. No.: 10	DATE: 10/16/25
DESIGNED: JP	DRAWN: JP	
CHECKED: JP	APPROVED: JP	
SHEET NO.: 1 OF 1		

STUB INFORMATION		
PIECE	STUB INVERT	SYSTEM INVERT
18"Ø STUB D2	146.80	146.80
10"Ø STUB E2	146.80	146.80

RISER INFORMATION		
PIECE	RIM ELEV.	SYSTEM INVERT
36"Ø RISER D1	TBD	146.80
36"Ø RISER F2	TBD	146.80



THE UNDERSIGNED HEREBY APPROVES THE ATTACHED (4) PAGES INCLUDING THE FOLLOWING:

- **PIPE STORAGE = 8,650 CF**
- **MAINLINE PIPE GAGE = 16**
- **WALL TYPE = PERFORATED**
- **DIAMETER = 60"**
- **FINISH = ALT2**
- **CORRUGATION = 5x1**

CUSTOMER DATE

ASSEMBLY
SCALE: 1" = 20'
STRUCTURAL BACKFILL STORAGE: 7040 CF
TOTAL STORAGE PROVIDED: 15690 CF
LOADING: H20
PIPE INV. = 146.8'±

NOTES

- THE PIPE SHOULD BE FULLY PERFORATED IN ACCORDANCE WITH AASHTO M 36, SECTION 8.3.2.2, AND USING CLASS 2 PERFORATIONS. THE TOTAL OPEN AREA OF THE PERFORATIONS WILL BE A MINIMUM OF 2.3% OF THE PIPE SURFACE AREA.
- BULKHEADS SHALL BE CONSTRUCTED USING 12 GAGE OR HEAVIER MATERIAL, WITH BOTH THE WATER AND SOIL SIDE FINAL COATINGS MATCHING THE SPECIFIED CMP COATING. BULKHEAD PLATES MUST BE FULLY WELDED TO THE CONNECTING PIPE. THE DESIGN OF BULKHEADS SHALL ADHERE TO CHAPTER 8 OF THE NCSPA CSP DESIGN MANUAL, MEETING THE HEIGHT OF COVER DESIGN REQUIREMENTS WITH APPROPRIATE REINFORCEMENTS OR A MINIMUM REQUIRED PLATE THICKNESS. ADDITIONALLY, REINFORCING MEMBERS SHALL BE POST-COATED WITH ZINC RICH PAINT IN ACCORDANCE WITH AASHTO M36 FOR GALVANIZED AND ALUMINUM CMP SYSTEMS, OR AASHTO M245 FOR POLYMER CMP SYSTEMS.
- ALL FITTINGS SHALL BE STRUCTURALLY CHECKED FOR REINFORCEMENTS PER ASTM A998 AND PROVIDED TO THE EOR FOR APPROVAL UPON REQUEST.
- CONNECTING BANDS FOR INFILTRATION SYSTEMS SHALL BE ANY TYPE, BUT MUST BE AT LEAST 12" WIDE. BANDS SHALL MATCH THE SPECIFIED CMP COATING AND MEET THE REQUIREMENTS OF AASHTO M 36.
- ALL METALLIC COATINGS AFFECTED BY MANUFACTURING FABRICATION SHALL BE REPAIRED PER AASHTO M 36 SECTION 11 REQUIREMENTS (E.G. ZINC-RICH PAINT ON ALL WELDS). IF POLYMER COATINGS ARE USED THE REPAIR OF DAMAGED COATINGS WILL BE IN CONFORMANCE WITH AASHTO M 245 SECTION 11 REQUIREMENTS.

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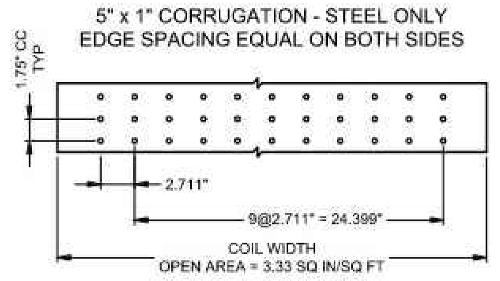
CONTECH CMP DETENTION SYSTEMS
CONTECH PROPOSAL DRAWING

60"Ø PERFORATED UNDERGROUND RETENTION SYSTEM - 841063-015
OC VIBE - OC V!BE - PARKING DECK A
ANAHEIM, CA
SITE DESIGNATION:

PROJECT No.: 841063	SEQ. No.: 015	DATE: 10/17/2025
DESIGNED: JP	DRAWN: JP	
CHECKED: JP	APPROVED: JP	
SHEET NO.: P1 OF 4		

5" x 1" CORRUGATION - STEEL ONLY
EDGE SPACING EQUAL ON BOTH SIDES



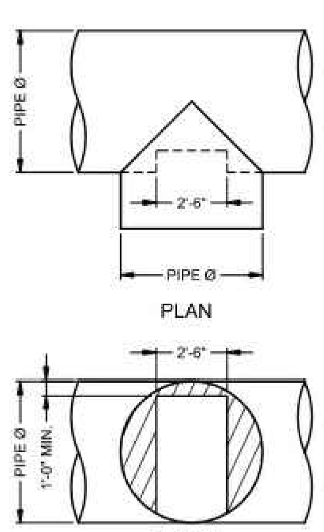
NOTES:
1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. DIMENSIONS SUBJECT TO MANUFACTURER'S TOLERANCES.
4. ALL HOLES 3/8"Ø.

EXFILTRATION AREA
STANDARD PERFORATION PATTERNS

APPROXIMATE AREA PER LINEAR FOOT OF PIPE				
PIPE	CORRUGATION PATTERN			
	2 2/3" x 1/2"	3" x 1"	5" x 1"	ULTRA FLO
60"Ø	61.1 SQ. IN.	64.5 SQ. IN.	62.8 SQ. IN.	

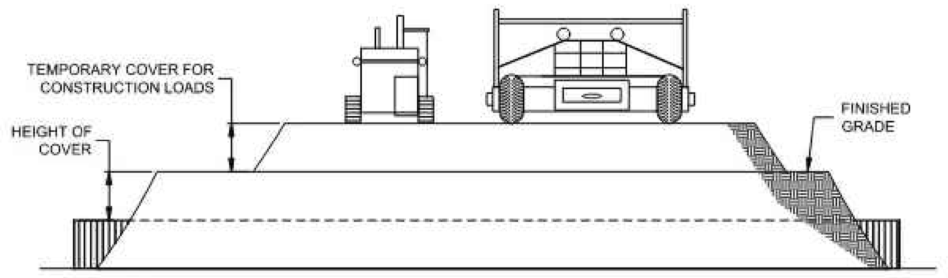
NOTES:
- GAGE AND COATING LIMITATIONS APPLY. 5" x 1" IS NOT AVAILABLE IN ALUMINUM.
- DIMENSIONS SUBJECT TO MANUFACTURER'S TOLERANCES.

TYPICAL PERFORATION DETAIL
NOT TO SCALE



48"Ø to 90"Ø FITTING REINFORCEMENT MAY BE REQUIRED BASED ON HEIGHT OF COVER AND LIVE LOAD CONDITION

TYPICAL MANWAY DETAIL
NOT TO SCALE



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM
NOT TO SCALE

SPECIFICATION FOR CORRUGATED STEEL PIPE-ALUMINIZED TYPE 2 STEEL

SCOPE

THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE CORRUGATED STEEL PIPE (CSP) DETAILED IN THE PROJECT PLANS.

MATERIAL

THE ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M274 OR ASTM A929.

PIPE

THE CSP SHALL BE MANUFACTURED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF AASHTO M36 OR ASTM A760. THE PIPE SIZES, GAGES AND CORRUGATIONS SHALL BE AS SHOWN ON THE PROJECT PLANS.

ALL FABRICATION OF THE PRODUCT SHALL OCCUR WITHIN THE UNITED STATES.

HANDLING AND ASSEMBLY

SHALL BE IN ACCORDANCE WITH RECOMMENDATIONS OF THE NATIONAL CORRUGATED STEEL PIPE ASSOCIATION (NCSPA)

INSTALLATION

SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II OR ASTM A798 AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

ANTI-FLOTATION PROVISIONS DUE TO HIGH GROUNDWATER OR OTHER FLOTATION CONCERNS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.

MATERIAL SPECIFICATION
NOT TO SCALE

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800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH PROPOSAL DRAWING

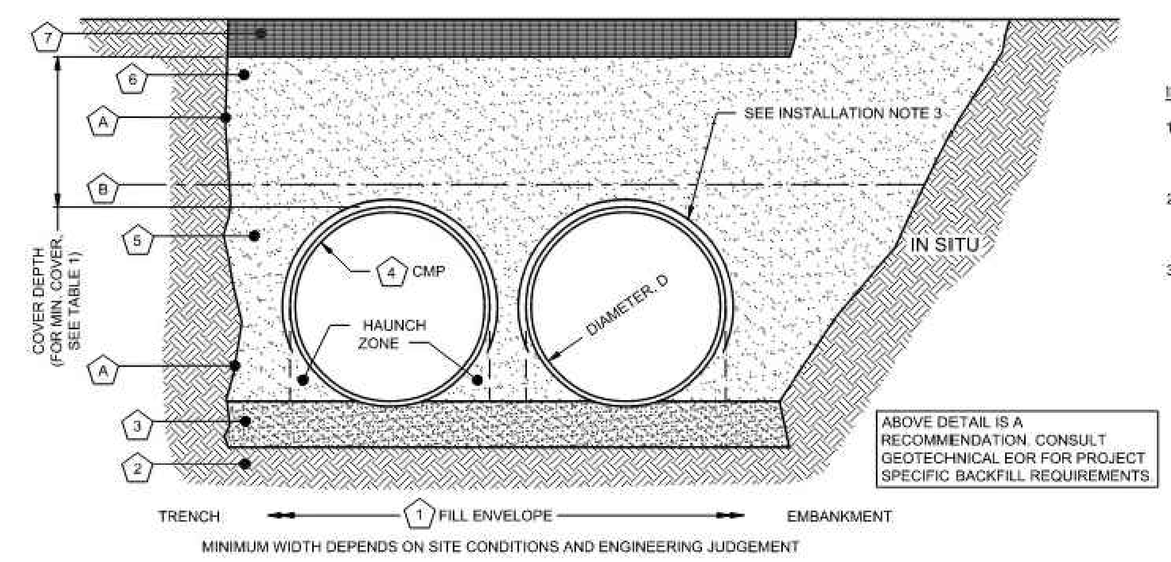
60"Ø PERFORATED UNDERGROUND RETENTION SYSTEM - 841063-015
OC VIBE - OC V!BE - PARKING DECK A
ANAHEIM, CA
SITE DESIGNATION:

PROJECT No.: 841063	SEQ. No.: 015	DATE: 10/17/2025
DESIGNED: JP	DRAWN: JP	
CHECKED: JP	APPROVED: JP	
SHEET NO.: P2 OF 4		

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



ABOVE DETAIL IS A RECOMMENDATION. CONSULT GEOTECHNICAL EOR FOR PROJECT SPECIFIC BACKFILL REQUIREMENTS.

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. AN HDPE MEMBRANE LINER WILL BE PLACED ON THE CROWN OF EACH PIPE TO PROVIDE AN IMPERMEABLE BARRIER AGAINST ENVIRONMENTAL CHANGES THAT MAY ADVERSELY AFFECT THE SYSTEM OVER TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL TECHNICAL DETAILS.

TABLE 2:

	CMP RETENTION STANDARD BACKFILL SPECIFICATIONS			
	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:
- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.
- * APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL
NOT TO SCALE

CONTECH ENGINEERED SOLUTIONS LLC A QUIKRETE® COMPANY
9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH PROPOSAL DRAWING

60"Ø PERFORATED UNDERGROUND RETENTION SYSTEM - 841063-015
OC VIBE - OC V!BE - PARKING DECK A
ANAHEIM, CA
SITE DESIGNATION:

PROJECT No.: 841063	SEQ. No.: 015	DATE: 10/17/2025
DESIGNED: JP	DRAWN: JP	
CHECKED: JP	APPROVED: JP	
SHEET NO.: P3 OF 4		

PREPARED BY:
Stantec
38 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000 stantec.com

OCVIBE
PARKING DECK A
FINAL WQMP EXHIBIT
ANAHEIM, CA

DATE: 10/27/2025
SHEET 2 OF 3
JOB NO. 2042682200

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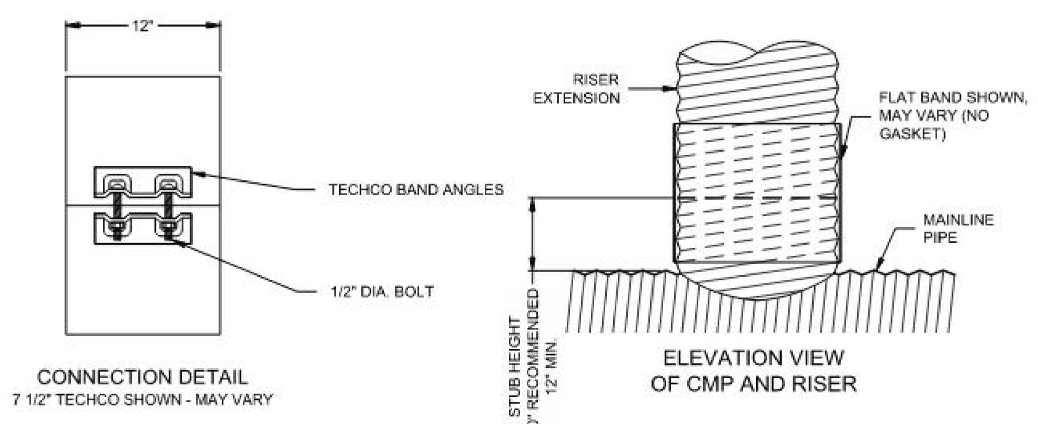
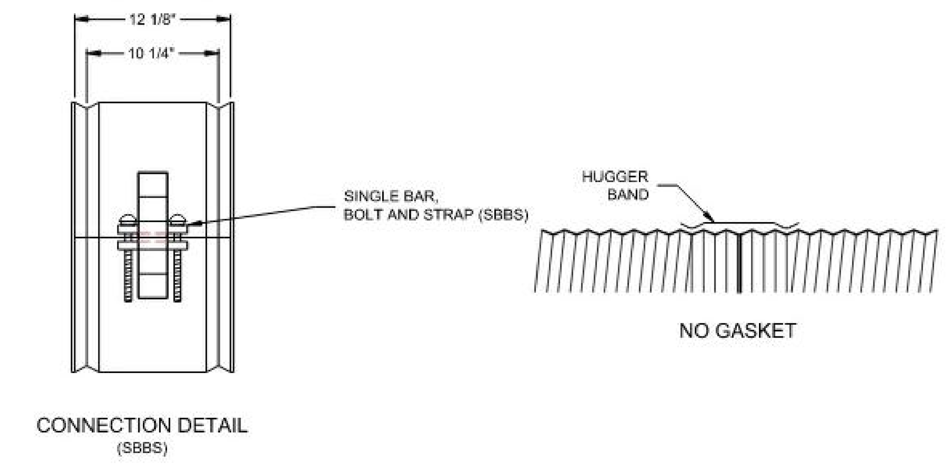


PLAIN END CMP RISER PIPE

GENERAL NOTES:

1. **DELIVERED BAND STYLE AND FASTENER TYPE MAY VARY BY FABRICATION PLANT.**
2. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
3. BAND MATERIAL AND GAGE TO BE SAME AS RISER MATERIAL.
4. IF RISER HAS A HEIGHT OF COVER OF 10' OR MORE, USE A SLIP JOINT.
5. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
   - 12" THRU 48" 1-PIECE
   - 54" 2-PIECES
6. ALL RISER JOINT COMPONENTS WILL BE FIELD ASSEMBLED.
7. MANHOLE RISERS IN APPLICATIONS WHERE TRAFFIC LOADS ARE IMPOSED REQUIRE SPECIAL DESIGN CONSIDERATIONS.
8. DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES.

12" RISER BAND DETAIL
NOT TO SCALE



2 2/3"x1/2" RE-ROLLED END HEL-COR PIPE

GENERAL NOTES:

1. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
2. BAND MATERIALS AND/OR COATING CAN VARY BY LOCATION. CONTACT YOUR CONTECH REPRESENTATIVE FOR AVAILABILITY.
3. BANDS ARE SHAPED TO MATCH THE PIPE-ARCH WHEN APPLICABLE.
4. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
   - 12" THRU 48" 1-PIECE
   - 54" THRU 96" 2-PIECES
   - 102" THRU 144" 3-PIECES
5. BAND FASTENERS ARE ATTACHED WITH SPOT WELDS, RIVETS OR HAND WELDS.
6. ALL CMP IS REROLLED TO HAVE ANNULAR END CORRUGATIONS OF 2 2/3"x1/2"
7. DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
8. ORDER SHALL DESIGNATE GASKET OPTION, IF REQUIRED (SEE DETAILS ABOVE).

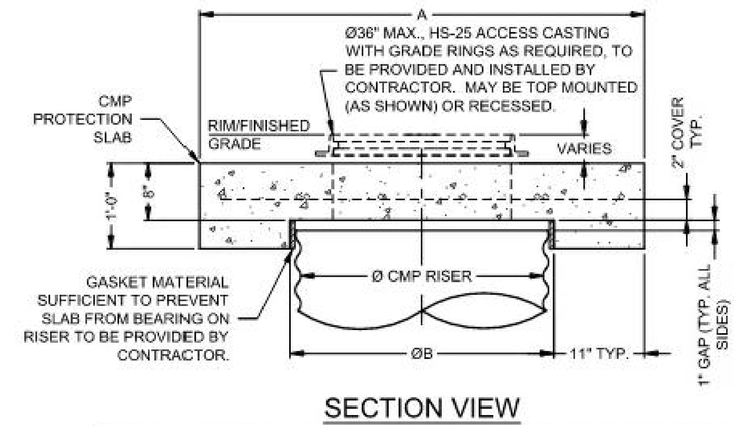
H-12 HUGGER BAND DETAIL
NOT TO SCALE

CONTECH ENGINEERED SOLUTIONS LLC
9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX
CONTECH CMP DETENTION SYSTEMS
CONTECH PROPOSAL DRAWING

MARK	DATE	REVISION DESCRIPTION	BY

60"Ø PERFORATED UNDERGROUND RETENTION SYSTEM - 841063-015
OC VIBE - OC VIBE - PARKING DECK A
ANAHEIM, CA
SITE DESIGNATION:

PROJECT No.: 841063 | SEQ. No.: 015 | DATE: 10/17/2025
DESIGNED: JP | DRAWN: JP
CHECKED: JP | APPROVED: JP
SHEET NO.: P4 OF 4

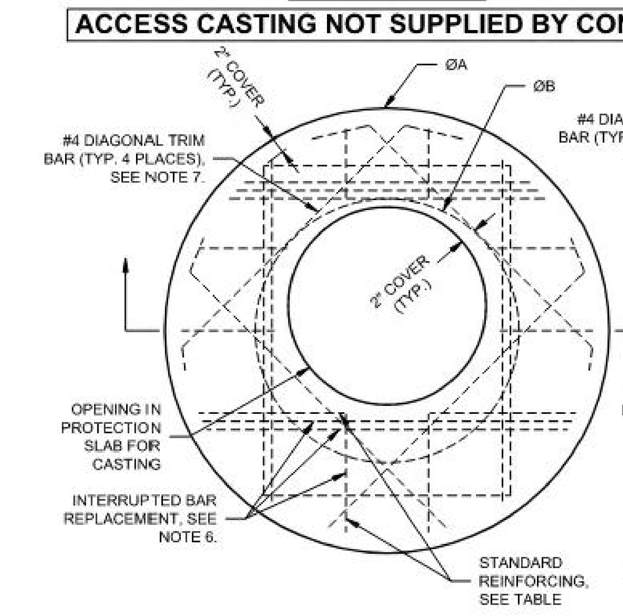


SECTION VIEW

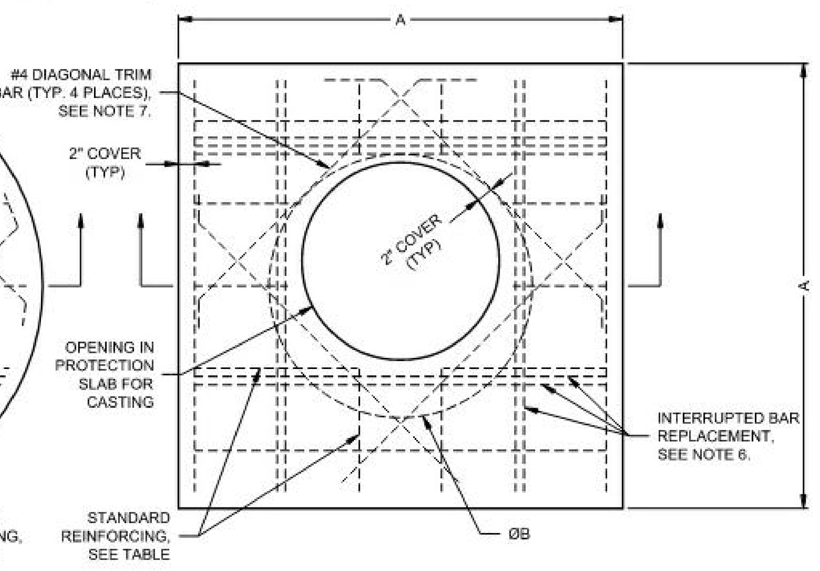
ACCESS CASTING NOT SUPPLIED BY CONTECH

REINFORCING TABLE				
Ø CMP RISER	A	Ø B	REINFORCING	**BEARING PRESSURE (PSF)
24"	Ø 4' 4'x4'	26"	#5 @ 10" OCEW #5 @ 10" OCEW	2,540 1,900
30"	Ø 4'-6" 4'-6" x 4'-6"	32"	#5 @ 10" OCEW #5 @ 9" OCEW	2,260 1,670
36"	Ø 5' 5' x 5'	38"	#5 @ 9" OCEW #5 @ 8" OCEW	2,060 1,500
42"	Ø 5'-6" 5'-6" x 5'-6"	44"	#5 @ 8" OCEW #5 @ 8" OCEW	1,490 1,370
48"	Ø 6' 6' x 6'	50"	#5 @ 7" OCEW #5 @ 7" OCEW	1,210 1,270

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION AND ACI 350.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 4,000 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERS, ARCHITECTS AND LAND SURVEYORS, ENDWELL, NY.
10. THIS DETAIL REFLECTS CAST-IN-PLACE MANHOLE CAP PROTECTION SLAB. PRECAST MANHOLE CAP AVAILABLE IN SELECT MARKETS UNDER SEPARATE SUBMITTAL & DESIGN.

CAST-IN-PLACE MANHOLE CAP DETAIL
NOT TO SCALE

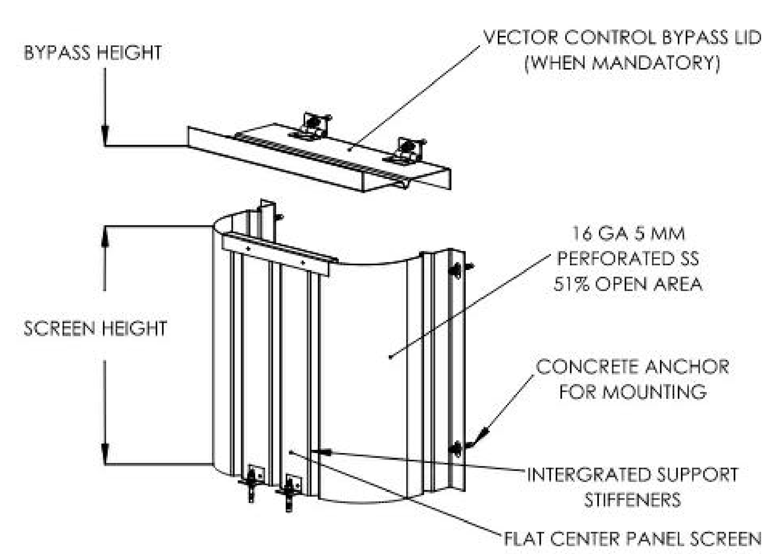
CONTECH ENGINEERED SOLUTIONS LLC
9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX
CONTECH CMP DETENTION SYSTEMS
CONTECH PROPOSAL DRAWING

MARK	DATE	REVISION DESCRIPTION	BY

60"Ø PERFORATED UNDERGROUND RETENTION SYSTEM - 841063-015
OC VIBE - OC VIBE - PARKING DECK A
ANAHEIM, CA
SITE DESIGNATION:

PROJECT No.: 841063 | SEQ. No.: 015 | DATE: 10/17/2025
DESIGNED: JP | DRAWN: JP
CHECKED: JP | APPROVED: JP
SHEET NO.: P5 OF 4

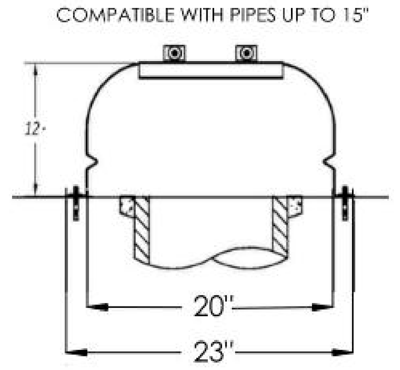
HYDRA CONNECTING PIPE SCREEN (CPS)
U 3.7



CPS "U" WITH 3.7 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	5.26
18	9.66
24	14.88
30	20.80
36	27.35

NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT HYDRA TMDL FOR ADDITIONAL INFORMATION

COMPATIBLE WITH PIPES UP TO 15"



TOP VIEW "U" SHAPE

GENERAL NOTES

1. HYDRA TMDL SYSTEMS TO PROVIDE ALL MATERIAL UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR THE TREATMENT OF FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL, THICKNESS IS 16 GAUGE, AND SCREEN PERFORATION IS 5 MILIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES

1. THE CONTRACTOR IS TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS UNLESS OTHERWISE STATED IN THE MANUFACTURE'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTING PIPE, ENSURING A MINIMUM OF 4-INCH SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR OR GAPS NO GREATER THAN 5-MILIMETERS.

HYDRA® TMDL, LLC.
5116 WEST EMERALD STREET, SUITE A, BOISE, IDAHO
OFFICE: 818-516-4946 EMAIL: DENIS@HYDRATMDL.COM

PREPARED BY:
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949.923.6000 stantec.com

OCVIBE
PARKING DECK A
FINAL WQMP EXHIBIT
ANAHEIM, CA

DATE: 10/27/2025
SHEET 3 OF 3
JOB NO. 2042682200

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VII.2 ROW Significant Redevelopment Footprint Exhibit (if applicable)

Not applicable. Project will replace parkway with new landscaping, sidewalk, curb ramps and driveway aprons. No significant redevelopment in ROW.

VII.3 Electronic Submittal Guidelines

For each electronic submittal, the WQMP must be uploaded to the City of Anaheim's Public Works Electronic Plan Review Portal in PDF format. Optional but recommended attachments include response to comments and grading plans associated with the project.

Prior to the approval of the Final Project-Specific WQMP, the WQMP must have the Project Owner's Certification page signed by the project owner and signed and stamped by the project engineer. The project engineer must also sign and stamp the cover page of the report.

In addition, applicants are required to submit computer files for Final WQMPs. The City's intent is to maintain a Geographic Information System (GIS) database. As such, GIS files are the City's preference. If the GIS file format is not easily accessible, Computer Aided Design (CAD) files may be provided to the City instead. However, to assist in the ease of utilizing GIS files, an ArcGIS Pro template with set feature classes in the geodatabase has been provided. The focus of the project specific information is Drainage Management Areas (DMAs) and Structural Treatment Control Best Management Practices (BMPs). Please find file standards below for each option:

<table>
<tr><th></th><th><u>GIS Files</u></th><th><u>CAD Files</u></th></tr>
<tr><td>File Name</td><td colspan="2">*Project Address*_AnaheimSWPrgm (Ex. 123AnaheimRd._AnaheimSWPrgrm)</td></tr>
<tr><td>File Type</td><td>Shapefile (.shp)</td><td>Drawing (.dwg)</td></tr>
<tr><td>Coordinate System</td><td colspan="2">• NAD83 California States Planes, Zone VI, US Foot (EPSG:2230)
o No shortened or truncated coordinates</td></tr>
<tr><td rowspan="3">Project Specific Information Required</td><td colspan="2">Geometry</td></tr>
<tr><td colspan="2">• A polygon of the Site Boundary
• A polygon for each DMA
• Point (if a BMP is < 200 SF) or a polygon (if a BMP is > 200 SF) at each BMP location</td></tr>
<tr><td></td><td>• One DMA per layer with layer name corresponding to DMA ID
• One BMP per layer with layer name corresponding to BMP ID
• Single closed polylines (no lines, hatches, blocks, or labels)</td></tr>
</table>

	GIS Files	**CAD Files**
	Attributes ***denotes requirements for only projects using City credits**	
Data Provided As	Attribute Table	Excel File (.xlsx), same file name
	DMA Information	
Data Type/Format	*String*	*Text*

	• DMA ID
	  o Ex: DMA 1, DMA 2, etc.
	• Land Use Designation*
	  o Per the WQMP template and/or the Credit Application Instructions
	• Project Treatment Designation
	  o Structural Control, Credits, or both	

Data Type/Format	*Float*	*Number*
	• Area (Round up to nearest SF) • Number of credits to be utilized by the DMA*	
	Structural Treatment BMP Information	
Data Type/Format	*String*	*Text*

	• BMP ID per the WQMP
	  o Ex: BMP 1, BMP 2, etc.
	• Flow or Volume Based
	  o Q or DCV
	• Units
	  o cfs for Q
	  o cu-ft for DCV	

Data Type/Format	*Float*	*Number*
	• Q or DCV to be managed	

Section VIII Educational Materials

Refer to the Orange County Stormwater Program (https://h2oc.org/) for a library of educational materials applicable to the project as checked below.

Education Materials			
Residential Material (https://h2oc.org/)	**Check If Applicable**	**Business Material (https://h2oc.org/)**	**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 (https://h2oc.org/) (BMP Handbooks | California Stormwater Quality Association)**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐	DF-1 Drainage System Operation & Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	R-1 Automobile Repair & Maintenance	☐
Recycle at Your Local Used Oil Collection Center (South County)	☐	R-2 Automobile Washing	☐
Tips for Maintaining a Septic Tank System	☐	R-3 Automobile Parking	☐
Responsible Pest Control	☐	R-4 Home & Garden Care Activities	☐
Sewer Spill	☐	R-5 Disposal of Pet Waste	☐
Tips for the Home Improvement Projects	☐	R-6 Disposal of Green Waste	☐
Tips for Horse Care	☐	R-7 Household Hazardous Waste	☐
Tips for Landscaping and Gardening	☐	R-8 Water Conservation	☐
Tips for Pet Care	☐	SD-10 Site Design & Landscape Planning	☒
Tips for Pool Maintenance	☐	SD-11 Roof Runoff Controls	☒
Tips for Residential Pool, Landscape and Hardscape Drains	☐	SD-12 Efficient Irrigation	☒
Tips for Projects Using Paint	☐	SD-13 Storm Drain Signage	☒
		SD-31 Maintenance Bays & Docs	☐
		SD-32 Trash Storage Areas	☒

Attachment A

Calculations, TGD References, and BMP Information Sheets

BMP SIZING CALCULATIONS

AREA SUMMARY:

	AREA (SF)	AREA (AC)
DMA1	140,915	3.23
DMA1*	12,813	0.29

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN. SEE NEXT PAGE FOR CACULATING EXPOSED AREA.

PERVIOUS & IMPERVIOUS SUMMARY:

	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	TOTAL AREA (SF)	PERVIOUS RATIO	IMPERVIOUS RATIO	RUNOFF COEFFICIENT	DESIGN STORM DEPTH (IN)	DCV (CF)
DMA1	25,942	114,973	140,915	0.184	0.816	0.762	0.85	7,594
DMA1*	0	12,813	12,813	0.000	1.000	0.900	0.85	805
							TOTAL DCV (CF):	8,400

*PARKING STRUCTURE AREAS WITH OPENINGS TO ACCOUNT FOR WIND DRIVEN RAIN. SEE NEXT PAGE FOR CACULATING EXPOSED AREA.

INFILTRATION BASIN SIZING CALCULATIONS:

REQUIRED DESIGN CAPTURE VOLUME (DCV):	8,400 CF
AREA OF 5' DIAMETER PERFORATED CMP:	19.625 SF
LENGTH OF 5' DIAMETER PERFORATED CMP REQUIRED TO RETAIN DCV:	428 LF
LENGTH OF 5' DIAMETER PERFORATED CMP PROVIDED:	430 LF

NOTE: MWS UNIT LOCATED UPSTREAM OF INFILTRATION BASIN FOR PRETREATMENT.

PARKING STRUCTURE AREAS EXPOSED TO WIND-DRIVEN RAIN CALCULATIONS

Sizing Criteria: LID BMP must be sized for 20% of the open areas of the structures longest side and the longest adjacent side, applying the 85th percentile, 24-hour storm depth to this area.

Parking Deck A - DMA1

Longest Side (LS):	561 ft
Longest Adjacent Side (LAS):	167 ft
Height (H):	88 ft
% Open Area (OA):	20%
Additional Area Required =	(LS+LAS) x H x OA
Additional Area Required =	12,813 sf

Worksheet B: Simple Design Capture Volume Sizing Method

Project: PARKING DECK A

Date: 6/18/2025

		DMA =	3.23	ACRES
Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.85	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP(s), *A* (acres)	A=	3.23	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.816	%
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.762	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	7,605	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$[1] (in/hr) (Appendix VII)	$K_{measured}$=	6.7	in/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	1.50	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	4.47	in/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	13.4	hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	5.0	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	1,521	sq-ft
Step 4: Design and Calculate BMP Design Effective Depth and Footprint				
7	Calculate effective depth ($d_{effective}$)[2] based on applicable BMP Fact Sheet	$d_{effective}$=	5.0	ft
8	Calculate BMP design drawdown time[3]	T=	13.4	hours
9a	Calculate minimum area required based on effective depth BMP (sq-ft), $A_{min} = V_{design} / d_{effective}$	A_{min}=	1,521	sq-ft
9b	Enter actual BMP area provided	A_{BMP}=	2,100	sq-ft

[1]$K_{measured}$ is the vertical infiltration measured in the field, before applying a factor of safety. If field testing measures a rate that is different than the observed vertical infiltration rate (for example, three-dimensional borehole percolation rate) then this rate must be adjusted by an acceptable method (for example, Porchet method) to yield the field estimate of vertical infiltration, $K_{measured}$. See Appendix VII.

[2]Effective depth ≤ Maximum depth in row 5. See further guidance for effective depth on pgs 3-4 of this document.

[3]If greater than 48 hours, adjust BMP design to meet 48 hours drawdown time. If BMP design is based on drawdown greater than 48 hours, Worksheet C must be utilized to design for 80% capture efficiency.

[4]Provided BMP area should be based on the footprint at the bottom of ponding for all BMPs with dedicated surface-level ponding and/or side slopes. See following pages for additional guidance.

Worksheet C: Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs

Project:

Date:

		DMA=		
Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=		inches
2	Enter calculated drawdown time of the proposed BMP based on equation provided in applicable BMP Fact Sheet, T^1 (hours)	T=		hours
3	Using Figure III.2, determine the "fraction of design capture storm depth" at which the BMP drawdown time (T) line achieves 80% capture efficiency, X_1	X_1=		
4	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=		inches
5	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=		%
6	Using Figure III.2, determine the fraction of "design capture storm depth" at which the drawdown time (T) achieves the equivalent of the upstream capture efficiency (Y_2), X_2	X_2=		
7	Calculate the fraction of design volume that must be provided by BMP, $fraction = X_1 - X_2$	fraction=		
8	Calculate the resultant design capture storm depth (inches), $d_{fraction} = fraction \times d$	$d_{fraction}$=		inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP(s), *A* (acres)	A=		acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=		%
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=		
4	Calculate runoff volume, $V_{design} = (C \times d_{fraction} \times A \times 43560 \times (1/12))$	V_{design}=		cu-ft
Step 3: Calculate BMP footprint required				
1	Enter BMP ponding depth (d_p) or effective depth ($d_{effective}$) depending on proposed BMP type[2]	$d_{effective}$= or d_p=		acres
2	Calculate minimum area required based on effective or ponded depth BMP (sq-ft), $A_{min} = [V_{design} / d_{effective}], [V_{design} / d_p]$	A_{min}=		sq-ft
3	Enter actual BMP area provided[3]	A_{BMP}=		sq-ft

[1]Drawdown time (T/DD) is based on ponding or effective depth of the BMP depending on BMP type for 80% capture sizing. See pgs 3-4 of this document for guidance on determining these criteria.

[2]BMP depth to calculate minimum area of BMP varies depending on BMP type. See pgs 3-4 of this document for guidance on determining these criteria.

[3]Provided BMP area should be based on the footprint at the bottom of ponding for all BMPs with dedicated surface-level ponding and/or side slopes. See following pages for additional guidance.

Infiltration BMPs

Calculating effective depth for the various types of infiltration BMPs varies depending on BMP geometry. For infiltration BMP sizing, credit can be taken for each layer of the infiltration BMP including ponding, media and gravel, as appropriate. The equation below can be utilized to determine effective depth when employing both the Simple Method and the 80% Capture Efficiency Method for sizing the BMPs:

$$\textit{Effective depth: } d_{effective} = d_p + (d_{media} * n_{media}) + (d_{gravel} * n_{gravel})$$

Where,

Ponding Depth = d_p (ft)
Media Depth = d_{media} (ft)
Media Porosity (n_{media}) = 0.2 unless otherwise verified
Gravel Depth = d_{gravel} (ft)
Gravel Porosity (n_{gravel}) = 0.35 unless otherwise verified

To calculate drawdown time (DD or T), the effective depth is divided by the design infiltration rate (K_{Design}) as shown below:

$$\textit{Drawdown (DD or T)} = (d_{effective}) / (K_{Design}) \times 12$$

See some additional details below when utilizing the Simple Method versus the 80% Capture Efficiency method for final infiltration BMP sizing:

- **Simple Method:** Drawdown must be within 48 hours. If greater than 48 hours based on BMP geometry, 80% Capture Efficiency Method must be employed.
- **80% Capture Efficiency Method:** Can be employed with any drawdown time, with the following BMP specific considerations:
  - Drawdown cannot exceed 96 hours even when 80% Capture Efficiency Method is utilized due to vector control concerns.

Infiltration BMP Footprints

For all BMPs that feature dedicated surface-level ponding areas or side slopes (e.g. bioretention without underdrain, infiltration trenches), the calculated minimum area and designed BMP footprint should both correspond the *bottom footprint only* of the BMP and cannot use area under side slopes for storage credit unless additional justification is provided.

Biotreatment BMPs

Calculating effective depth for the various types of biotreatment BMPs also varies depending on BMP geometry. For biotreatment BMP sizing, however, the effective depth that can be counted for treating the water quality volume is typically limited to the ponding depth and/or the “filtered” depth depending on BMP sizing method. Gravel, as it does not provide treatment, cannot be counted towards the treatment volume. See details below for the differences in calculating effective depth for the Simple Method versus the 80% Capture Efficiency Method and additional specifications for certain BMP types:

Simple Method Biotreatment BMP Sizing Details

For Bioretention with Underdrain BMPs (BIO-1), an additional step must be taken to determine the filtered depth through the media as it compares to the ponding depth. The filtered depth is estimated as the amount of water routed through the media during the design storm, or the ponding depth, whichever is smaller.

$$\text{Filtered depth: } d_{filtered} = MIN\ [((K_{Media} * T_{routing})/12),\ d_p]$$

$$\textit{Effective depth: } d_{effective} = d_p + d_{filtered}$$

Where,

K_{media} = 2.5 in/hr unless otherwise verified
$T_{routing}$ ≤ 3 hrs per BMP Fact sheet
Ponding Depth = d_p (ft)

For Simple Method BMP sizing, the drawdown time (DD or T) of the ponding depth through the media must be within 48 hours, which is calculated using the media filtration rate (K_{media}) as shown below:

$$\textit{Drawdown (DD or T)} = (d_p / K_{Media}) \times 12$$

Where,

Ponding Depth = d_p (ft)
Media Filtration Rate (K_{media}) = 2.5 in/hr unless otherwise verified

80% Capture Efficiency Biotreatment BMP Sizing Details

When applying the 80% Capture Efficiency method for biotreatment BMP sizing, only the ponding depth can be counted towards the effective depth.

$$\textit{Effective depth: } d_{effective} = d_p$$

Drawdown is calculated the same way for 80% Capture Efficiency as compared to the Simple Method shown above.

$$\textit{Drawdown } (DD_p) = (d_p) / (K_{Media}) \times 12$$

Where,

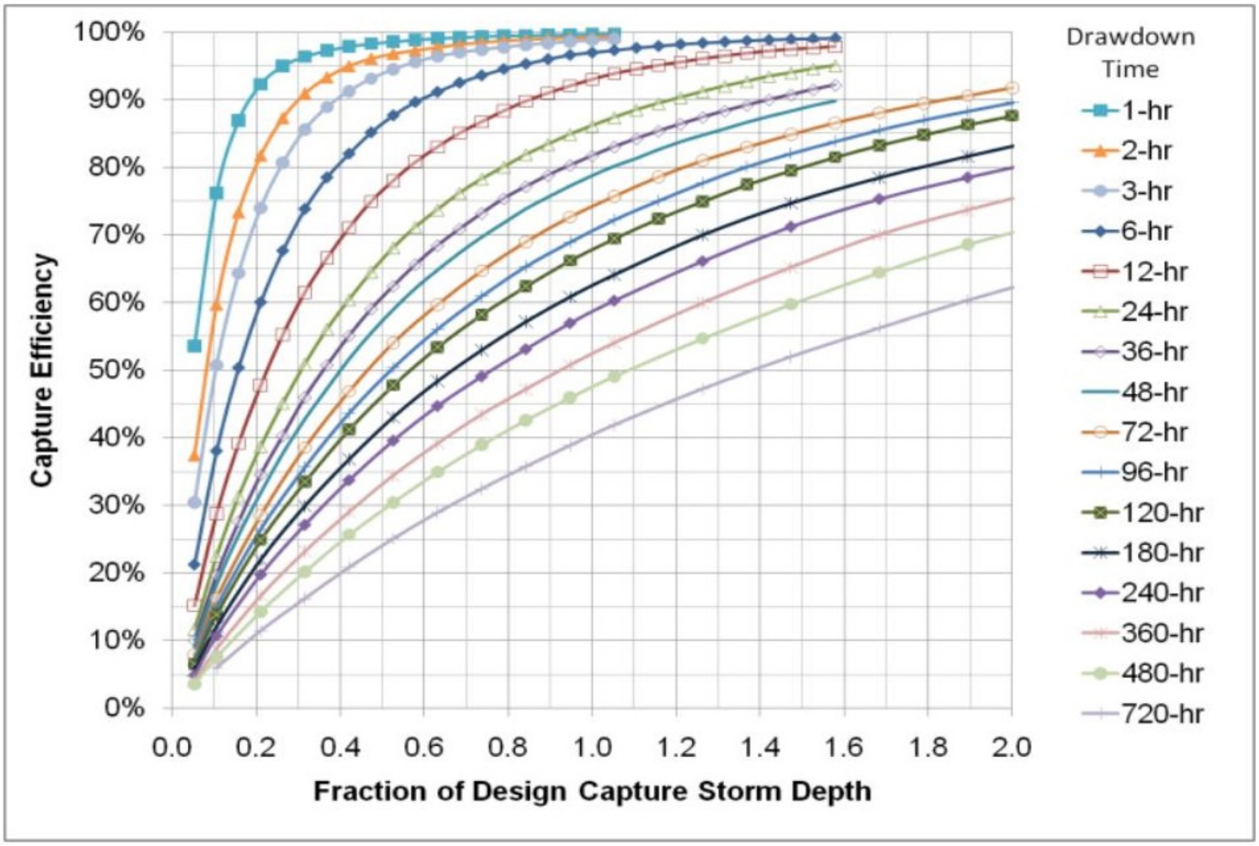
K_{media} = 2.5 in/hr unless otherwise verified
DD_p ≥ 3 hours per BMP Fact sheet for 80% Capture Efficiency Method
Ponding Depth = d_p (ft)

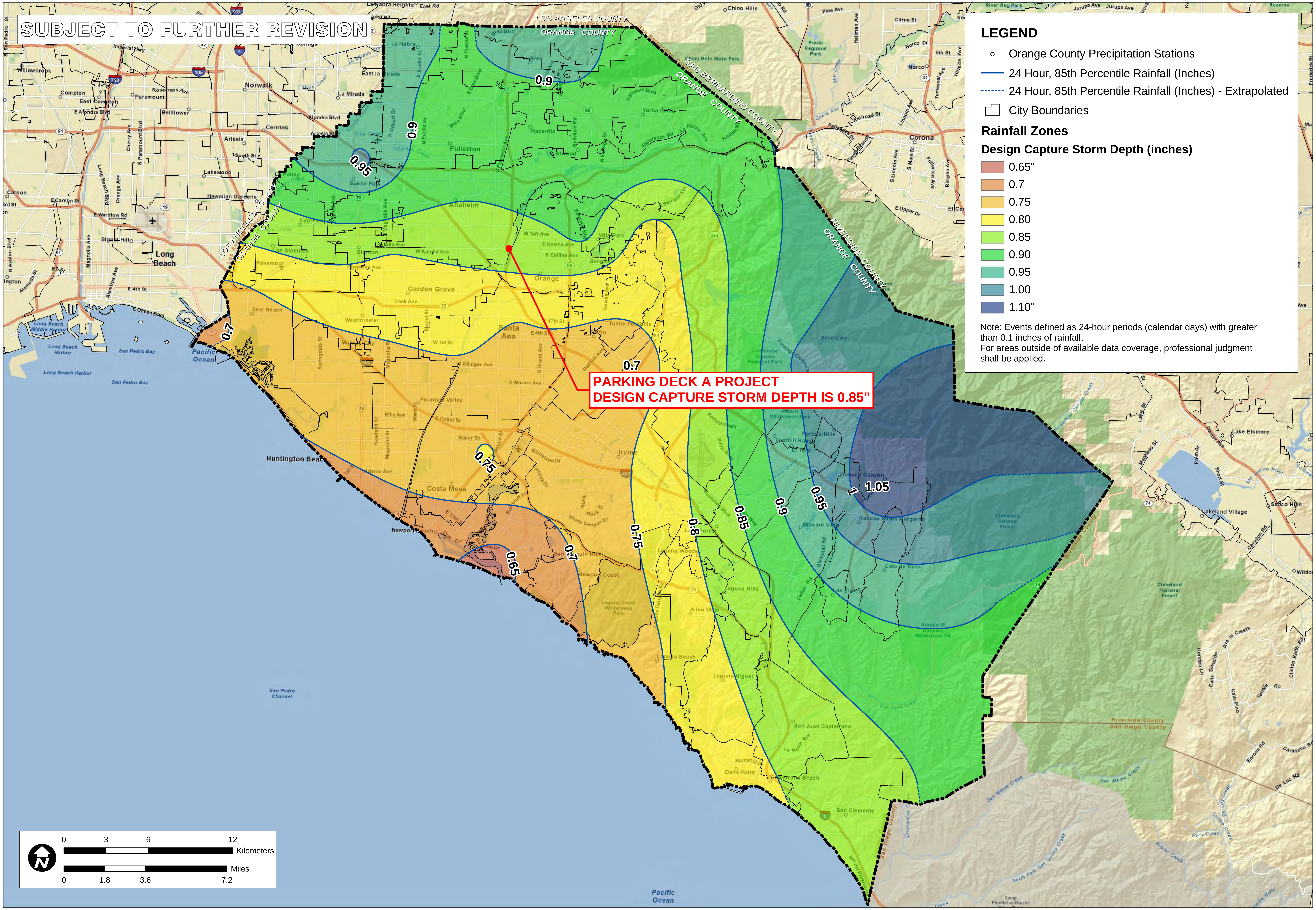
See Figure III.2 *Capture Efficiency Nomograph for Constant Drawdown Systems in Orange County* below, that is utilized when sizing BMPs following the 80% Capture Efficiency Method.

Biotreatment BMP Footprints

For all BMPs that feature dedicated surface-level ponding areas or side slopes (e.g. bioretention with underdrain), the calculated minimum area and designed BMP footprint should both correspond the *bottom footprint only* of the BMP and cannot use area under side slopes for storage credit unless additional justification is provided.

Figure III.2. Capture Efficiency Nomograph for Constant Drawdown Systems in Orange County





TITLE
RAINFALL ZONES

JOB
ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT
ORANGE CO. CA

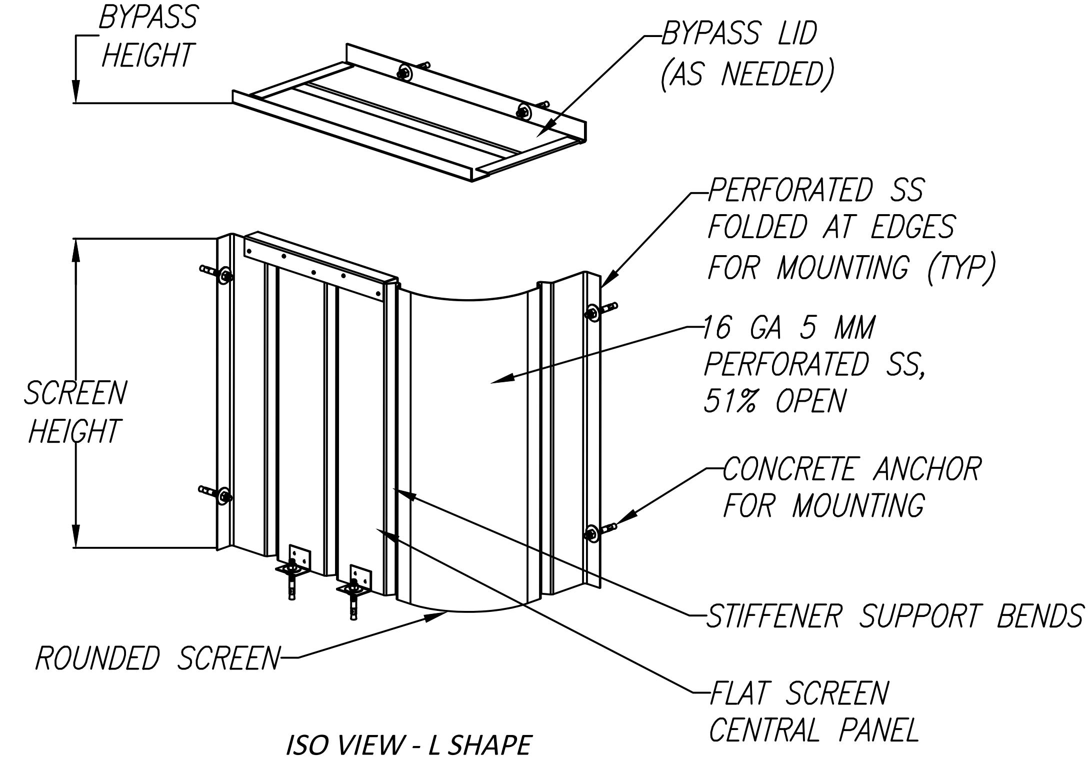
SCALE 1" = 1.8 miles
DESIGNED TH
DRAWING TH
CHECKED BMP
DATE 04/22/10
JOB NO. 9526-E

PACE Advanced Water Engineering

FIGURE
XVI-1

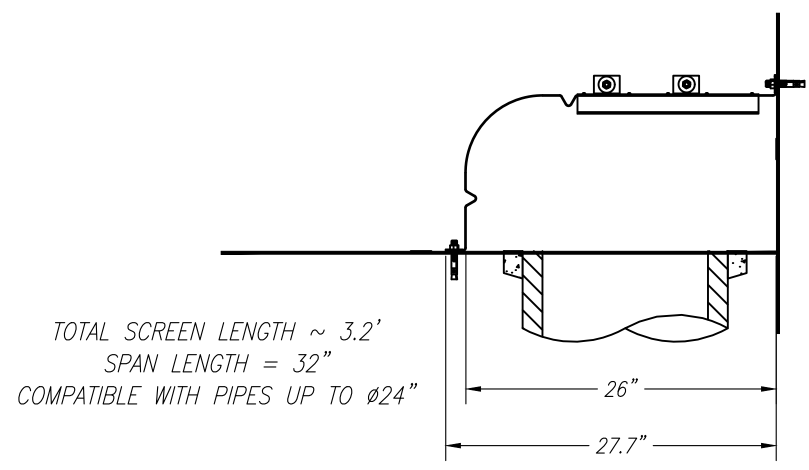
P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

CONNECTOR PIPE SCREEN (CPS)
L 3.2



ISO VIEW - L SHAPE

CPS L WITH 3.2 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	4.53
18	8.32
24	12.81
30	17.91
36	23.55
NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT BIO CLEAN FOR ADDITIONAL INFORMATION.	



TOP SECTION VIEW - L SHAPE

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR TREATMENT FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL. THICKNESS IS 16 GAUGE. SCREEN PERFORATIONS ARE 5 MILLIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTOR PIPE, ENSURING A MIN. OF 4" SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR, OR WITH GAPS NO GREATER THAN 5 MM.
3. IF A BYPASS LID IS REQUIRED, VERIFY THE BYPASS HEIGHT NEEDED AND MARK THAT LOCATION ON THE WALL DIRECTLY ABOVE THE BASE UPRIGHTS. LIFT THE LID IN PLACE AND MARK THE HOLE LOCATIONS FOR THE LID MOUNTING BRACKETS. SECURE THE LID WITH STAINLESS STEEL NUTS.

WARRANTY: 3 YEAR MANUFACTURER'S		MEETS FULL CAPTURE REQUIREMENTS	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 1/17/2020	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

Hydra TMDL Systems, Inc. CPS (L-Shaped) Characteristics and Capacity Table
California Full Capture Certified Capacities

TABLE 2

CPS Length (ft)	CPS Height (in)	Net Open Area (Screen) (S.F.)	Treatment Capacity (CFS)
2.7	12	1.39	3.84
3.7	12	1.90	5.26
2.7	18	2.08	7.06
3.7	18	2.84	9.66
4.7	18	3.61	12.26
2.7	24	2.77	10.88
3.7	24	3.79	14.88
4.7	24	4.81	18.88
2.7	30	3.46	15.20
3.7	30	4.74	20.80
4.7	30	6.01	26.40
2.7	36	4.16	19.99
3.7	36	5.69	27.35
4.7	36	7.22	34.71

*Other standard and custom model sizes available. Contact Hydra TMDL Systems, Inc. for more information

The equation below is used to calculate hydraulic capacity:

$$Orifice\ Equation: Q = C\ A\ \ \sqrt{2gh}$$

where,
Q = flow rate [in^3/s] *converted to [CFS and GPM]
C = coefficient of discharge [0.53 used by Hydra TMDL Systems, Inc.]
A = area of orifice or net open area [in^2] = area of screen [in^2] * % open area
g = acceleration from gravity [in/s^2]
h = head acting on the centerline of each screening window [in]

3. D. Comparison Tables

Please see Section 3.C. for hydraulic capacity tables for five standard sizes of the CPS in U-shape and L-shape configurations.

3. E. Design Drawings

Please refer to Appendix A for representative design drawings of the configurations.

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2016 Advanced Engineering Software (aes)
              Ver. 23.0  Release Date: 07/01/2016  License ID 1535

                           Analysis prepared by:

                                  Stantec



 ************************ DESCRIPTION OF STUDY ************************
* OCVIBE - Deck A                                                            *
* 1-YR Storm Analysis - Proposed Developed Condition                         *
* 2042682200\design\drain\deck_a_preliminary_drainage_study\VIBEDA1.dat      *
 **************************************************************************

  FILE NAME: VIBEDA1.DAT
  TIME/DATE OF STUDY: 15:26 06/13/2025
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    1.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED TABLED RAINFALL USED*
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  5
   1)    5.00;  1.510
   2)   10.00;  1.080
   3)   15.00;  0.872
   4)   30.00;  0.602
   5)   60.00;  0.422
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
```

```
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   375.00
  ELEVATION DATA: UPSTREAM(FEET) =    161.00  DOWNSTREAM(FEET) =    158.05

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.624
  *   1 YEAR RAINFALL INTENSITY(INCH/HR) =  1.012
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       B        0.45      0.30     0.600    36   11.62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.34
  TOTAL AREA(ACRES) =      0.45   PEAK FLOW RATE(CFS) =      0.34

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   150.60  DOWNSTREAM(FEET) =   149.96
  FLOW LENGTH(FEET) =    64.00   MANNING'S N =  0.010
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   2.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.33
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.34
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =   11.94
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     439.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.94
  RAINFALL INTENSITY(INCH/HR) =   1.00
  AREA-AVERAGED Fm(INCH/HR) =  0.18
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.60
  EFFECTIVE STREAM AREA(ACRES) =       0.45
  TOTAL STREAM AREA(ACRES) =       0.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.34

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   154.00
  ELEVATION DATA: UPSTREAM(FEET) =    159.27  DOWNSTREAM(FEET) =    157.48

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.557
  *   1 YEAR RAINFALL INTENSITY(INCH/HR) =  1.462
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.29      0.30     0.100    36    5.56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.29   PEAK FLOW RATE(CFS) =      0.37

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    5.56
  *   1 YEAR RAINFALL INTENSITY(INCH/HR) =  1.462
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.18      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.18      SUBAREA RUNOFF(CFS) =    0.23
  EFFECTIVE AREA(ACRES) =      0.47   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =       0.61

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   153.48  DOWNSTREAM(FEET) =   153.00
  FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.010
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.24
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.61
  PIPE TRAVEL TIME(MIN.) =   1.71    Tc(MIN.) =    7.27
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =     384.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.27
  *   1 YEAR RAINFALL INTENSITY(INCH/HR) =  1.315
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                B        0.16      0.30     0.850    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.16      SUBAREA RUNOFF(CFS) =    0.15
  EFFECTIVE AREA(ACRES) =      0.63   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =       0.6       PEAK FLOW RATE(CFS) =      0.70

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   153.00  DOWNSTREAM(FEET) =   151.00
  FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.010
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.03
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.70
  PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =    8.13
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    106.00 =     591.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.13
  *   1 YEAR RAINFALL INTENSITY(INCH/HR) =  1.241
```

```
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        2.15      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    2.34
  EFFECTIVE AREA(ACRES) =      2.78   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.14
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =       3.00

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   151.00  DOWNSTREAM(FEET) =   149.96
  FLOW LENGTH(FEET) =   111.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.87
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.00
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =    8.44
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    102.00 =     702.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.44
  RAINFALL INTENSITY(INCH/HR) =   1.21
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.14
  EFFECTIVE STREAM AREA(ACRES) =       2.78
  TOTAL STREAM AREA(ACRES) =       2.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.00

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.34   11.94    0.999  0.30( 0.18) 0.60       0.4     100.00
      2        3.00    8.44    1.214  0.30( 0.04) 0.14       2.8     103.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.30    8.44    1.214  0.30( 0.06) 0.19       3.1     103.00
      2        2.78   11.94    0.999  0.30( 0.06) 0.21       3.2     100.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.30    Tc(MIN.) =     8.44
  EFFECTIVE AREA(ACRES) =       3.10   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.19
  TOTAL AREA(ACRES) =        3.2
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    102.00 =     702.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   149.49  DOWNSTREAM(FEET) =   148.42
  FLOW LENGTH(FEET) =    71.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.21
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.30
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    8.61
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    107.00 =     773.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   153.92  DOWNSTREAM(FEET) =   152.12
  FLOW LENGTH(FEET) =   393.00   MANNING'S N =  0.010
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.62
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.30
  PIPE TRAVEL TIME(MIN.) =   1.42    Tc(MIN.) =   10.03
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    108.00 =    1166.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   152.12  DOWNSTREAM(FEET) =   148.75
```

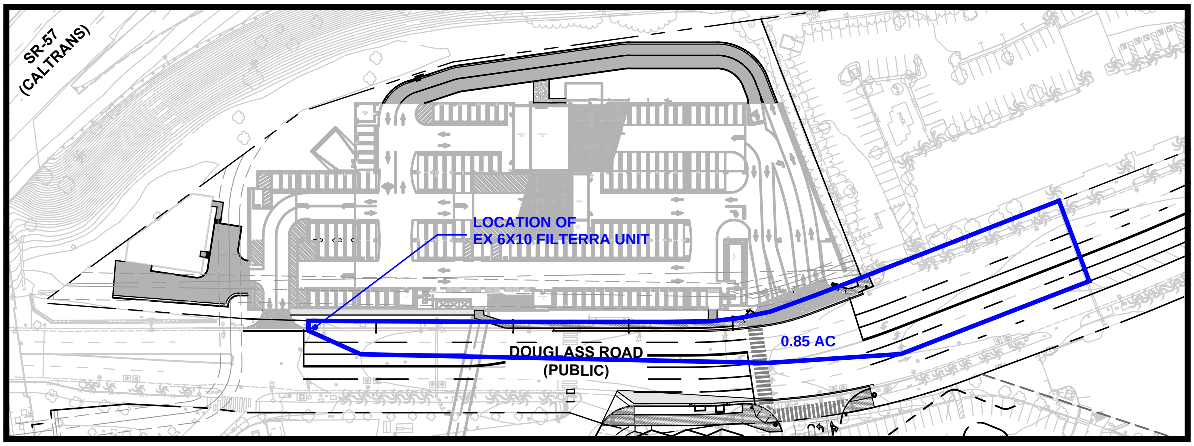
```
  FLOW LENGTH(FEET) =     5.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.62
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.30
  PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =   10.03
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    109.00 =    1171.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =     10.03
  EFFECTIVE AREA(ACRES) =      3.10  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.190
  PEAK FLOW RATE(CFS)   =       3.30

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       3.30   10.03    1.079  0.30( 0.06) 0.19       3.1     103.00
      2       2.78   13.64    0.929  0.30( 0.06) 0.21       3.2     100.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CALCULATION TO CONFIRM CAPACITY OF EXISTING 6'X10' FILTERRA UNIT IN DOUGLASS ROAD.

WQDF = (C)(I)(A) = (0.85)(0.23)(0.85 AC) = 0.166 CFS

PER SIZING TABLE BELOW, THE EXISTING 6'X10' FILTERRA HAS ENOUGH CAPACITY.



Filterra Infiltration Rate	(in/hr)	140
Filterra flow per ft^2	(ft3/sec/ft2)	0.0032

Available Filterra Box Sizes			
Length	Width	Surface Area	Treatment Capacity
(ft)	(ft)	(ft2)	(ft^3/sec)
4	4	16	0.0519
6	4	24	0.0778
6.5	4	26	0.0843
8	3	24	0.0778
8	4	32	0.1037
12	4	48	0.1556
6	6	36	0.1167
8	6	48	0.1556
10	6	60	0.1944
12	6	72	0.2333
13	7	91	0.2949
12	8	96	0.3111
14	8	112	0.3630
16	8	128	0.4148
18	8	144	0.4667

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	11.10	minutes
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=	0.225	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (**Worksheet A**)	d_{HSC}=	0.85	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (**Worksheet A**)	Y_2=	100	%
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=	0.225	
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1 - I_2$	I_{design}=	0.225	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), A (acres)	A=	3.23(1) 0.29(2)	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.816(1) 1.000(2)	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.762(1) 0.900(2)	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.554(1) 0.059(2)	cfs

Supporting Calculations

Notes: (1) Value for DMA1 tributary area.
(2) Value for DMA1 parking structure areas with openings to account for wind-driven rain.
Total Q_{design} is equal to 0.613.

Describe system:

The proposed onsite storm drain conveys surface drainage from the existing building, pavements, planter areas and new parking structure. Tributary area also includes parking structure areas with openings to account for wind-driven rain. Runoff is directed to a Modular Wetland System (MWS) unit for pretreatment prior to flows discharging into an underground infiltration basin comprised of 5' diameter perforated CMP. Larger storm flows drain into an overflow pipe that connects to the existing 48" storm drain running through the project site.

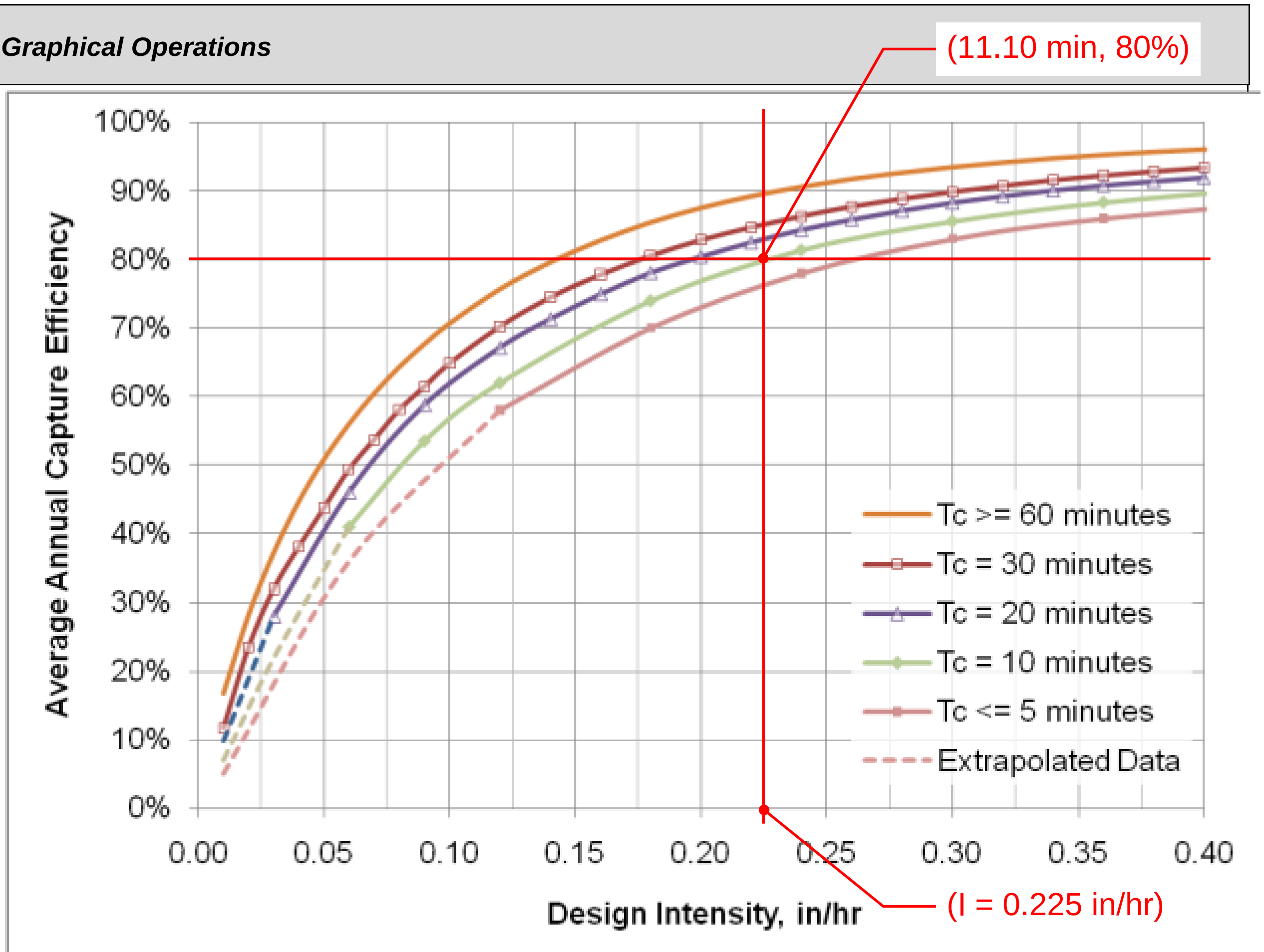
Proprietary and flow based biotreatment BMPs for pretreatment shall be sized for 50% of the total design flow. Total design flow is 0.613 cfs. 50% of the total design flow is 0.307 cfs. Based on the MWS unit sizing charts, the project will use an MWS-L-8-12.

Provide time of concentration assumptions:

Rational method calculations were prepared for the proposed condition 2-year storm. Attached is the AES rational method results showing a Time of Concentration of 11.10 minutes.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Graphical Operations



Provide supporting graphical operations. See Example III.7.

Worksheet A: Hydrologic Source Control Calculation Form

Drainage area ID	DMA 1
Total drainage area	3.23 acres
Total drainage area Impervious Area (IA_{total})	2.64 acres

HSC ID	HSC Type/ Description/ Reference BMP Fact Sheet	Effect of individual HSC_i per criteria in **BMP Fact Sheets (XIV.1)** (d_{HSCi})[1]	Impervious Area Tributary to HSC_i (IA_i)	$d_i \times IA_i$
DMA1	HSC-1 / UNDERGROUND INFILTRATION BASIN / INF-7	0.85	2.64	2.24
Box 1:		$\sum d_i \times IA_i =$		2.24
Box 2:		$IA_{total} =$		2.64
[Box 1]/[Box 2]:		$d_{HSC\ total} =$		0.85
		Percent Capture Provided by HSCs (Table III.1)		100%

1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
             (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
          (c) Copyright 1983-2016 Advanced Engineering Software (aes)
              Ver. 23.0  Release Date: 07/01/2016  License ID 1535

                           Analysis prepared by:

                                  Stantec




 ************************ DESCRIPTION OF STUDY ************************
* OCVIBE - DECK A                                                          *
* 2-YR Storm Analysis - Proposed Condition                                 *
* 2042682200\design\npdes\preliminary wqmp\deck_a\3rd_submittal\pda2p.dat  *
 **************************************************************************

  FILE NAME: PDA2P.DAT
  TIME/DATE OF STUDY: 09:35 07/29/2025
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   400.00
  ELEVATION DATA: UPSTREAM(FEET) =    161.00  DOWNSTREAM(FEET) =    158.05

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.915
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.624
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                B        0.14      0.30     0.100    36    8.92
  APARTMENTS                B        0.31      0.30     0.200    36    9.50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
  SUBAREA RUNOFF(CFS) =      0.64
  TOTAL AREA(ACRES) =      0.45   PEAK FLOW RATE(CFS) =      0.64

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   150.60  DOWNSTREAM(FEET) =   149.86
  FLOW LENGTH(FEET) =    62.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.35
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.64
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    9.22
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     462.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.22
  RAINFALL INTENSITY(INCH/HR) =   1.59
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       0.45
  TOTAL STREAM AREA(ACRES) =       0.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.64

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   175.00
  ELEVATION DATA: UPSTREAM(FEET) =    159.27  DOWNSTREAM(FEET) =    158.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.931
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.877
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp        Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B       0.09      0.30     0.100    36    6.93
  APARTMENTS                 B       0.20      0.30     0.200    36    7.39
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
  SUBAREA RUNOFF(CFS) =      0.48
  TOTAL AREA(ACRES) =      0.29   PEAK FLOW RATE(CFS) =      0.48

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.93
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.877
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp        Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B       0.05      0.30     0.100    36
  APARTMENTS                 B       0.13      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
  SUBAREA AREA(ACRES) =    0.18      SUBAREA RUNOFF(CFS) =    0.30
  EFFECTIVE AREA(ACRES) =      0.47   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   155.40  DOWNSTREAM(FEET) =   153.00
  FLOW LENGTH(FEET) =   227.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.41
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       0.77
  PIPE TRAVEL TIME(MIN.) =   1.11    Tc(MIN.) =    8.04
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.04
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.724
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                B        0.16      0.30     0.850    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.16      SUBAREA RUNOFF(CFS) =    0.21
  EFFECTIVE AREA(ACRES) =      0.63   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =        0.6       PEAK FLOW RATE(CFS) =       0.92

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   153.00  DOWNSTREAM(FEET) =   151.00
  FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.48
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.92
  PIPE TRAVEL TIME(MIN.) =   0.99    Tc(MIN.) =    9.03
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    106.00 =     609.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.03
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.612
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.64      0.30     0.100    36
  APARTMENTS                 B        1.50      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
```

```
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    3.02
  EFFECTIVE AREA(ACRES) =      2.78   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =      3.88

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    102.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   151.00  DOWNSTREAM(FEET) =   149.86
  FLOW LENGTH(FEET) =   119.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.20
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.88
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    9.41
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    102.00 =     728.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.41
  RAINFALL INTENSITY(INCH/HR) =   1.57
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.21
  EFFECTIVE STREAM AREA(ACRES) =      2.78
  TOTAL STREAM AREA(ACRES) =      2.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.88

  ** CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       0.64    9.22    1.593  0.30( 0.05) 0.17       0.4     100.00
      2       3.88    9.41    1.574  0.30( 0.06) 0.21       2.8     103.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER    (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       4.48    9.22    1.593  0.30( 0.06) 0.20       3.2     100.00
      2       4.51    9.41    1.574  0.30( 0.06) 0.20       3.2     103.00
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.51    Tc(MIN.) =     9.41
  EFFECTIVE AREA(ACRES) =       3.23   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        3.2
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    102.00 =     728.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    107.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   154.01  DOWNSTREAM(FEET) =   152.12
  FLOW LENGTH(FEET) =   413.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.08
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.51
  PIPE TRAVEL TIME(MIN.) =   1.69    Tc(MIN.) =   11.10
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    107.00 =    1141.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =     11.10
  EFFECTIVE AREA(ACRES) =      3.23  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.204
  PEAK FLOW RATE(CFS)   =       4.51

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       4.48   10.91    1.446  0.30( 0.06) 0.20       3.2     100.00
      2       4.51   11.10    1.432  0.30( 0.06) 0.20       3.2     103.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

MWS UNIT SIZING CHART

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Worksheet I: Summary of Groundwater-related Feasibility Criteria

1	Is project large or small? (as defined by **Table VIII.2**) circle one	$\boxed{\text{Large}}$		Small
2	What is the tributary area to the BMP?	A	3.2	acres
3	What type of BMP is proposed?	UNDERGROUND INFILTRATION GALLERY (5' DIAMETER PERFORATED CMP)		
4	What is the infiltrating surface area of the proposed BMP?	A_{BMP}	5,564	sq-ft
5	What land use activities are present in the tributary area (list all) THE EXISTING LANDUSE INCLUDES SIX (6) OFFICE BUILDINGS WITH PARKING, WALKWAYS AND DRIVEWAYS LOCATED THROUGHOUT.			
6	What land use-based risk category is applicable?	L	$\boxed{\text{M}}$	H
7	If M or H, what pretreatment and source isolation BMPs have been considered and are proposed (describe all): MODULAR WETLAND SYSTEM UNIT IS PROPOSED FOR PRETREATMENT.			
8	What minimum separation to mounded seasonally high groundwater applies to the proposed BMP? See Section **VIII.2** (circle one)	5 ft		$\boxed{\text{10 ft}}$
9	Provide rationale for selection of applicable minimum separation to seasonally high mounded groundwater: PER GEOTECHNICAL STUDY PREPARED BY LANGAN DATED JUNE 10, 2025 , THE HISTORICAL HIGH GROUNDWATER LEVEL AT THE SITE IS ON THE ORDER OF 25 FEET BELOW GROUND SURFACE.			
10	What is separation from the infiltrating surface to seasonally high groundwater?	SHGWT	10	ft
11	What is separation from the infiltrating surface to mounded seasonally high groundwater?	Mounded SHGWT	10	ft
12	Describe assumptions and methods used for mounding analysis: PER GEOTECHNICAL STUDY PREPARED BY LANGAN DATED JUNE 10, 2025 , THE HISTORICAL HIGH GROUNDWATER LEVEL AT THE SITE IS ON THE ORDER OF 25 FEET BELOW GROUND SURFACE.			
13	Is the site within a plume protection boundary (See **Figure**	Y	$\boxed{\text{N}}$	N/A

Worksheet I: Summary of Groundwater-related Feasibility Criteria

	VIII.2)?	
14	Is the site within a selenium source area or other natural plume area (See Figure VIII.2)?	Y $\boxed{N}$ N/A
15	Is the site within 250 feet of a contaminated site?	Y $\boxed{N}$ N/A
16	If site-specific study has been prepared, provide citation and briefly summarize relevant findings: BASED ON FIGURE XVI-2F OF TGD, THE PROJECT IS NOT LOCATED IN A SELENIUM CONTAMINATION AREA.	
17	Is the site within 100 feet of a water supply well, spring, septic system?	Y $\boxed{N}$ N/A
18	Is infiltration feasible on the site relative to groundwater-related criteria?	$\boxed{Y}$ N
Provide rationale for feasibility determination: BASED ON GEOTECHNICAL STUDY PREPARED BY LANGAN DATED JUNE 10, 2025, THE NEAREST GROUNDWATER WELLS ARE LOCATED 0.25 MILE TO THE SOUTH AND 0.35 MILE TO THE WEST.		

Note: if a single criterion or group of criteria would render infiltration infeasible, it is not necessary to evaluate every question in this worksheet.

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 VIII (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)

<table>
<tr><th></th><th>Partial Infeasibility Criteria</th><th>Yes</th><th>No</th></tr>
<tr><td>4</td><td>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?</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>5</td><td>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.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>6</td><td>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?</td><td></td><td>X</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>7</td><td>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?</td><td></td><td>X</td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

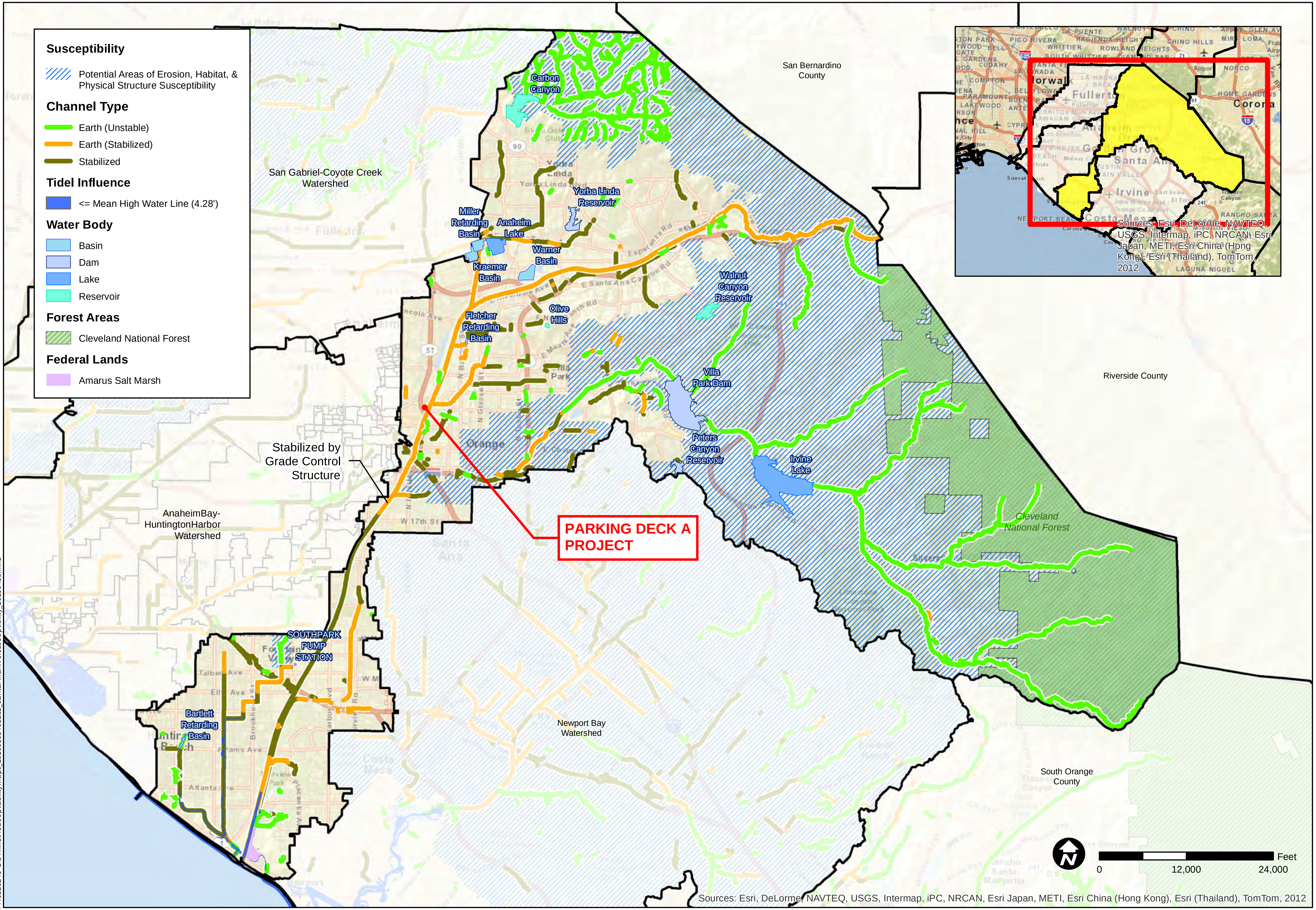
Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

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.	
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	
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: Summarize findings of infeasibility screening	
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.	**X**

Harvest and Use Infeasibility

Harvest and use infeasibility criteria include:

- If inadequate demand exists for the use of the harvested rainwater. See **Appendix X** for guidance on determining harvested water demand and applicable feasibility thresholds.
- If the use of harvested water for the type of demand on the project violates codes or ordinances most applicable to stormwater harvesting in effect at the time of project application and a waiver of these codes and/or ordinances cannot be obtained. It is noted that codes and ordinances most applicable to stormwater harvesting may change



P:\9526E\6-GIS\Mxds\SusceptabilityMaps_20100505\9526E_SantaAnaRiverSusceptibility_20100430.mxd

TITLE: SUSCEPTIBILITY ANALYIS SANTA ANA RIVER

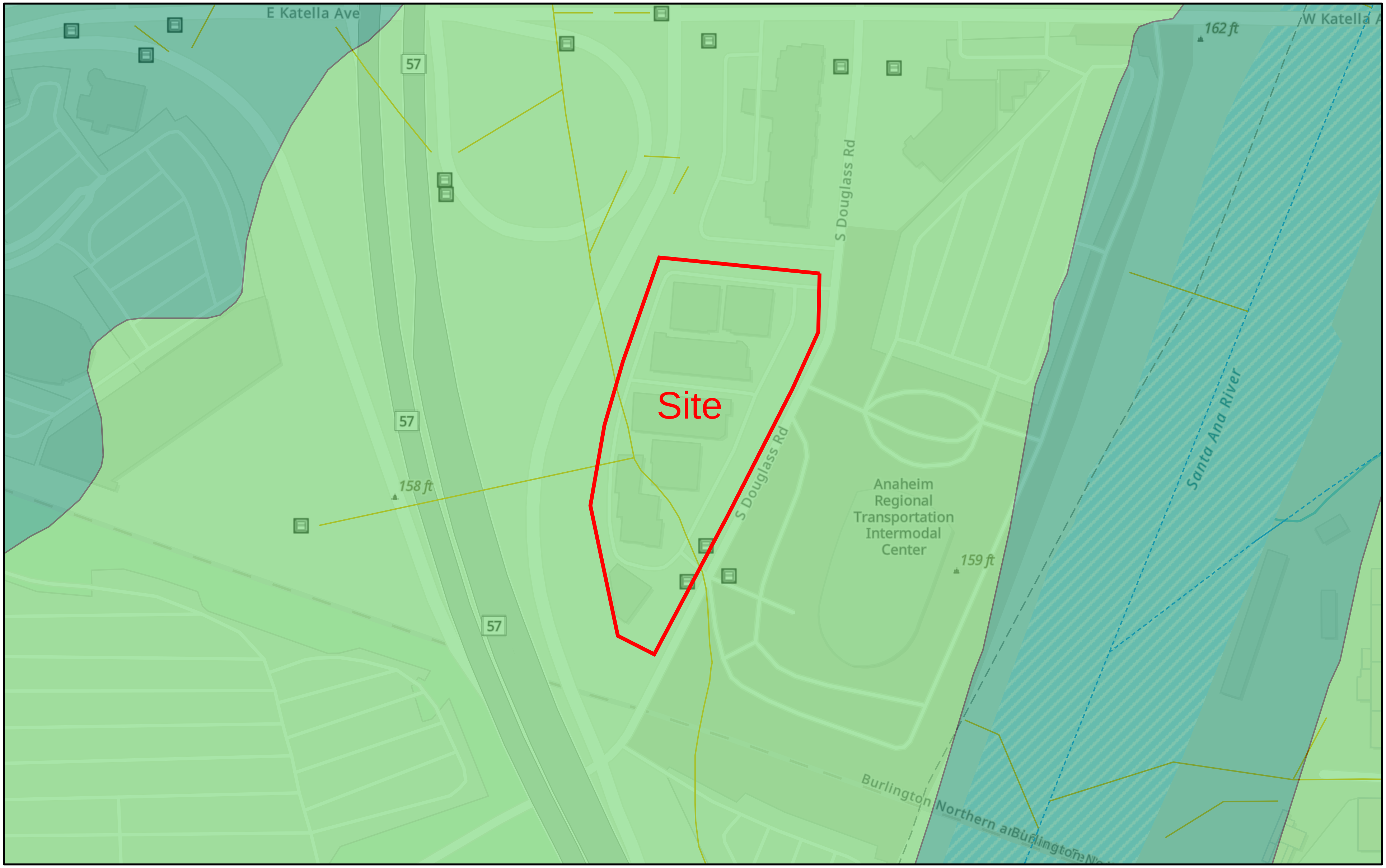
JOB: ORANGE COUNTY WATERSHED MASTER PLANNING
ORANGE CO. CA

SCALE	1" = 12000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE 3

Soils Map

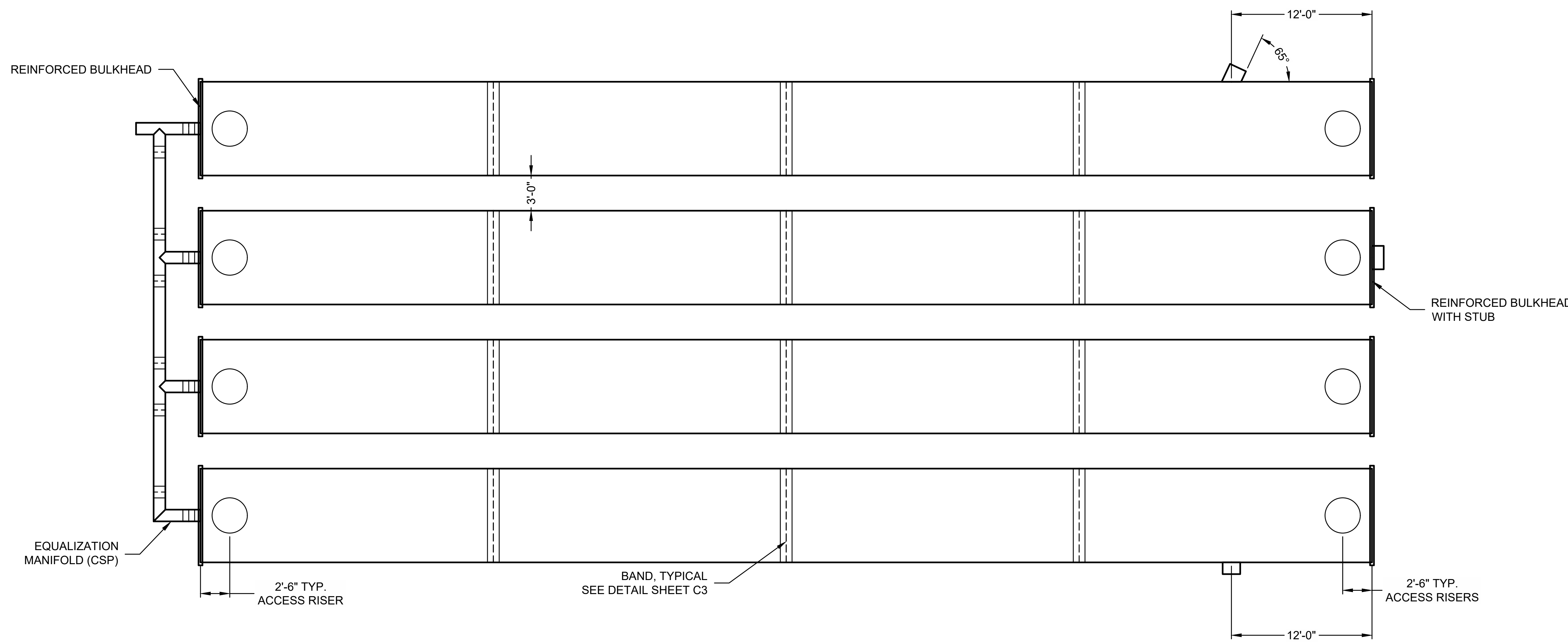


3/19/2025

Soil
A Local Drainage
B
Inlets
Closed Conveyance
Regional Channels
Open Conveyance
Closed Conveyance

1:3,404
0 0.02 0.04 0.09 mi
0 0.04 0.07 0.15 km

Figure 3



ASSEMBLY

SCALE: 1" = 10'

THE UNDERSIGNED HEREBY APPROVES THE ATTACHED (6) PAGES INCLUDING THE FOLLOWING:

- **MAINLINE PIPE GAGE = 18, 16, 14, 12, 10, 8**
- **WALL TYPE = SOLID OR PERF**
- **DIAMETER = 12 - 144"**
- **FINISH = ALT2, POLY, GALV, ALUM**
- **CORRUGATION = 2 2/3x1/2, 3x1, 5x1**

CUSTOMER   DATE

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE.
- ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD (EOR) PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE AS REQUIRED, BY CONTRACTOR.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- ALL ACCESS CASTINGS ARE THE RESPONSIBILITY OF THE CONTRACTOR AND ARE NOT SUPPLIED BY CONTECH.

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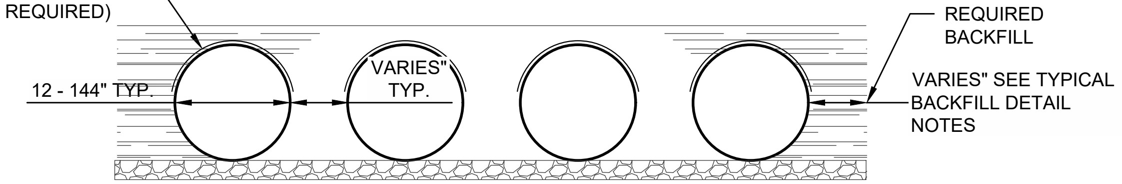
CONTECH®
CMP DETENTION SYSTEMS

CONTECH
CONTRACT
DRAWING

12 - 144"Ø SOLID OR PERFORATED UNDERGROUND SYSTEM
SAMPLE PROJECT
ANYTOWN, USA
SITE DESIGNATION: SAMPLE TANK

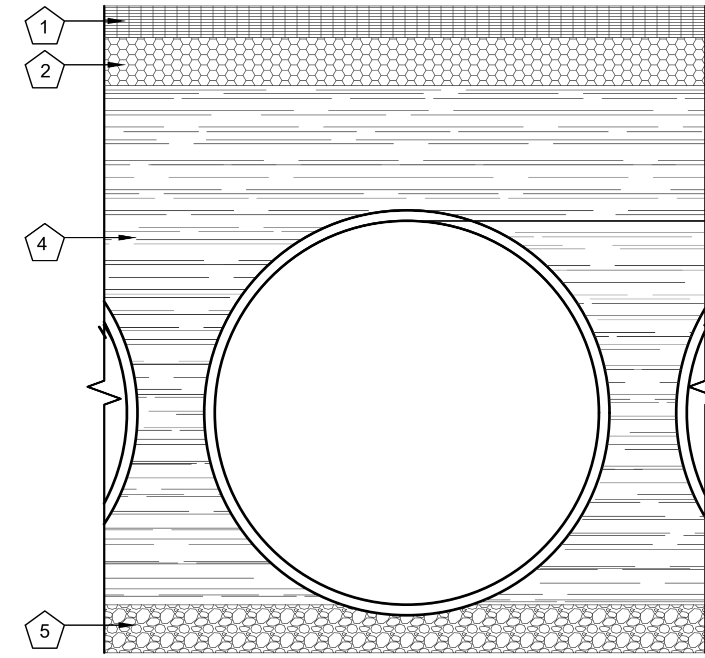
PROJECT No.:	SEQ. No.:	DATE:
----	----	1/10/2019
DESIGNED: xxx		DRAWN: DAH
CHECKED: xxx		APPROVED: xxx
SHEET NO.: C1 OF 6		



TYPICAL SECTION VIEW

NOT TO SCALE

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.



KEY

1. RIGID OR FLEXIBLE PAVEMENT
2. GRANULAR ROAD BASE
3. 12" MIN. FOR DIAMETERS THROUGH 96" 18" MIN. FOR DIAMETERS FROM 102" AND LARGER MEASURED TO TOP OF RIGID OR BOTTOM OF FLEXIBLE PAVEMENT.
4. SELECT GRANULAR FILL PER AASHTO M145 A1, A2 OR A3, OR APPROVED EQUAL. PLACED IN 8" LIFTS (COMPACTED TO MIN. 90% STANDARD DENSITY PER AASHTO T99.)
5. GRANULAR BEDDING, ROUGHLY SHAPED TO FIT THE BOTTOM OF PIPE, 4" TO 6" IN DEPTH

FOUNDATION/BEDDING PREPARATION

PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER. ONCE THE FOUNDATION PREPARATION IS COMPLETE, 4" - 6" OF A WELL-GRADED GRANULAR MATERIAL SHALL BE PLACED AS THE BEDDING.

BACKFILL

THE BACKFILL SHALL BE AN A1, A2 OR A3 GRANULAR FILL PER AASHTO M145, OR A WELL-GRADED GRANULAR FILL AS APPROVED BY THE SITE ENGINEER (SEE INSTALLATION GUIDELINES). THE MATERIAL SHALL BE PLACED IN 8" LOOSE LIFTS AND COMPACTED TO 90% AASHTO T99 STANDARD PROCTOR DENSITY. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE DETENTION SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON THE PIPE.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.

BACKFILL DETAIL

NOT TO SCALE

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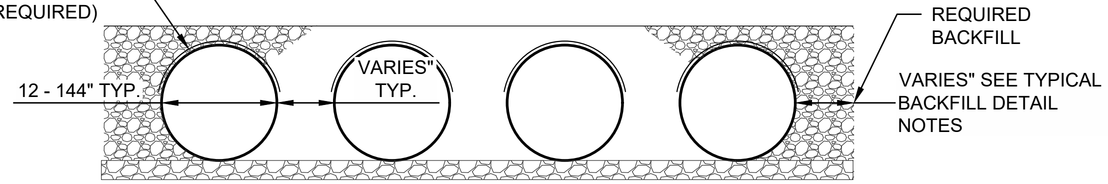
12 - 144"Ø SOLID OR PERFORATED UNDERGROUND SYSTEM - ---------
SAMPLE PROJECT
ANYTOWN, USA
SITE DESIGNATION: SAMPLE TANK

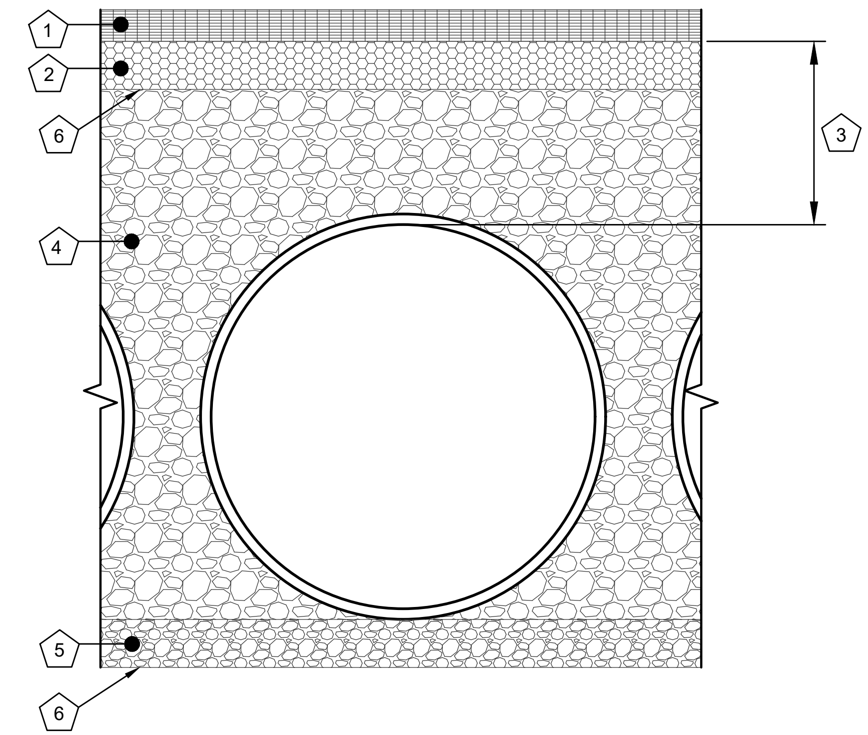
PROJECT No.:	SEQ. No.:	DATE:
----	----	1/10/2019
DESIGNED: xxx		DRAWN: DAH
CHECKED: xxx		APPROVED: xxx
SHEET NO.: C2 (2) OF 6		



TYPICAL SECTION VIEW

NOT TO SCALE

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.



KEY

1.) RIGID OR FLEXIBLE PAVEMENT

2.) GRANULAR ROAD BASE

3.) 12" MIN. FOR DIAMETERS THROUGH 96"
18" MIN. FOR DIAMETERS FROM 102" AND LARGER MEASURED TO TOP OF RIGID OR BOTTOM OF FLEXIBLE PAVEMENT.

4.) FREE DRAINING ANGULAR WASHED STONE 3/4" - 2" MIN. PARTICLE SIZE.

5.) GRANULAR BEDDING, ROUGHLY SHAPED TO FIT THE BOTTOM OF PIPE, 4"- 6" IN DEPTH.

6.) CONTECH C-40 OR C-45 NON-WOVEN GEOTEXTILE REQUIRED, WRAPPING TRENCH ONLY.

FOUNDATION/BEDDING PREPARATION

PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER. ONCE THE FOUNDATION PREPARATION IS COMPLETE, THE 4 INCHES OF A WELL-GRADED GRANULAR MATERIAL SHALL BE PLACED AS THE BEDDING.

BACKFILL

THE BACKFILL MATERIAL SHALL BE FREE-DRAINING ANGULAR WASHED STONE 3/4" - 2" PARTICLE SIZE. MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR-TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE PROJECT ENGINEER OR HIS REPRESENTATIVE IS SATISFIED WITH THE LEVEL OF COMPACTION. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT, AND MAINTAINING BALANCED LOADING ON ALL PIPES IN THE SYSTEM, DURING ALL SUCH OPERATIONS.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

1 / C3 BACKFILL DETAIL
SCALE: N.T.S.

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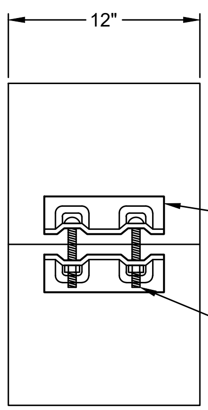
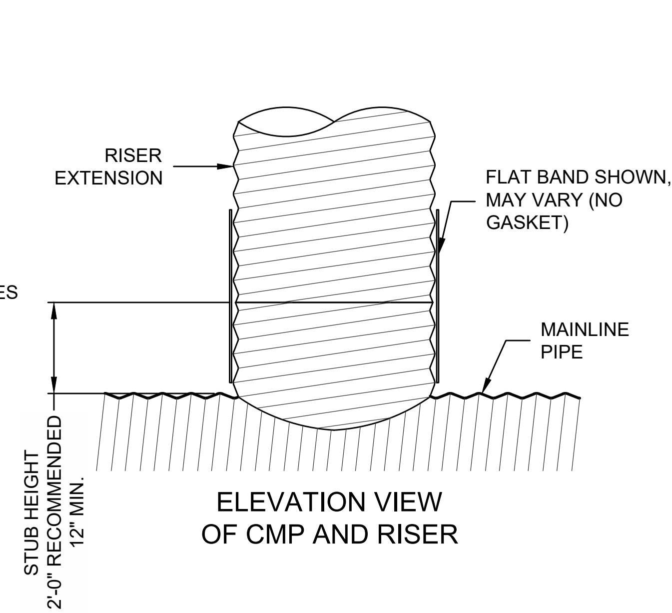
12 - 144"Ø SOLID OR PERFORATED UNDERGROUND SYSTEM - ---------
SAMPLE PROJECT
ANYTOWN, USA
SITE DESIGNATION: SAMPLE TANK

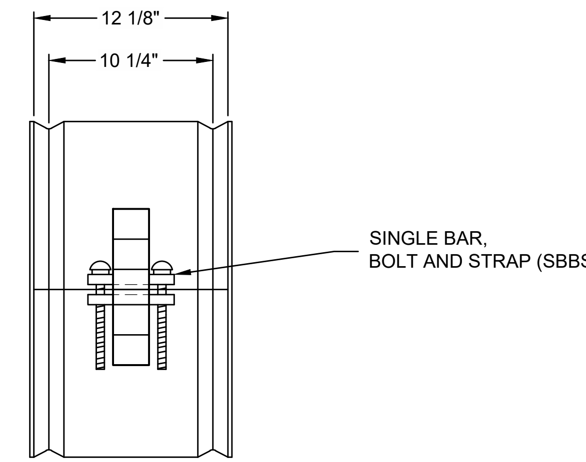
PROJECT No.:	SEQ. No.:	DATE:
----	----	1/10/2019
DESIGNED: xxx		DRAWN: DAH
CHECKED: xxx		APPROVED: xxx
SHEET NO.: C2 OF 6		



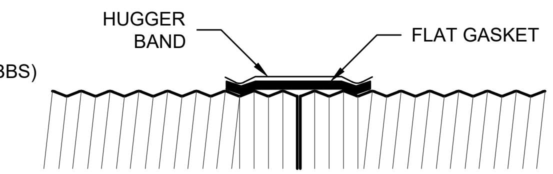
CONNECTION DETAIL
7 1/2" TECHCO SHOWN - MAY VARY



ELEVATION VIEW
OF CMP AND RISER



CONNECTION DETAIL
(SBBS)



FLAT GASKET

PLAIN END CMP RISER PIPE

GENERAL NOTES:

1. **DELIVERED BAND STYLE AND FASTENER TYPE MAY VARY BY FABRICATION PLANT.**
2. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
3. BAND MATERIAL AND GAGE TO BE SAME AS RISER MATERIAL.
4. IF RISER HAS A HEIGHT OF COVER OF 10' OR MORE, USE A SLIP JOINT.
5. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
   - 12" THRU 48" 1-PIECE
   - 54" 2-PIECES
6. ALL RISER JOINT COMPONENTS WILL BE FIELD ASSEMBLED.
7. MANHOLE RISERS IN APPLICATIONS WHERE TRAFFIC LOADS ARE IMPOSED REQUIRE SPECIAL DESIGN CONSIDERATIONS.
8. DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES.

12" RISER BAND DETAIL

NOT TO SCALE

2 2/3"x1/2" RE-ROLLED END HEL-COR PIPE

GENERAL NOTES:

1. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
2. BAND MATERIALS AND/OR COATING CAN VARY BY LOCATION. CONTACT YOUR CONTECH REPRESENTATIVE FOR AVAILABILITY.
3. BANDS ARE SHAPED TO MATCH THE PIPE-ARCH WHEN APPLICABLE.
4. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
   - 12" THRU 48" 1-PIECE
   - 54" THRU 96" 2-PIECES
   - 102" THRU 144" 3-PIECES
5. BAND FASTENERS ARE ATTACHED WITH SPOT WELDS, RIVETS OR HAND WELDS.
6. ALL CMP IS REROLLED TO HAVE ANNULAR END CORRUGATIONS OF 2 2/3"x1/2"
7. DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
8. ORDER SHALL DESIGNATE GASKET OPTION, IF REQUIRED (SEE DETAILS ABOVE).

H-12 HUGGER BAND DETAIL

NOT TO SCALE

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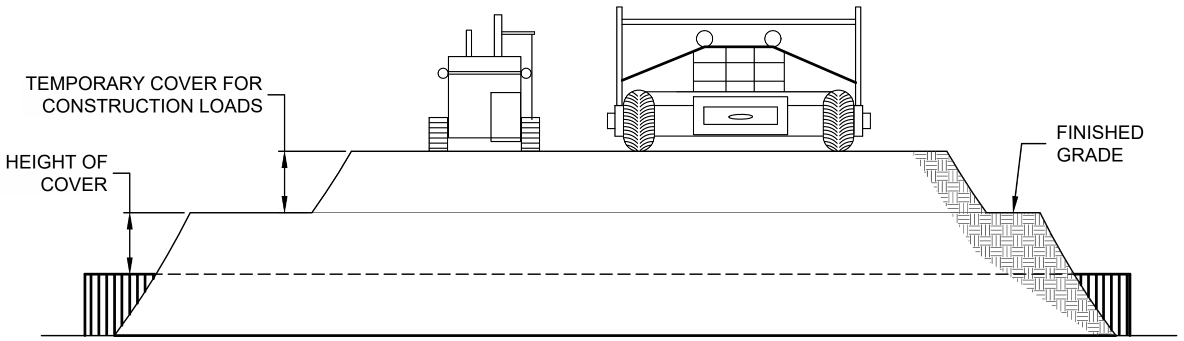
800-548-4667 503-240-3393 800-561-1271 FAX

CONTECH
CMP DETENTION SYSTEMS

CONTECH
CONTRACT
DRAWING

12 - 144"Ø SOLID OR PERFORATED UNDERGROUND SYSTEM - ---------
SAMPLE PROJECT
ANYTOWN, USA
SITE DESIGNATION: SAMPLE TANK

PROJECT No.:	SEQ. No.:	DATE:
----	----	1/10/2019
DESIGNED: xxx		DRAWN: DAH
CHECKED: xxx		APPROVED: xxx
SHEET NO.: C3 OF 6		



CONSTRUCTION LOADS

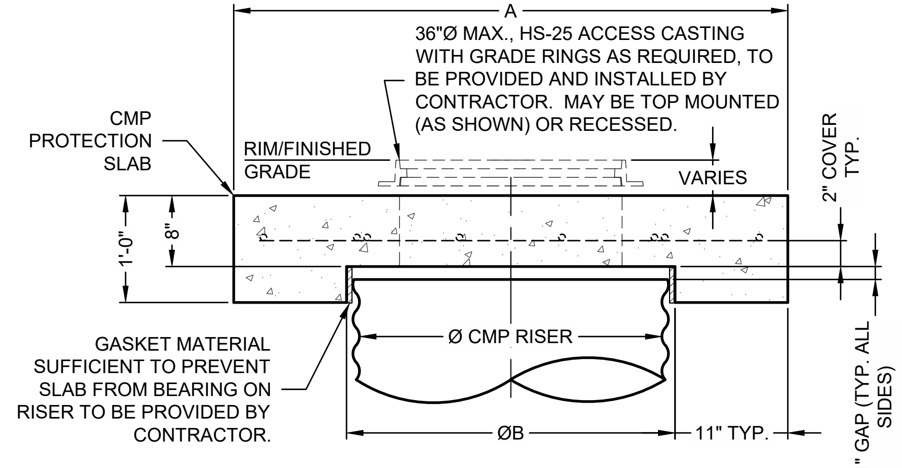
FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

NOT TO SCALE



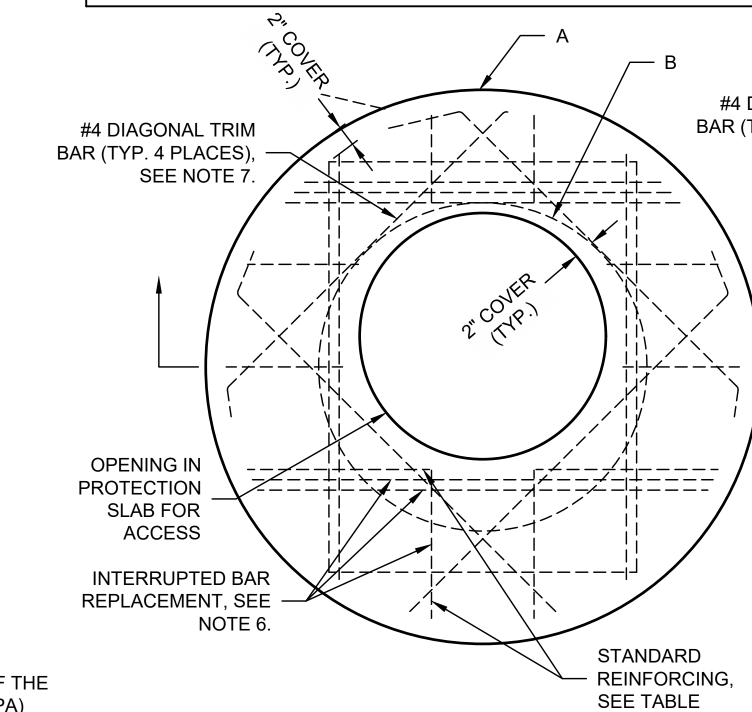
SECTION VIEW

REINFORCING TABLE

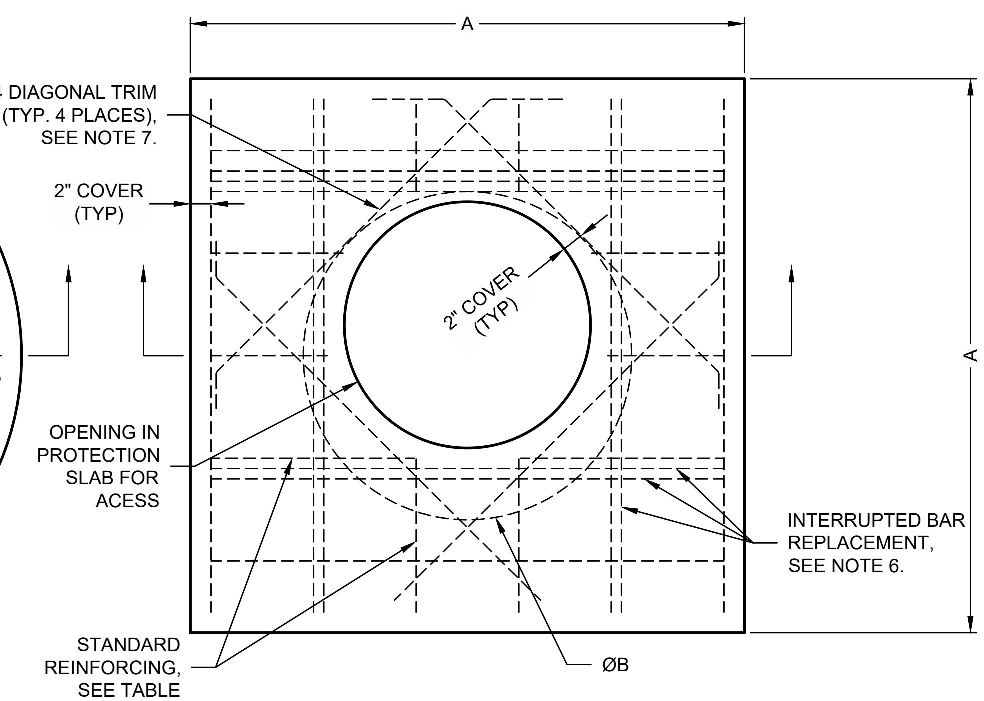
Ø CMP RISER	A	B Ø	REINFORCING	**BEARING PRESSURE (PSF)
24"	4'Ø 4'x4'	26"	#5 @ 10" OCEW #5 @ 10" OCEW	2,540 1,900
30"	4'-6"Ø 4'-6" x 4'-6"	32"	#5 @ 10" OCEW #5 @ 9" OCEW	2,260 1,670
36"	5'Ø 5' x 5'	38"	#5 @ 9" OCEW #5 @ 8" OCEW	2,060 1,500
42"	5'-6"Ø 5'-6" x 5'-6"	44"	#5 @ 8" OCEW #5 @ 8" OCEW	1,490 1,370
48"	6'Ø 6' x 6'	50"	#5 @ 7" OCEW #5 @ 7" OCEW	1,210 1,270

** ASSUMED SOIL BEARING CAPACITY

ACCESS CASTING NOT SUPPLIED BY CONTECH



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION AND ACI 350.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 4,000 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERS, ARCHITECTS AND LAND SURVEYORS, ENDWELL, NY.

MANHOLE CAP DETAIL

NOT TO SCALE

SPECIFICATION FOR CORRUGATED STEEL PIPE-ALUMINIZED TYPE 2 STEEL

SCOPE

THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE CORRUGATED STEEL PIPE (CSP) DETAILED IN THE PROJECT PLANS.

MATERIAL

THE ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M274 OR ASTM A929.

PIPE

THE CSP SHALL BE MANUFACTURED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF AASHTO M36 OR ASTM A760. THE PIPE SIZES, GAGES AND CORRUGATIONS SHALL BE AS SHOWN ON THE PROJECT PLANS.

ALL FABRICATION OF THE PRODUCT SHALL OCCUR WITHIN THE UNITED STATES.

HANDLING AND ASSEMBLY

SHALL BE IN ACCORDANCE WITH RECOMMENDATIONS OF THE NATIONAL CORRUGATED STEEL PIPE ASSOCIATION (NCSPA)

INSTALLATION

SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II OR ASTM A798 AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

MATERIAL SPECIFICATION

NOT TO SCALE

C:\USERS\DHOPKINS\DESKTOP\000000-001-CMP SAMPLE SOLID - PERF.DWG 3/7/2019 5:49 PM

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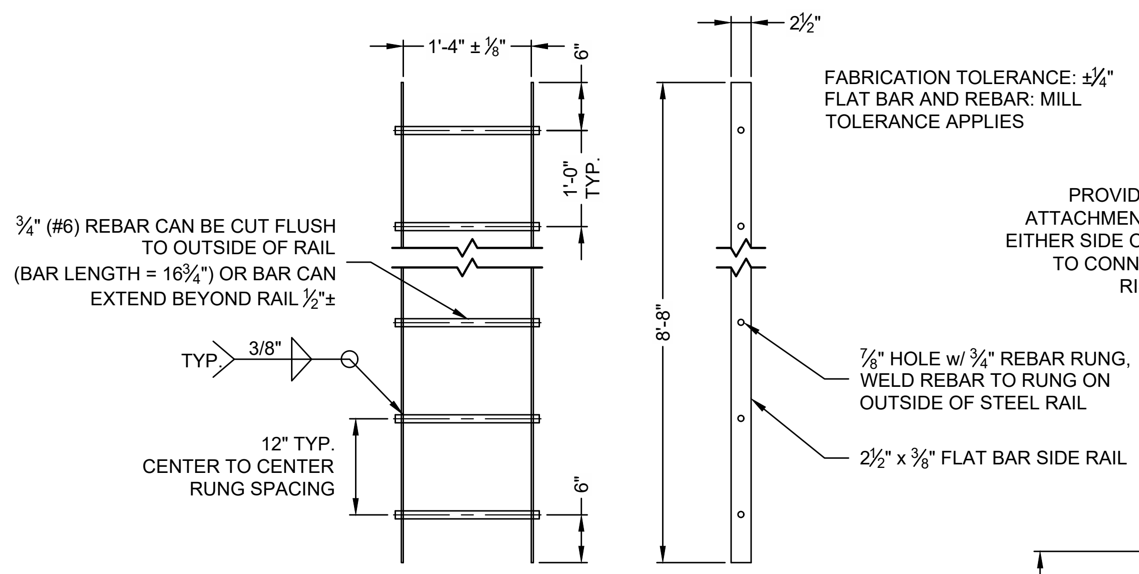
11815 NE Glenn Widing Drive, Portland, OR 97220
800-548-4667 503-240-3393 800-561-1271 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH CONTRACT DRAWING

12 - 144"Ø SOLID OR PERFORATED UNDERGROUND SYSTEM - ---------
SAMPLE PROJECT
ANYTOWN, USA
SITE DESIGNATION: SAMPLE TANK

PROJECT No.:	SEQ. No.:	DATE:
----	----	1/10/2019
DESIGNED: xxx		DRAWN: DAH
CHECKED: xxx		APPROVED: xxx
SHEET NO.: C4 OF 6		



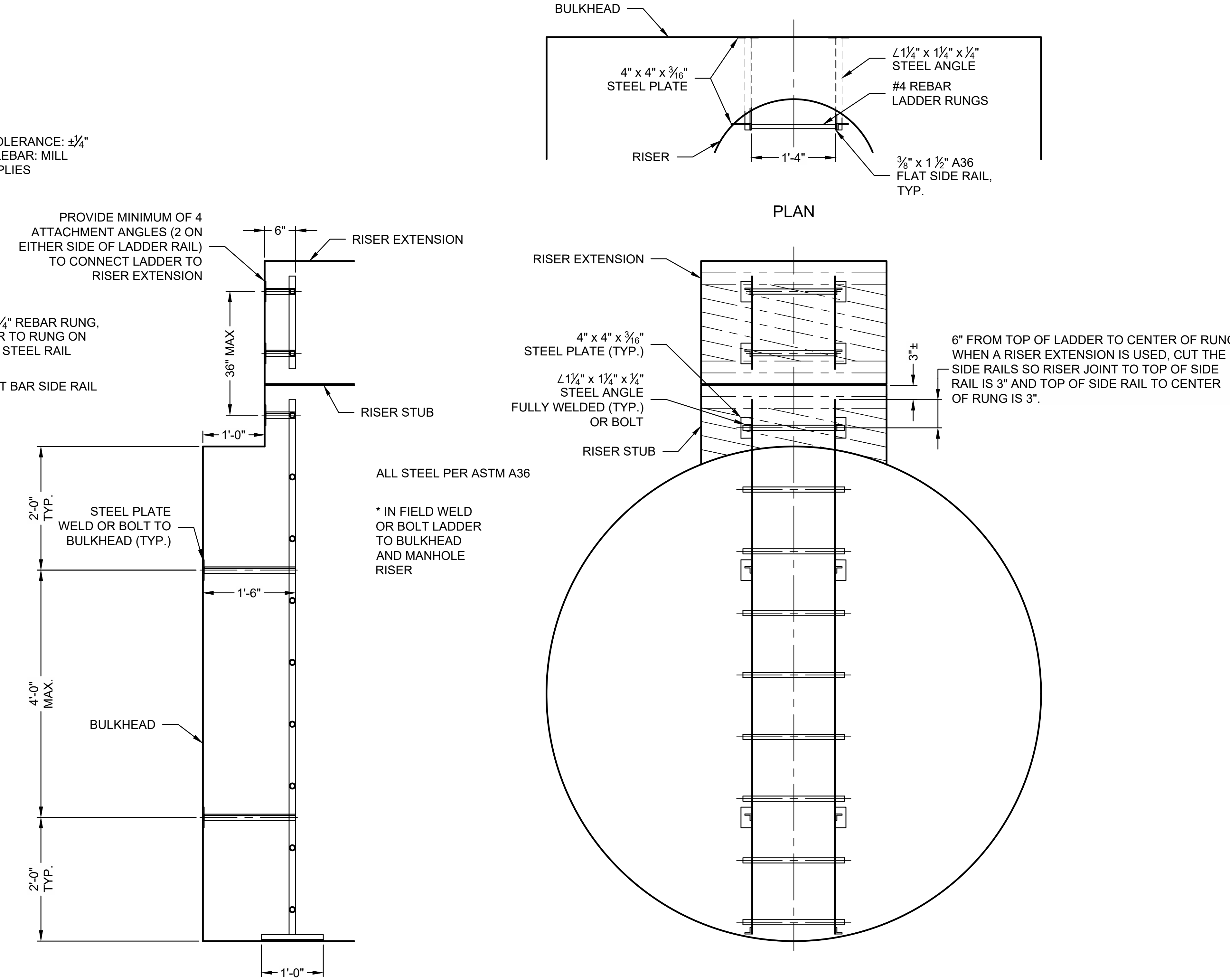
NOTES:

1. LADDERS CAN BE MADE IN STANDARD LENGTHS AND CUT TO FIT
2. ALL MATERIAL TO MEET ASTM A36
3. LADDER TO BE HOT DIPPED GALVANIZED PER ASTM A-123 AFTER FABRICATION IS COMPLETE

STANDARD LADDER DETAIL

NOT TO SCALE

PART No. HALAGVL16



RISER LADDER DETAIL

NOT TO SCALE

NOTE:
THIS DRAWING IS INTENDED TO APPLY TO LADDERS INSTALLED IN RISERS HAVING A DIAMETER OF 36" OR LARGER AND LOCATED ONE FOOT FROM THE BULKHEAD ONLY

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CONTECH CMP DETENTION SYSTEMS

CONTECH CONTRACT DRAWING

12 - 144"Ø SOLID OR PERFORATED UNDERGROUND SYSTEM - ---------
SAMPLE PROJECT
ANYTOWN, USA
SITE DESIGNATION: SAMPLE TANK

PROJECT No.:	SEQ. No.:	DATE:
----	----	1/10/2019
DESIGNED: xxx		DRAWN: DAH
CHECKED: xxx		APPROVED: xxx
SHEET NO.: C5 OF 6		

CMP Detention and Infiltration Installation Guide

CMP Detention and Infiltration Installation Guide

Proper installation of a flexible corrugated metal pipe (CMP) underground detention system will ensure long-term performance. The configuration of these systems often requires special construction practices that differ from conventional flexible pipe construction. Contech recommends scheduling a preconstruction meeting with your local Contech Representative to determine if additional measures, not covered in this guide, are appropriate for your site.

Preconstruction Meeting

It is a best practice to have a pre-construction meeting with the installation contractor and Contech personnel. Included at the end of this guide is a preconstruction checklist to review prior to installation.

Proper Pipe Unloading, Handling and Placement

The pipe should be unloaded off the flatbed trailer with a fork lift, excavator, crane or other piece of construction equipment. The pipe should never be dropped or rolled off the flatbed trailer. Nylon slings or lifting lugs should be used to lift the pipe into place.

Normally the header row pipe section is placed on the downstream end. For detention systems with a single header row on one end and pipe with bulkheads on the other end; it is a best practice to start pipe placement on the header row end.

Lifting CMP off the flatbed with a front end loader and forks.

Lifting ALT2 CMP with nylon slings.

Lowering the header pipe section into place first.

Lifting polymer-coated CMP into place with nylon slings.

Foundation and Pipe Bedding

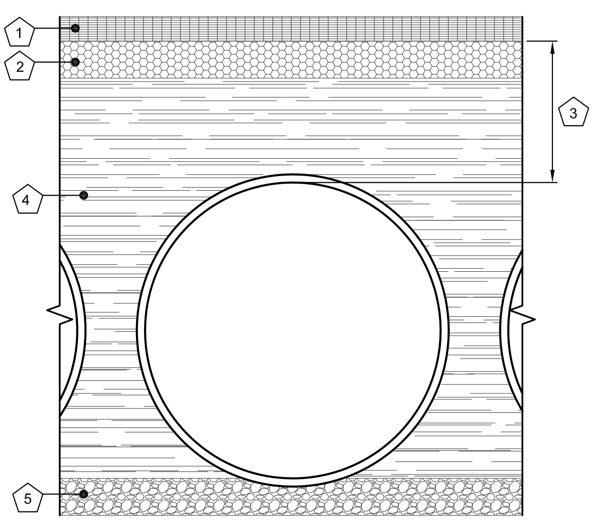
Construct a foundation that can support the design loading applied by the pipe and adjacent backfill weight as well as maintain its integrity during construction. If soft or unsuitable soils are encountered, remove the poor soils to a suitable depth and then replace with a competent granular material to the appropriate elevation. The granular material gradation should not allow the migration of fines, which can cause settlement of the detention system or pavement above. If the structural fill material is not compatible with the underlying soils a geotextile fabric should be used as a separator.

Grade the foundation subgrade to a uniform or slightly sloping grade. If the subgrade is clay or relatively non-porous and the construction sequence will last for an extended period of time, it is best to slope the grade to one end of the system. This will allow excess water to drain quickly, preventing saturation of the subgrade.

A 4”- 6” thick, well-graded granular material is preferred pipe bedding. If the existing foundation is made up of a course sand or other suitable granular material, imported bedding material will not be required.

Site conditions may require 4” – 6” of imported granular material as pipe bedding.

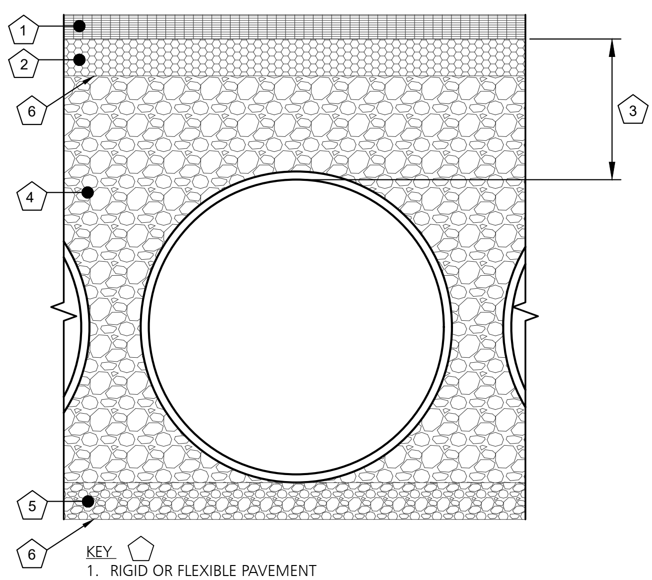
SOLIDWALL BACKFILL DETAIL



KEY

1. RIGID OR FLEXIBLE PAVEMENT
2. GRANULAR ROAD BASE
3. 12” MIN. FOR DIAMETERS THROUGH 96”
   18” MIN. FOR DIAMETERS FROM 102” AND LARGER MEASURED TO TOP OF RIGID OR BOTTOM OF FLEXIBLE PAVEMENT.
4. SELECT GRANULAR FILL PER AASHTO M145 A1, A2 OR A3 OR APPROVED EQUAL. PLACED IN 8” LIFTS (COMPACTED TO MIN. 90% STANDARD DENSITY PER AASHTO T99)
5. GRANULAR BEDDING, ROUGHLY SHAPED TO FIT THE BOTTOM OF PIPE, 4” TO 6” IN DEPTH.

PERFORATED BACKFILL DETAIL



KEY

1. RIGID OR FLEXIBLE PAVEMENT
2. GRANULAR ROAD BASE
3. 12” MIN. FOR DIAMETERS THROUGH 96”
   18” MIN. FOR DIAMETERS FROM 102” AND LARGER MEASURED TO TOP OF RIGID OR BOTTOM OF FLEXIBLE PAVEMENT.
4. FREE DRAINING ANGULAR WASHED STONE 3/4” - 2” MIN. PARTICLE SIZE.
5. GRANULAR BEDDING, ROUGHLY SHAPED TO FIT THE BOTTOM OF PIPE, 4” TO 6” IN DEPTH.
6. NON WOVEN GEOTEXTILE (IF REQUIRED), WRAPPING TRENCH ONLY. CONSULT GEOTECHNICAL EOR FOR PROJECT SPECIFIC BACKFILL REQUIREMENTS.

Connecting Bands

There are various types of connecting bands for connecting CMP. Hugger and corrugated bands are the most common. Flat gaskets or O-ring gaskets can also be used in conjunction with connecting bands to reduce leakage in the joints.

Installing a Hugger band on a perforated pipe.

Tightening bolts on a corrugated band.

Installation of band with flat neoprene gasket.

Some jobs may require special bands, such as rod and lug connection, flat bands, or dimple bands.

Geomembrane Barrier

When indicated on the Contech contract drawings or the project plans, an HDPE membrane liner will be placed on the crown of each pipe to help protect the system from environmental changes that may adversely affect the system over time. The liner should extend beyond the 8 and 4 o'clock positions (crown) of the pipe. Please refer to Contech's CMP Detention Design Guide or Contech contract drawings for additional technical details.


An HDPE liner is rolled out over the crown of the pipe prior to backfilling around the pipe.


For large diameter pipes, the liner is shipped in rolls that are folded in half. The liner is rolled out over the crown of the pipe, unfolded, and covered over the pipe from the eight and four o'clock positions.

In-Situ Trench Wall

If excavation is required, the trench wall needs to be capable of supporting the load that the pipe sheds as the system is loaded. If soils are not capable of supporting these loads, the pipe can deflect. Perform a simple soil pressure check using the applied loads to determine the limits of excavation beyond the spring line of the outer most pipes.

In most cases, the requirements for a safe work environment and proper backfill placement and compaction take care of the concern. The contractor is responsible for the safety of his/her employees and agents.

Safe practices on construction work as outlined in the latest edition of the "Manual of Accident Prevention in Construction," published by the Associated General Contractors, shall be used as a guide and observed. The contractor shall comply with all applicable city, state, and federal safety codes in effect in the area where work is being performed. This conformance shall include the provisions of the current issue of the "OSHA Safety and Health Standards (29 CFR 1926/1910)" as published by the U.S. Department of Labor.

Backfill Material

Corrugated Steel Pipe is a flexible pipe. All buried flexible pipes are dependent on a quality backfill material for structural support. AASHTO refers to these pipe systems as, "Soil-Corrugated Metal Structure Interaction Systems". The best backfill material is an angular, well-graded, granular fill meeting the requirements of AASHTO A-1, A-2, or A-3. Aggregate materials that are free draining and compact easily such as crushed aggregate, crushed aggregate with fines, gravely sand, and coarse sand make good backfill. The aggregate particle size shall not exceed 3" in diameter.

For solid pipe, well graded or open graded granular material can be used as backfill. Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded stone, with a particle size of ½" – 2 ½" diameter is recommended for backfill around perforated pipe.

Backfill using controlled low-strength material (CLSM, "flash fill", or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill.

EXAMPLES OF ACCEPTABLE BACKFILL MATERIAL

Course Sand

Crushed Limestone

Crushed Granite

Crushed River Gravel

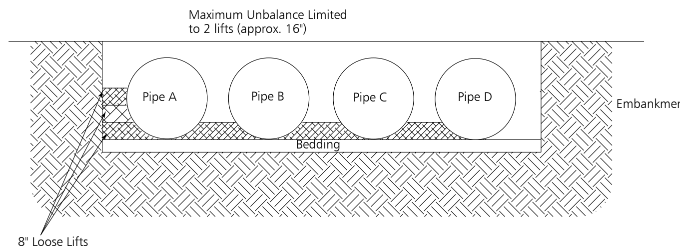
Backfill Placement

The backfill shall be placed in 8” +/- loose lifts and compacted to 90% AASHTO T99 standard proctor density. Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, vibratory packer, or other effective methods. If AASHTO T99 procedures are determined infeasible by the geotechnical engineer of record, compaction is considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the geotechnical engineer of record (or representative thereof) is satisfied with the level of compaction.

For large systems, conveyor systems, backhoes with long reaches may be used to place backfill. Once minimum cover for the construction loading across the entire width of the system is reached, advance the equipment to the end of the recently placed fill, and begin the sequence again until the system is completely backfilled. This type of construction sequence provides room for stockpiled backfill directly behind the backhoe, as well as the movement of construction traffic.

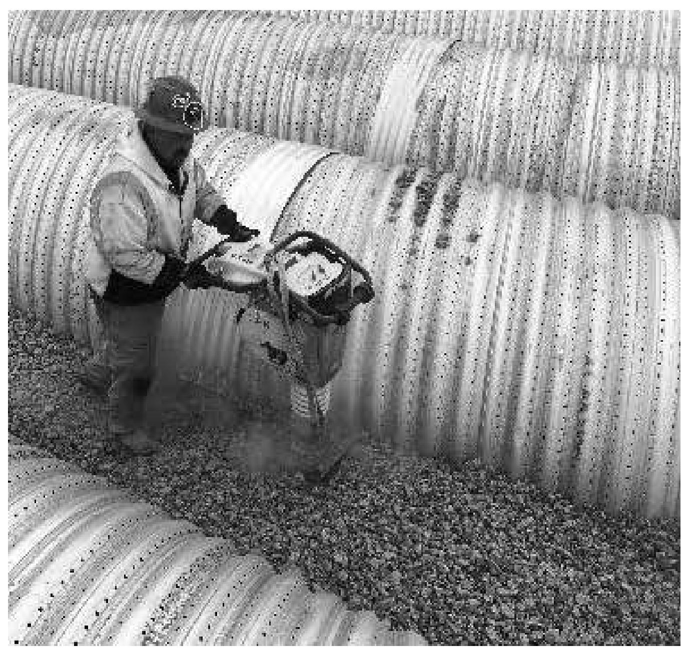
It is important to keep the elevation of backfill between pipes and side embankment evenly. As a rule of thumb, do not allow for backfill to exceed the elevation of one side of pipe to another pipe or one side of pipe to the outside trench/embankment by more than 24”.

Material stockpiles on top of the backfilled detention system should be limited to 9’ +/- high and must provide balanced loading across all barrels. To determine the proper minimum cover over the pipes to allow the movement of construction equipment, contact your local Contech Sales Engineer.



If CLSM or “flowable fill” is used as backfill, pipe flotation needs to be prevented. Typically, small lifts are placed between the pipes and then allowed to set-up prior to the placement of the next lift. The allowable thickness of the CLSM lift is a function of a proper balance between the uplift force of the CLSM, the opposing weight of the pipe, and the effect of other restraining measures. Your local Sales Engineer can help determine an appropriate lift thickness.

Placing backfill with a conveyor.



Compaction with vibratory equipment.

Final Cover Placement and Construction Loading

The minimum cover specified for a project normally assumes H-20 highway live loading. Backfill must be placed and fully compacted to the minimum cover level over the structure before the pipe is subjected to design loads. The minimum cover for AASHTO H-20 Live Loading per design section 12, is span of the pipe divided by eight plus asphalt pavement.

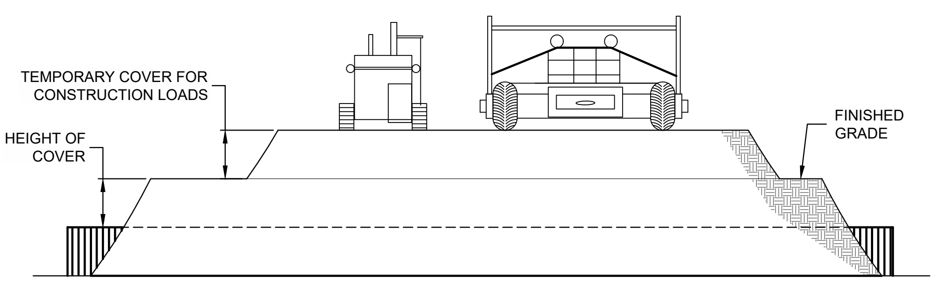
Construction loads often exceed design highway loading. During construction, keep heavy construction equipment that exceeds legal highway loads off the pipe. Light construction equipment on tracks such as a D-3 dozer (or lighter weight) may cross over the pipe when a minimum of 12" of compacted backfill is over pipe. Since construction equipment varies from job to job, it is best to address equipment specific minimum cover requirements with your local Contech Sales Engineer during your pre-construction meeting.

Minimum Height of Cover Requirements for Tracked Equipment HEL-COR® Corrugated Steel Pipe[1]					
Diameter (inches)	Minimum Cover (Ft)	Track Width (inches) Maximum Track Pressure at Surface (psi)			
		12	18	24	30
12 – 42	1.0	29	22	18	17
	1.5	58	41	34	30
	2.0	95	65	51	44
	2.5	138	91	70	59
	3.0	189	120	91	75
	4.0	321	195	143	115
48 – 66	1.0	10.6	8	6.9	6.2
	1.5	24	17	14	12.2
	2.0	39	26	21	18
	2.5	56	37	28	24
	3.0	77	49	37	30
	4.0	132	80	59	47
72 – 102	1.0	3.2	2.5	2.1	1.9
	1.5	8.8	6.2	5	4.4
	2.0	16	11.1	8.8	7.5
	2.5	24	15	12	10.1
	3.0	32	20	15	12.9
	4.0	56	34	25	20
108 – 120	1.0	2.8	2.1	1.7	1.6
	1.5	6.9	4.9	3.9	3.4
	2.0	14.8	10.1	8	6.7
	2.5	21	14.2	10.9	9.1
	3.0	29	18	14.1	11.6
	4.0	51	31	22	18
126 – 144	1.0	2.8	2.1	1.7	1.5
	1.5	6	4.3	3.5	3
	2.0	12	8	6.4	5.4
	2.5	21	14	10.6	8.9
	3.0	29	18	13.9	11.4
	4.0	50	30	22	18

1 *The values in this table represent the maximum ground pressure permitted when performing reasonable work over the pipes, using the manufacture's published equipment specifications. (Ground pressure for track equipment is the vehicle operating weight divided by the total ground contact area for both tracks.) This table is to be used as a guide. Talk to your Contech representative if you have questions about the equipment you plan on operating over the pipes. Care should be taken to maintain adequate cover depth during construction activities.*

Examples of light, tracked, construction equipment used to place final cover over the pipe system.


Examples of heavy construction equipment that may require additional minimal cover. Contech can help evaluate minimum cover for the installation contractor for all the equipment on the site.



CONSTRUCTION LOADS

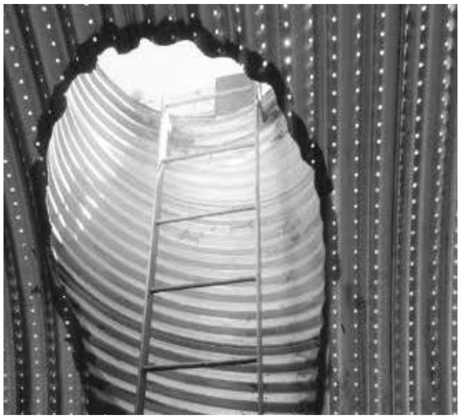
FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

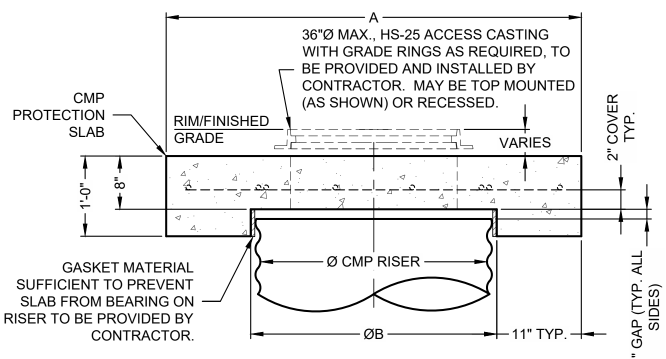
Minimum Height of Cover Requirements for Rubber-Tired Equipment Over HEL-COR® CSP

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

CMP Manhole Risers

CMP manhole risers allow easy access for future maintenance of the system. If the system is installed under a parking lot or road way subject to live loads, care must be taken to ensure loads are not applied directly to the riser structure. A pre-cast or cast-in-place slab should be installed above the riser. The manhole lid and frame should not rest directly on the CMP riser.





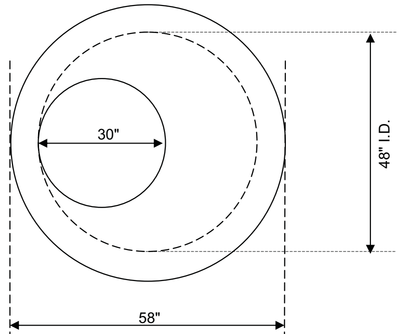
SECTION VIEW

Reinforcing Table				
Ø CMP Riser	A	ØB	Reinforcing	Bearing Pressure** (psf)
24	4'Ø 4' x 4'	26"	#5 @ 10" OCEW #5 @ 10" OCEW	2,540 1,900
30"	4'-6"Ø 4'-6" x 4'-6"	32"	#5 @ 10" OCEW #5 @ 9" OCEW	2,260 1,670
36"	5'Ø 5' x 5'	38"	#5 @ 9" OCEW #5 @ 8" OCEW	2,060 1,500
42"	5'-6"Ø 5'-6" x 5'-6"	44"	#5 @ 8" OCEW #5 @ 8" OCEW	1,490 1,370
48"	6'Ø 6' x 6'	50"	#5 @ 7" OCEW #5 @ 7" OCEW	1,210 1,270

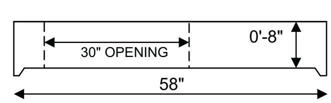
*** Assumed soil bearing capacity.*

Precast Option for Manhole Riser Caps

PLAN VIEW



SECTION



NOTES:

A.) 4000 P.S.I. CONCRETE

B.) GRADE 60 REINFORCING PER ASTM A-615

C.) BUTYL SEALANT IN JOINTS

Additional Considerations

Because most systems are constructed below-grade, rainfall can rapidly fill the excavation; potentially causing floatation and movement of the previously placed pipes. To help mitigate potential problems, it is best to start the installation at the downstream end with the outlet already constructed to allow a route for the water to escape. Temporary diversion measures may be required for high flows due to the restricted nature of the outlet pipe.

CMP Preconstruction Checklist

Contech Field Contact and Phone: ______________________________

Contech Plant Contact and Phone: ______________________________

Contractor Contact and Phone: ______________________________

Project Name: ______________________________

Site Address: ______________________________

Pre-con Attendees: ______________________________

Topics to Review:

- [ ] Truck access and pipe storage availability/expectation
- [ ] Pipe unloading and handling safety, equipment and procedures
- [ ] System layout and shop drawing review
- [ ] Shipping schedule and installation sequence
- [ ] Joint configuration and assembly
- [ ] Connection with unlike storm sewer materials
- [ ] Backfill material selection and placement strategy
- [ ] Backfill sequence, lift thickness and balanced loading
- [ ] Compaction requirement (90%) and equipment
- [ ] Additional cover requirements for heavy construction loads
- [ ] CMP riser concrete cap installation

Notes: ______________________________

CONTECH ENGINEERED SOLUTIONS

800-338-1122

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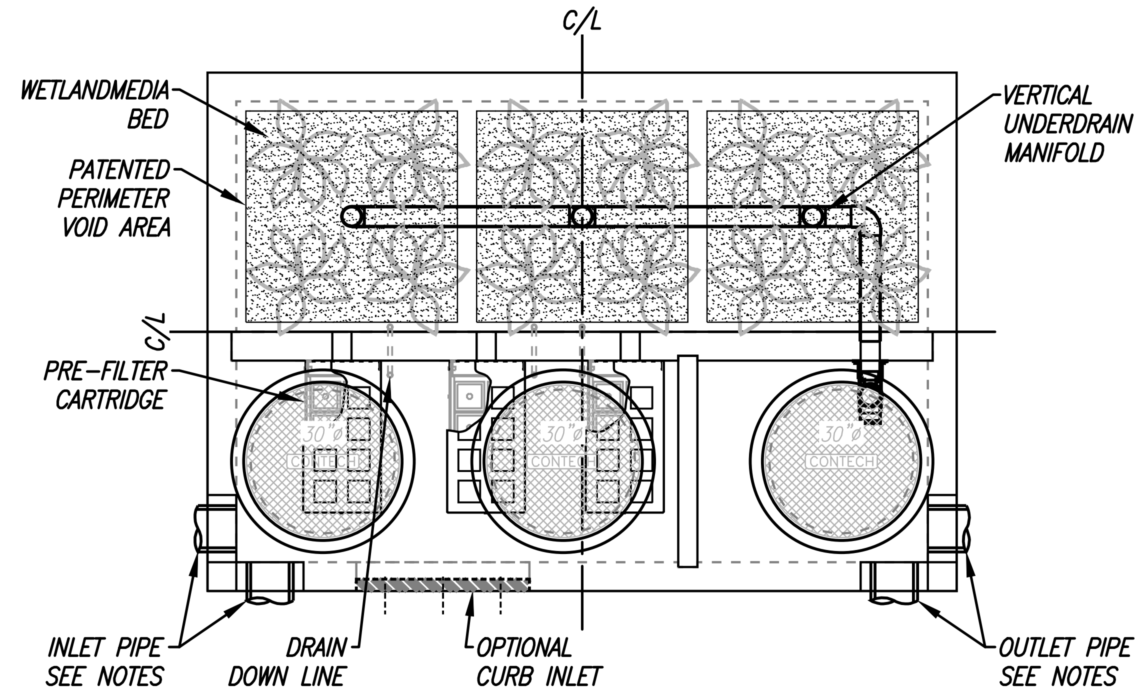
SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

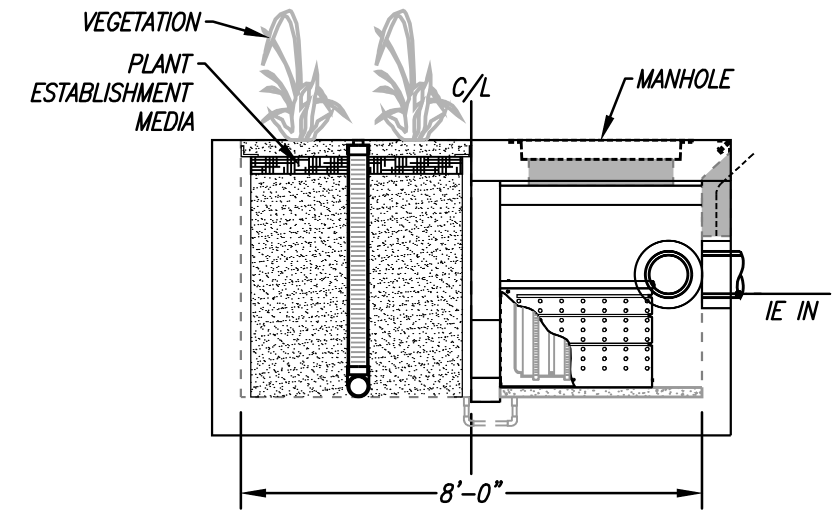
SITE SPECIFIC DATA

PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
TREATMENT FLOW (CFS)			
PRETREATMENT LOADING RATE (GPM/SF)			2.1 GPM/SF
WETLAND MEDIA LOADING RATE (GPM/SF)			1.0
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			____ (CFS)
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
NOTES:			

* PRELIMINARY ONLY - NOT FOR CONSTRUCTION



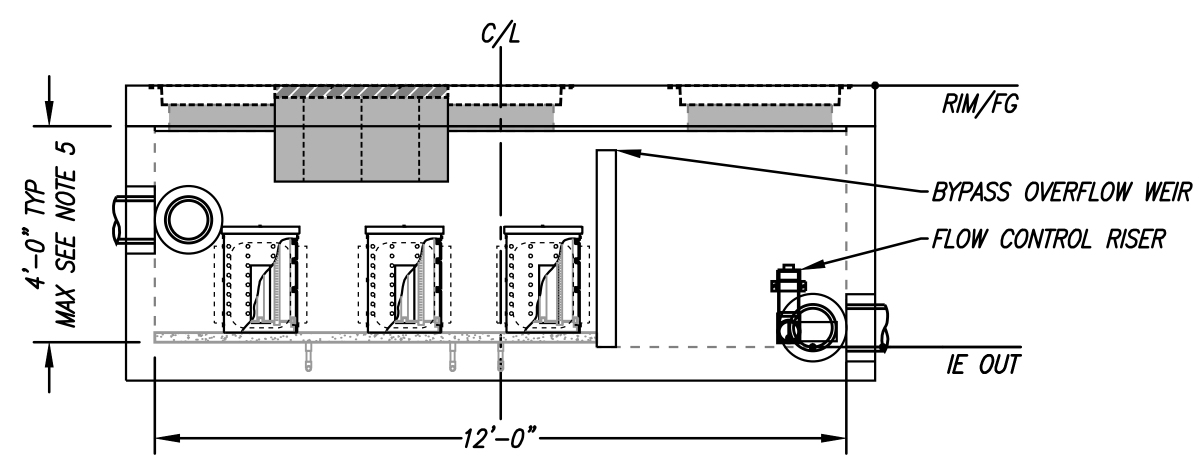
PLAN VIEW



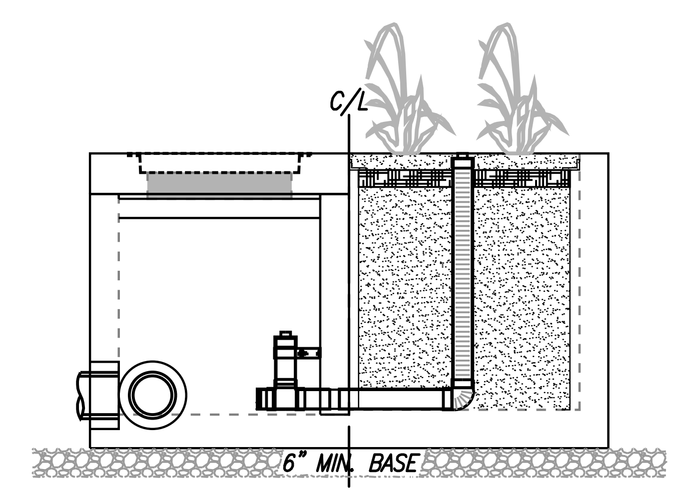
LEFT END VIEW

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 MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. 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.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.



ELEVATION VIEW



RIGHT END VIEW

8/14/23SCOTT SERTICH

MODULAR WETLANDS
FOR PATENT INFORMATION, GO TO www.ContechES.com/IP

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

CONTECH ENGINEERED SOLUTIONS
A QUIKRETE® COMPANY

Modular Wetlands® Linear Vault Installation Manual for Open Planter

MODULAR WETLANDS®

OVERVIEW

This installation guide is for the vaults containing the Open Planter variations of the Modular Wetlands Linear (MWL). Please refer to the separate installation guide for Underground Modular Wetlands Linear. Read all warning and safety instructions prior to rigging and installing the vault. The Contractor is responsible for supplying all cranes and rigging equipment required for installation. The Contractor is also responsible for all pipe grouting and system pre-activation requirements.

WARNING

Fall protection may be required. Great care must be taken while transporting and installing the vault to ensure the vertical underdrains of the system remain perfectly centered and level. If the top slab, covers, or hatches have not yet been installed or are removed for any reason, great care must be taken to not drop MWL internals. The MWL internals may be damaged under high impact loads. This type of activity voids all warranties.

SAFETY NOTICE AND PERSONAL SAFETY EQUIPMENT

Jobsite safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Contractor(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Contractor's responsibility and outside the scope of Contech Engineered Solutions.

Fall Protection Equipment

Safety Boots

Gloves

Hard Hat

Eye Protection

Ear Protection

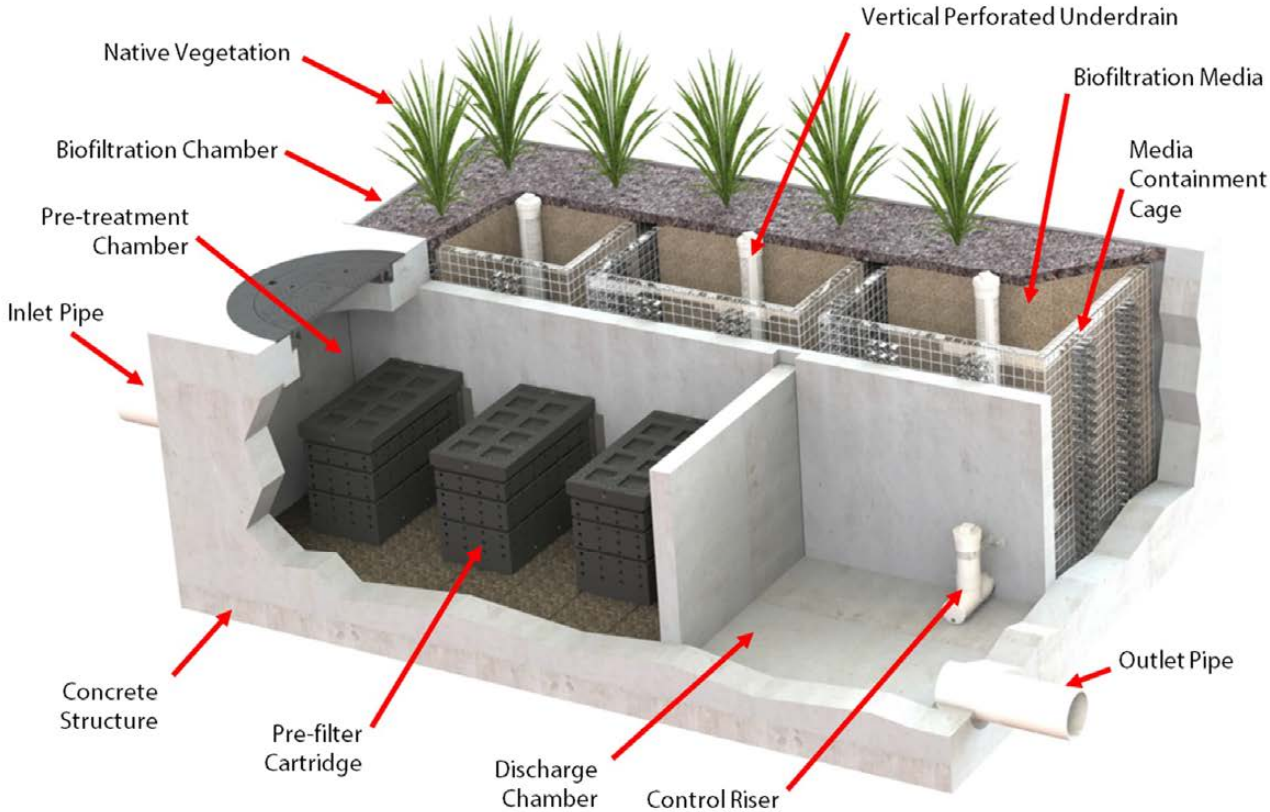
Ventilation and Respiratory Protection

Maintenance and Protection of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL will typically arrive on-site with the internals pre-installed, secured, and sealed to a precast structure. Some taller MWL vaults may require onsite assembly of internals. Due to weight restrictions, biofiltration media for MWL ships separate and needs to be installed on site after the system has been installed in the ground. The MWL comes in multiple sizes and configurations, including side-by-side or end-to-end layouts. See shop drawings (plans) for project specific details.

The standard MWL is comprised of the following components:



CONFINED SPACE ENTRY

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

UNLOADING AND HANDLING

Any unloading/handling guidance of the MWL precast structure is beyond the scope of work of Contech but can be obtained from the precaster. Contact Contech to obtain precaster contact information. Handle MWL components with care. Special lift gear and rigging may be necessary to unload and handle any precast components, which is the responsibility of the site Contractor.

DO NOT DAMAGE the parts in handling or unloading, and if parts are damaged prior to off-loading, immediately call Contech.

The Contractor is responsible for the inspection of all MWL components shipped, and all components shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any nonconformance to approved drawings or damage to any part of the system shall be documented on the shipping ticket, and Contech should be contacted immediately. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs shall be made at the acceptance of the Engineer/Inspector.

CRANE SELECTION

The Contractor is responsible for selecting the appropriate equipment to safely rig, lift, unload, and set-in-place the MWL, as well as provide a safe environment at the jobsite for the offloading and installation/assembly of the structure. Please see project specific drawings for the maximum pick weight of the heaviest precast component. Safety considerations of crane size, placement, ground support, stability, distance to excavation, swing and lifting radius, overhead conflicts, permits, or traffic control and other items must be carefully addressed but are outside the responsibility of Contech.

EXCAVATION SAFETY

Any site excavation and shoring are beyond the scope of work of Contech. **This is the responsibility of the Contractor, and all OSHA, Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards shall apply on all sites.**

BASE PREPARATION

The MWL shall be placed on a compacted surface to ensure matching the final grade listed on the drawings. Compact undisturbed sub-grade materials to 95% of maximum density at +/- 2% of optimum moisture content prior to placement of crushed rock. Crushed rock base material shall be six-inch minimum layer of ¾-inch minus rock. Unsuitable material below sub-grade shall be replaced per site engineer's approval. The allowable amount of variation from corner to corner is 0.5%.

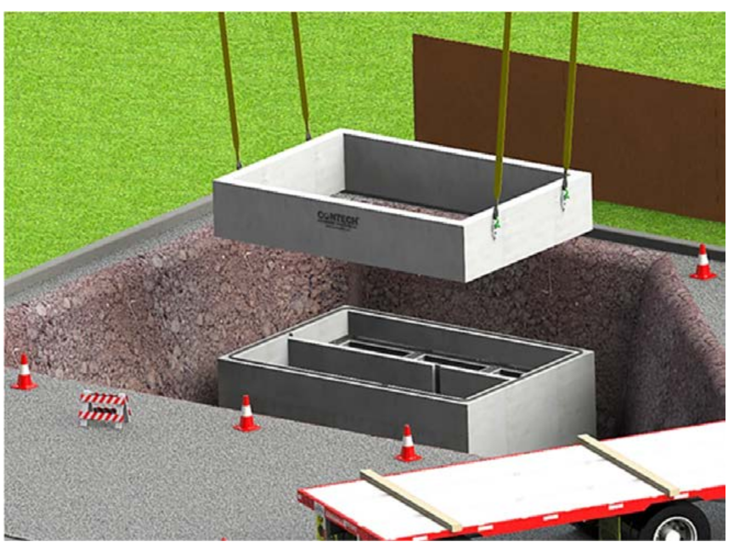
SETTING THE MODULAR WETLANDS LINEAR VAULT

1. SETTING BASE SECTION

Before offloading, obtain a copy of the final approved shop drawings and site plan to verify all components are correctly placed and at the proper elevation. The Contractor is responsible for safely rigging and offloading the structure and associated components. Set the base section of the MWL vault on solid, level sub-grade. Ensure the inlet(s) and outlet are properly oriented. The system floor shall slope ¼" maximum across the width and slope downstream 1 inch per 12 foot of length.

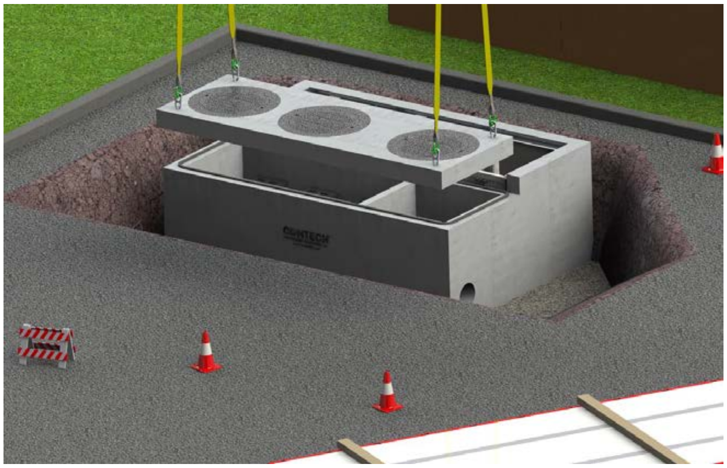
2. SEAL PRECAST SECTIONS

Place butyl mastic tape between each precast section to seal. Verify level and elevation of the base section before adding any additional precast tops riser sections.



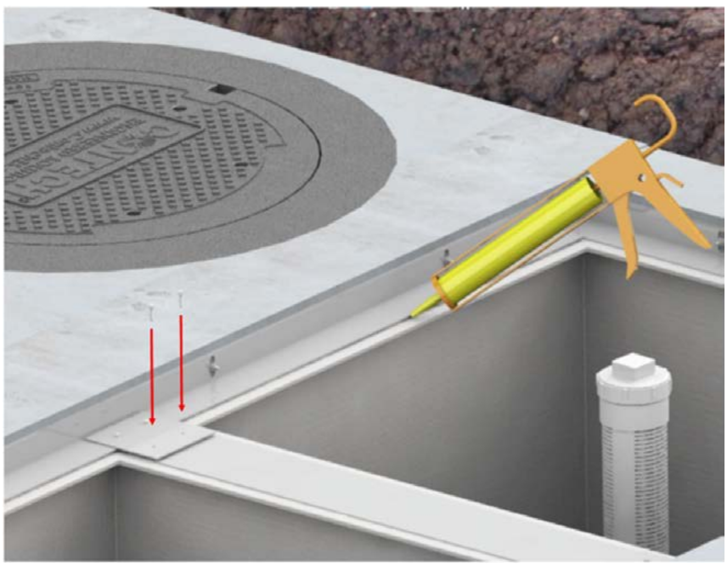
3. RISER SECTIONS (IF APPLICABLE)

Set riser section(s), if needed, on the base section per approved shop drawings. If riser sections are not required, proceed to **Step 4.**



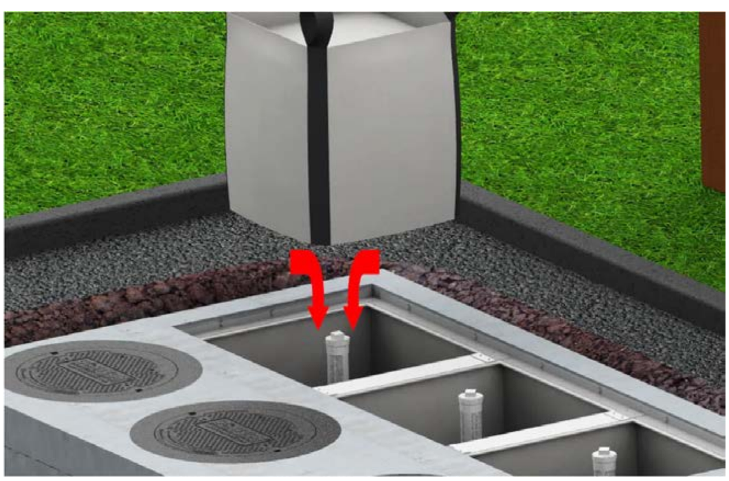
4. TOP SLAB

Set the Top Slab according to the approved shop drawings. Prior to setting the top slab, ensure butyl mastic tape has been applied to all joints. The top slab may be provided as a separate slab as shown or it can be cast together with a riser section (see plan drawings for project specific details).



5. SECURE AND SEAL ALUMINUM TOP ANGLE

Sections of aluminum angle come attached to the side of the precast concrete top slab. The aluminum angle has slots that allow it to be raised or lowered to rest on the top of the media containment cage(s). Once the aluminum angle is positioned to the top of the media cage and flush with the other angles, use a 7/16″ socket to tighten the hex nuts securing the angles and then a 3/8″ socket to install the provided self-drilling screws. After all aluminum is secured, seal it to the cage(s) and precast wall using provided Sikaflex sealant.



6. BIOFILTRATION MEDIA INSTALLATION

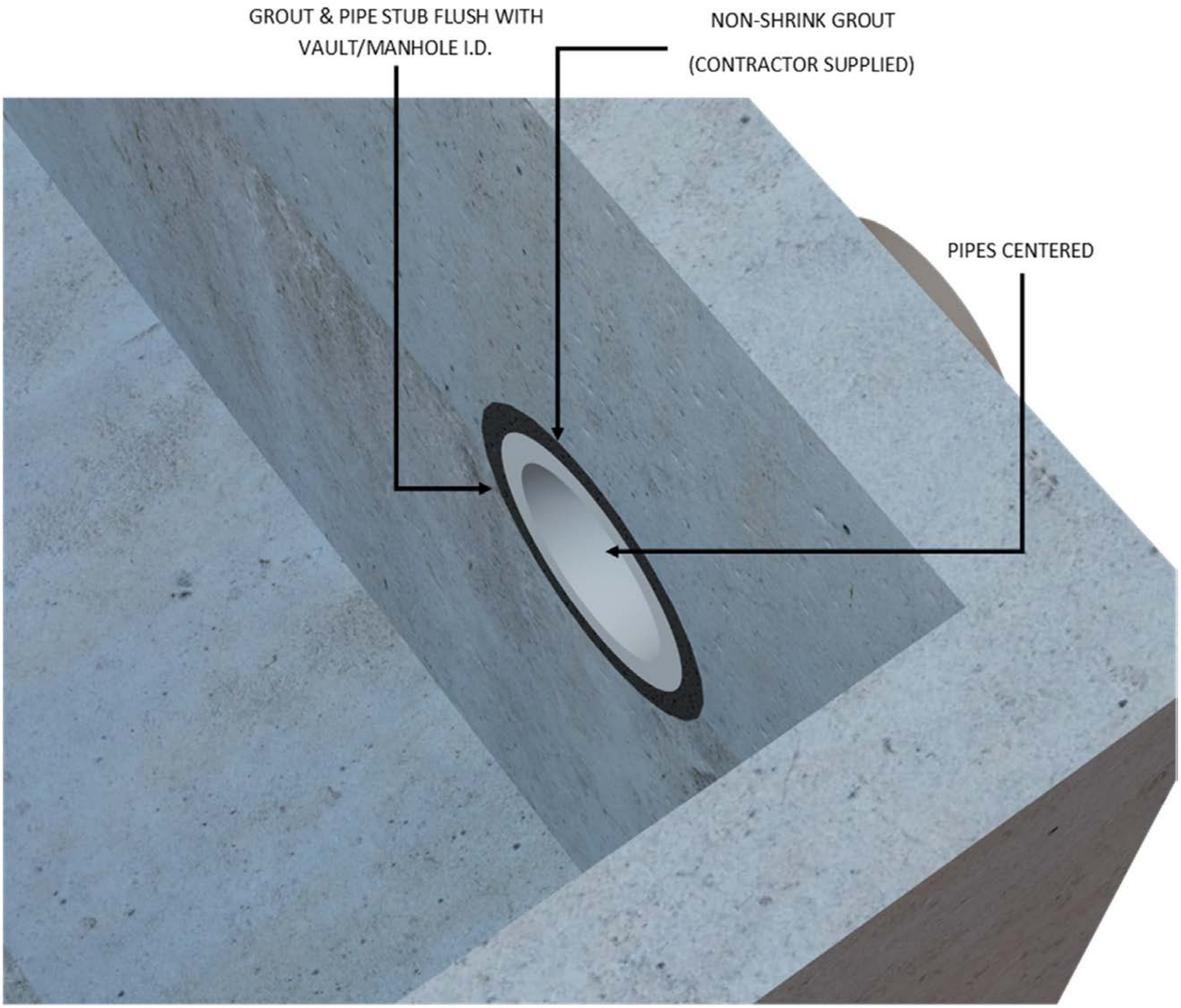
Biofiltration media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Media sacks must be stored in a dry, temperate environment prior to installation. To install media, first ensure that the chamber is fully clear of debris and the vertical riser pipes are centered and straight. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Do not let media free fall at a height greater than 3ft to prevent damage to pipes. Fill the media cage(s) up to a height of 9″ below the top of the center vertical riser pipe.

7. INSTALL PLANT PROPAGATION BLOCKS

Plant propagation blocks will be provided by Contech in the size and quantity required for the system. See the plant propagation block details in the appendix for model specific block layouts. Blocks must be stored in a dry, temperate environment prior to installation. To install the blocks, first remove the plastic wrapper and place the blocks on top of the media in the layout specified. The tops of the blocks should be 6 1/4" below the top of the finished surface in the biofiltration chamber. Once the blocks are placed cover them with remaining biofiltration media to finished surface. The top of the media may also be covered with a layer of approved mulch or other decorative landscape material (see plan drawings for details).

PIPE CONNECTIONS

Inlet pipe(s) and outlet pipe shall be stubbed in and connected to the system according to Engineer's requirements and specifications. The pipe material should be indicated on the site plan. Connect pipes in accordance with approved watertight boot connection, if applicable. Contractor to grout all inlet and outlet pipes flush with interior of vault per plan and specifications. Contractor to supply non-shrink grout. Inlet pipe(s) should be centered in the hole and the outlet pipe should be flush with the chamber floor.



BALLAST

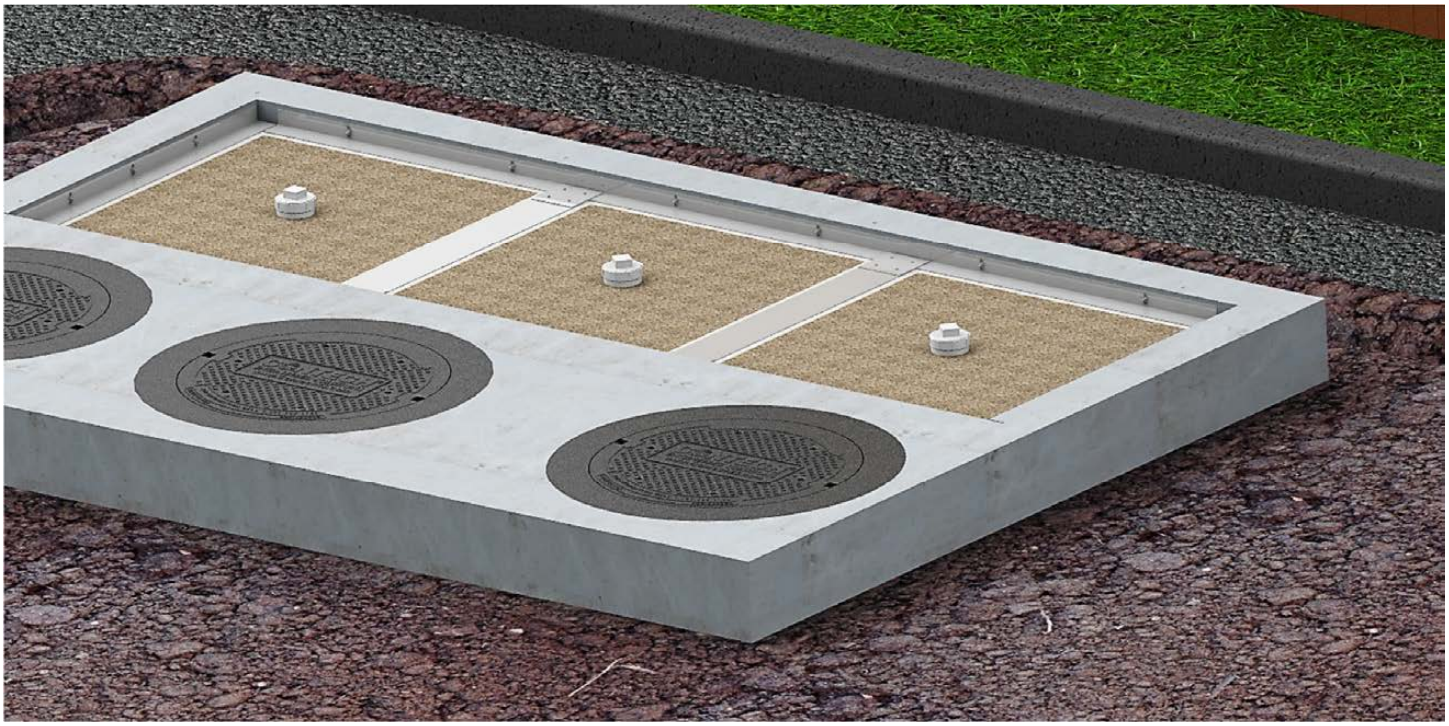
When required, the Contractor shall place ballast to the dimensions specified by the Engineer and noted on the plans. Ballast shall not encase the inlet and/or outlet piping, and 12-inches of clearance should be provided between the ballast and the inlet/outlet pipes.

RISERS, COVERS, AND CLOSING THE SYSTEM

The MWL is delivered with the necessary risers and covers (if necessary) to bring the unit to grade. It is the contractor's responsibility to assemble the MWL per the plans and as directed by the Engineer.

- The top slab should be oriented per the drawing
- Install frames and covers per plans

The contractor is responsible for sealing and making all joints, line entry, and exit points watertight.



BACKFILL

Backfill material and placement method should be performed in accordance with the construction plans and specifications and as directed by the Engineer.

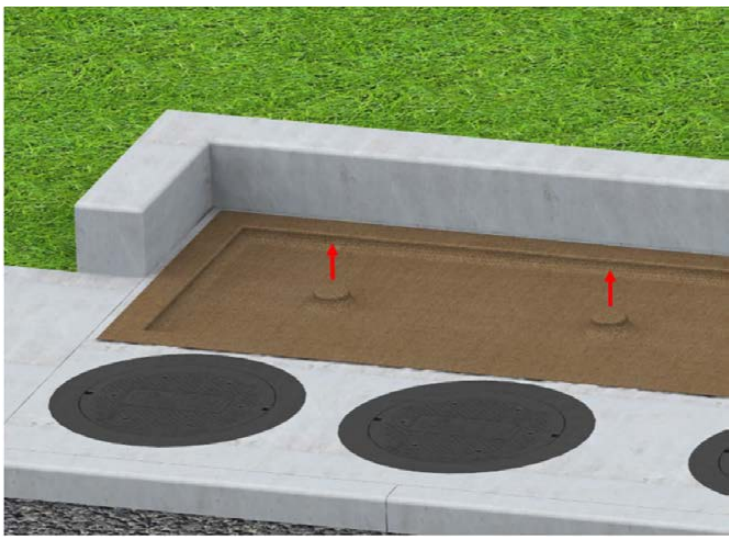
CURB & GUTTER APPLICATIONS

It is the responsibility of the Contractor to provide curb and gutter and transition to the MWL for proper flow into the system through a 4"-6" throat opening. It is the responsibility of the Contractor to provide inlet protection/sediment control and cleaning around each MWL. See project drawings for details on the throat opening.

SYSTEM ACTIVATION

Once construction is complete and the site has been fully stabilized (i.e., landscaping is in place, grass growing, and top course pavement laid), the MWL can be activated. Final activation is performed ONLY by Contech authorized personnel. Please call 513-645-7770 to schedule your activation. Prior to requesting final activation, the following steps must be completed by the Contractor as well as completing the pre-activation items attached in the appendix as part of the pre-activation process.

The contractor is responsible for keeping the MWL clean and free of construction debris and sediment prior to activation. This reduces the potential of a large rainfall/runoff event entering the pretreatment chamber and/or biofiltration chamber and prematurely contaminating the prefilter cartridges or wetland media during the project construction phase. Practices to protect the media include, but are not limited to, plugging the inlet pipe and diverting construction run off around the unit. For open planter units, media protection is recommended. This can be done using a geotextile/silt fabric to protect the media from water entering the chamber from the top.



1. REMOVE MEDIA PROTECTION

As stated above, all pre-activation activities must be performed prior to requesting final activation. The first step of the pre-activation process is to remove any media protection that may have been added to the MWL unit. Remove the silt fabric protecting the media and discard it while being careful not to spill any sediment or debris into the exposed media. If media was installed into the unit at the time the vault was set, proceed to **Step 4**. If not, proceed to **Step 2** for media installation.

2. BIOFILTRATION MEDIA INSTALLATION

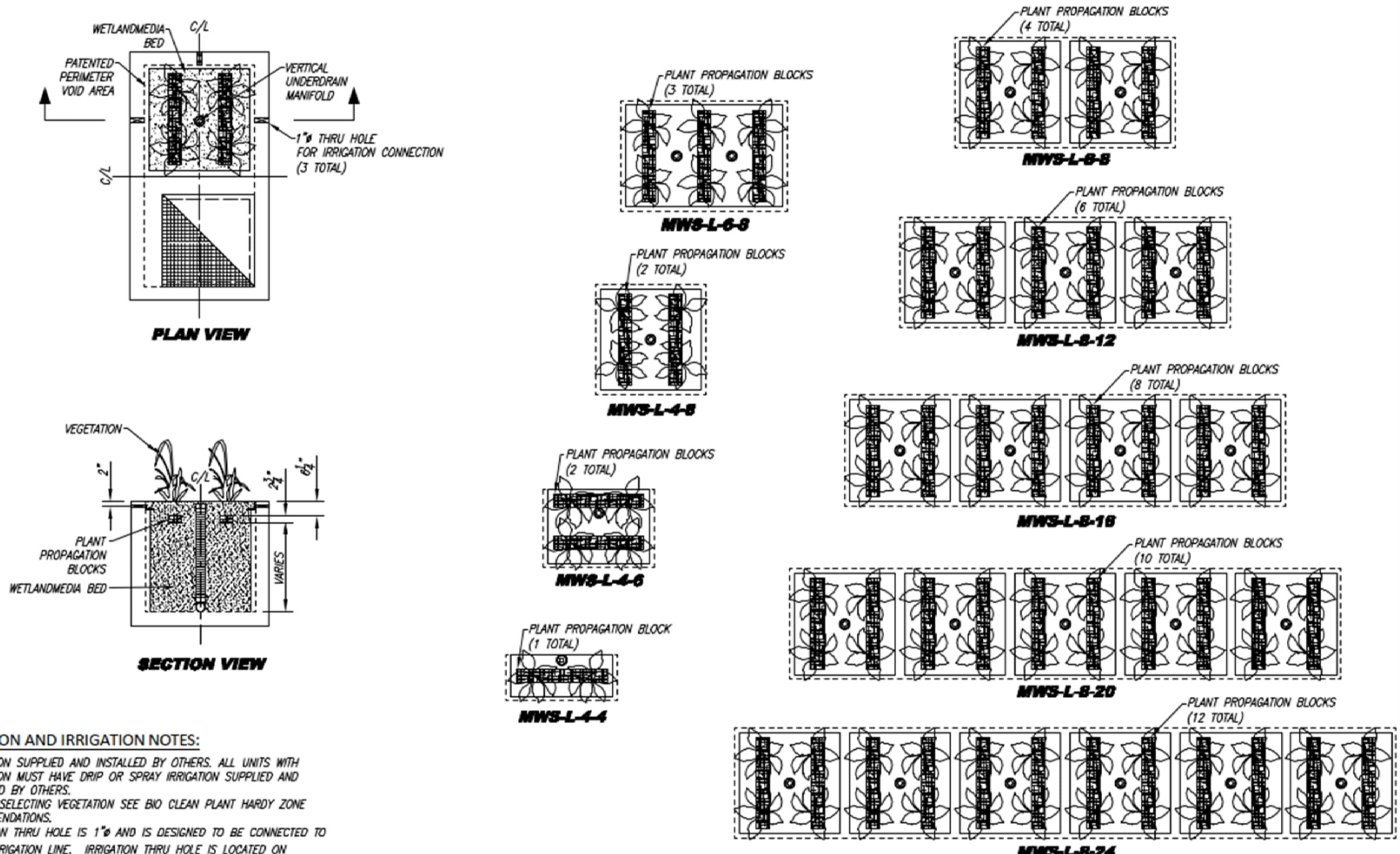
Biofiltration media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Media sacks must be stored in a dry, temperate environment prior to installation. To install media, first ensure that the chamber is fully clear of debris and the vertical riser pipes are centered and straight. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Do not let media free fall at a height greater than 3ft to prevent damage to pipes. Fill the media cage(s) up to a height of 9” below the top of the center vertical riser pipe.

3. INSTALL PLANT PROPAGATION BLOCKS

Plant propagation blocks will be provided by Contech in the size and quantity required for the system. See the plant propagation block details in the appendix for model specific block layouts. Blocks must be stored in a dry, temperate environment prior to installation. To install the blocks, first remove the plastic wrapper and place the blocks on top of the media in the layout specified. The tops of the blocks should be 6 1/4″ below the top of the finished surface in the biofiltration chamber. Once the blocks are placed cover them with remaining biofiltration media to finished surface. The top of the media may also be covered with a layer of approved mulch or other decorative landscape material (see plan drawings for details).

4. PLANT VEGETATION

Plant the approved vegetation by digging small holes to place them on top of the plant propagation blocks in the layout shown in the plant propagation block details in the appendix. Once the vegetation is placed, cover the vegetation roots with media or approved mulch (see plan drawings for details).



VEGETATION AND IRRIGATION NOTES:

1. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
2. BEFORE SELECTING VEGETATION SEE BIO CLEAN PLANT HARDY ZONE RECOMMENDATIONS.
3. IRRIGATION THRU HOLE IS 1"ø AND IS DESIGNED TO BE CONNECTED TO A $\frac{1}{2}$"ø IRRIGATION LINE. IRRIGATION THRU HOLE IS LOCATED ON CENTER OF WETLAND CHAMBER 2" DOWN FROM THE TOP OF THE SYSTEM.
4. IRRIGATION SYSTEM FOR MODULAR WETLAND SYSTEM CAN BE PLACED ON SAME VALVE AS SURROUNDING PLANTING AREAS AND REQUIRES NO SPECIAL WATERING NEEDS.

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

CONTECH ENGINEERED SOLUTIONS LLC
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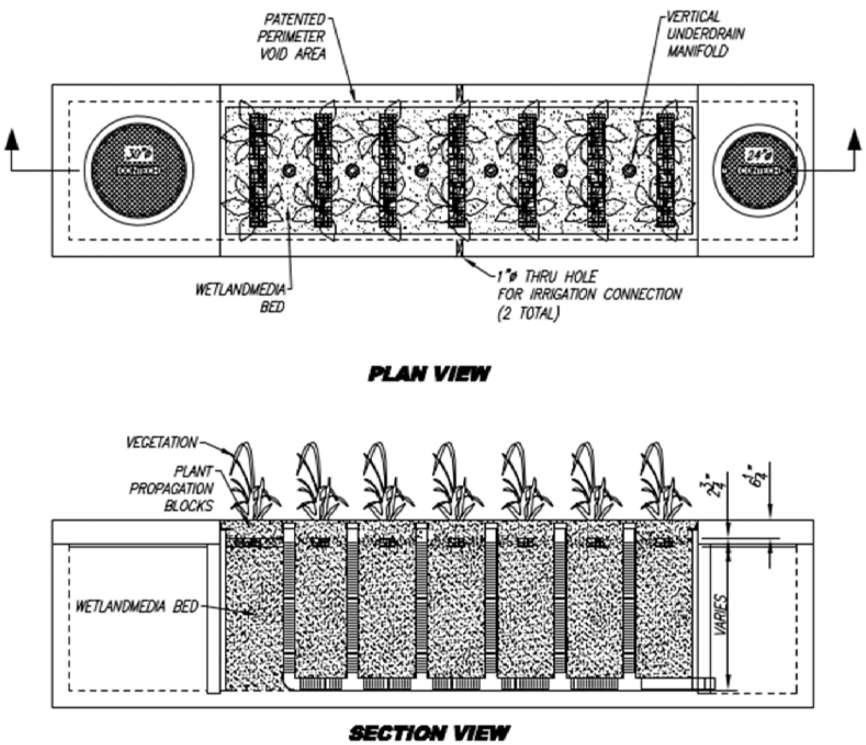
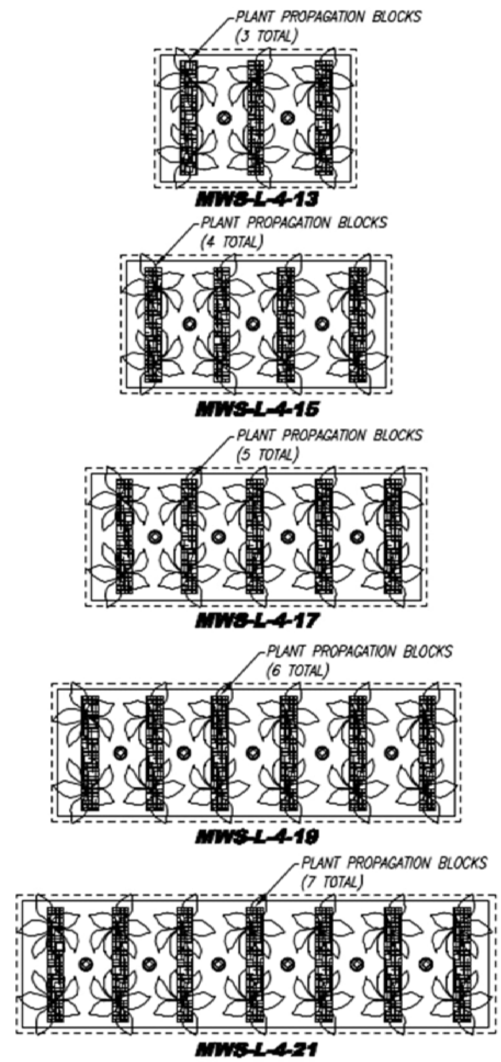
STORMWATER BIOFILTRATION SYSTEM
PLANTER INSTALLATION





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4. IRRIGATION SYSTEM FOR MODULAR WETLAND SYSTEM CAN BE PLACED ON SAME VALVE AS SURROUNDING PLANTING AREAS AND REQUIRES NO SPECIAL WATERING NEEDS.

MODULAR WETLANDS	PROPRIETARY AND CONFIDENTIAL: THE INFORMATION CONTAINED IN THIS DOCUMENT IS THE SOLE PROPERTY OF FORTERRA AND ITS COMPANIES. THIS DOCUMENT, NOR ANY PART THEREOF, MAY BE USED, REPRODUCED OR MODIFIED IN ANY MANNER WITH OUT THE WRITTEN CONSENT OF FORTERRA.	CONTECH ENGINEERED SOLUTIONS LLC www.ContechES.com	STORMWATER BIOFILTRATION SYSTEM PLANTER INSTALLATION

Modular Wetlands System Pre-Activation Request Checklist

Project Name: ____

Contact Name: _______________________________ Company:_____________________________________

Preferred Activation Date: ________________________ (Provide 2 weeks min from date this form is submitted)

	Modular Wetlands System Site Designation and Size (EX: Str. No. ##, MWS-L-X-X-X-V)				
Grout in all hatches and manholes covers to specified finish	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Grout in all visible lifting points	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Piping has finished grout and is flush with the inside surface of concrete	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Invert of outlet pipe is flush with floor or discharge chamber	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Curbing and finished concrete work in complete and forms are removed	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Internal components are present and undamaged	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Wetland Media and Bio Media Green slabs are installed	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Wetland Media is protected from contamination	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Irrigation and specified landscaping are installed (when applicable)	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Unit contains no trash, debris, waste, or standing water	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DVERT elevations are set according to plans (when applicable)	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Attach additional sheets as necessary

NOTE: A charge of $1,500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Modular Wetlands Systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation.

____ ____________________________

Signature Date

800-338-1122

WWW.CONTECHES.COM

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Modular Wetlands Linear Vault Install for Planters 11/24

HYDRA® TMDL SYSTEMS LLC.

[CPS] CONNECTING PIPE SCREEN

Patent Pending

100% Full-Capture Device
The CPS (Connector Pipe Screen)
A Stormwater Trash Capture Solution

INSTALLATION MANUAL

5116 W. Emerald Street | Boise, Idaho 83706 | 818.516.4946

Denis@hydratmdl.com | hydratmdl.com

OVERVIEW

Hydra Connector Pipe Screen (CPS) Overview

The Hydra Connector Pipe Screen (Hydra CPS) is engineered to utilize the existing catch basins effectively capture 100% of trash and debris.

This innovative CPS technology is compatible with both curb and drop inlets, helping municipalities comply with stormwater regulations under NPDES and MS4 permits.

Hydra CPS units are also ideal for new developments, serving as the first line of defense in preventing trash and debris from reaching downstream stormwater BMPs, where they could cause clogs and increase maintenance demands.

Constructed entirely from 304 perforated stainless steel, the system is both highly durable and cost-effective. Its innovative curved structure, reinforced by multiple cross supports, allows it to withstand several hundred pounds of pressure—well beyond the 60-pound requirement set by Los Angeles County.

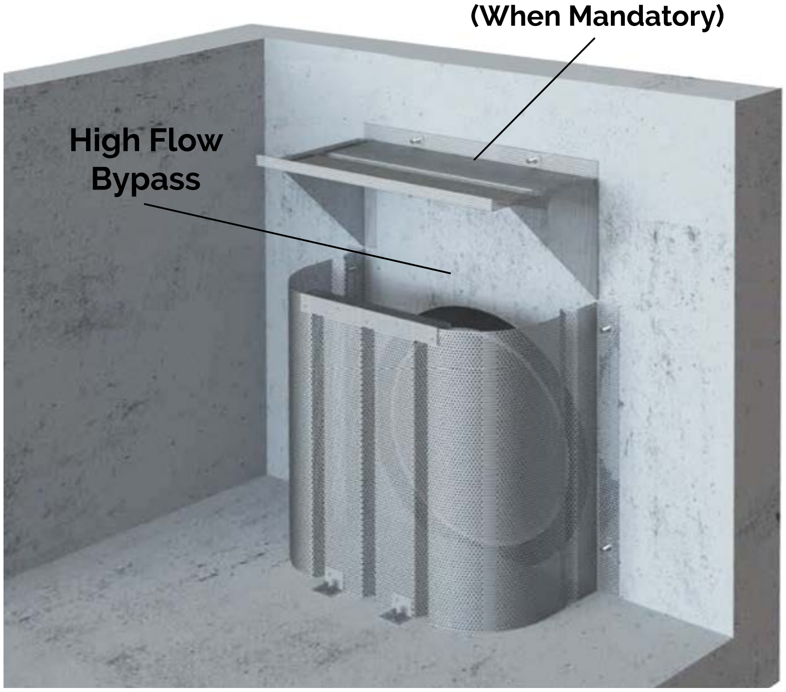
The modular design is engineered for easy installation: it can be inserted through a standard 24-inch manhole and assembled inside the catch basin within minutes. The adjustable centerpiece is available in various lengths to accommodate outlet pipes of 48 inches or larger. For catch basins with outlet pipes positioned at corners, the system can be adapted into an L-shaped configuration using a single extension piece and centerpiece.

CPS DIAGRAM

Additional features include an integrated lid for vector control and a boom trough to enhance hydrocarbon capture efficiency.

FEATURES

- 1 Piece Design
- Integral Stiffeners
- Low Profile Design
- Shapes include "U" "L" Tilted & Straight
- No Obstructive Assembly Fasteners
- Hydro-Carbon Boom Trough
- Vector Control Lid
- Custom sizes available



ADVANTAGES

- Captures 100% of Trash & Debris
- 100% Stainless Steel perforated metal construction
- Installable Through Curb Inlets
- Modular design to adapt to pipe sizes 4" up to 48"
- Will Work In All Storm Drains
- Reduced Maintenance Time/Cost

Accessibility to the storm drain unit is achieved through manhole access covers. The unit is a confined space environment and to perform maintenance procedures, requires properly trained personnel. Contractor is responsible to obtain all necessary training, personal protective equipment to meet applicable OSHA regulations and appropriate standards for confined space entry.

SAFETY NOTICES AND PERSONAL PROTECTIVE EQUIPMENT

Safety notices are reminders that it's the responsibility of the owner, manager, or contractor to follow these rules.

- ➢ Hard Hat
- ➢ High Visibility vest
- ➢ Ventilation and respiratory protection
- ➢ Pedestrian delineation
- ➢ Traffic control plan
- ➢ Confined space entry gear
- ➢ Job Site Safety Analysis
- ➢ Etc.

All work must follow OSHA rules, along with any federal, state, and local safety regulations specific to the project. Job site safety is the contractors responsibility and is outside from the scope of HYDRA TMDL.

TOOLS AND HARDWARE CHECK LIST

Tools

- Manhole hook
- Marker – Sharpie
- Tape Measure
- Square – Straight Edge
- Hammer (recommend 2lbs sledgehammer)
- Level 24"
- Roto Hammer w/ 3/8" x 6" concrete bit
- 9/16 wrench
- Impact Drill with 9/16 socket (not required)
- Angle grinder & cut off disk








Hardware

- 3/8" x 2 ¾" Wedge Anchors
- 3/8" x 1 ½" Nuts & Bolt, Washers

* All hardware nuts and bolts must be stainless steel and under no circumstances shall anything other than such

CATCH BASIN PREPARATION

Accessibility to the storm drain unit is achieved through manhole access covers. The unit is a confined space environment and to perform maintenance procedures, requires properly trained personnel. Contractor is responsible to obtain all necessary training, personal protective equipment to meet applicable OSHA regulations and appropriate standards for confined space entry. Hydra TMDL Systems is not responsible for any injuries or damages that might occur during this installation process.

CATCH BASIN CLEANING FOR CPS INSTALLATION

The CPS must rest flush at the bottom of the catch basin floor, therefore It is recommended that the

catch basin is properly cleaned and inspected for any damage prior to installing the CPS Screen.

- Performing the cleaning during install maximizes efficiency and minimizes downtime
- A clean, debris-free surface is required to ensure proper placement of the Hydra CPS.
- The CPS must rest securely with no gaps larger than 5mm along any edge for optimal performance.

Installation Notes:

Installer to determine which Hydra CPS model to install based on the following criteria:

1. Location of connector pipe inside the catch basin to determine the screen shape
2. Sizing of the Outlet Pipe for Connector Pipe Screen to Filter
3. Location of the curb opening to determine if a bypass lid is required
4. Treatment flow rate through the screen
5. Bypass requirements – typically over the screen

FOR INSTALLATION SUPPORT

PLEASE CONTACT US AT:

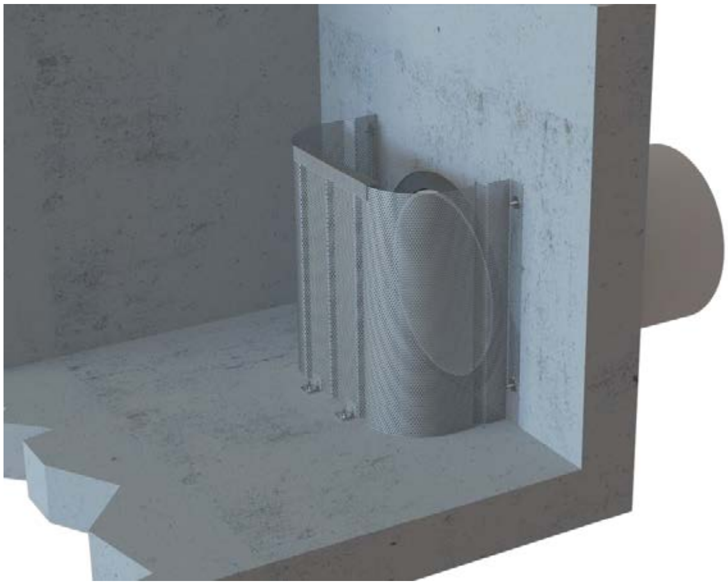
818.516.4946

Denis@hydratmdl.com

Installation Instructions

1. Carefully lower the Modular CPS unit through the manhole opening.
2. Position the Modular CPS so it is evenly spaced around the connector pipe, ensuring a minimum of 4" spacing away from any corners.
3. Mark the hole locations on the wall for the stainless anchor bolts.
4. Drill holes and hammer the bolts in place
5. Secure the Hydra CPS using stainless nuts.
6. If the bottom of the base exposes more than a 5 mm gap, then an additional face strip may be fastened to the base channel using stainless

The contractor shall furnish all labor, equipment, materials, and incidentals required to install the CPS and appurtenances in accordance with the contract documents.



CATCH BASIN PREPARATION

Any damage to the existing drainage structure (retrofit applications) or surrounding infrastructure that may need to be repaired to allow for proper installation of the CPS shall be considered incidental and to be paid for at no cost to the client (or installer responsibility).

Hydra TMDL Systems does offer installation services in certain areas. Please contact Hydra TMDL Systems for more information on pre-authorized 3rd party contractors that can provide install service in your area.

DISCLAIMER: The manufacturer of the Hydra CPS does provide a warranty against defects in materials and workmanship for a period of 3 years from the date of acceptance by the Engineer.

The Hydra CPS also carries a 2-year warranty on installation when installed by an authorized installer. All suggested applications are provided solely as general guidance to assist readers in making their own informed evaluations and decisions. These examples are not intended to serve as guarantees or assurances of fitness or suitability for any specific purpose or application.

COMPONENTS:

U-Shape diagram

L-Shape diagram

Attachment B

O&M Plan

Operations and Maintenance (O&M) Plan

Water Quality Management Plan
for

OCVIBE – PARKING DECK A

1725 S. Douglas Road, Anaheim, CA 92806

APN 232-071-02 & 232-071-03

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** For developments with no Property Owners Association (POA) or with POAs of less than fifty (50) dwelling units, practical information materials will be provided to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially developed and provided to first residents/occupants/tenants by the developer. Thereafter such materials will be available through the Permittees' education program. Different materials for residential, office commercial, retail commercial, vehicle-related commercial and industrial uses will be developed.	Provide all tenants with environmental awareness education materials (made available by municipalities). Implement upon initial leasing to occupants, and/or tenants, and annually thereafter.	City of Anaheim
YES	**N2. Activity Restrictions** If a POA is formed, conditions, covenants and restrictions (CCRs) must be prepared by the developer for the purpose of surface water quality protection. An example would be not allowing car washing outside of established community car wash areas in multi-unit complexes. Alternatively, use restrictions may be developed by a building operator through lease terms, etc. These restrictions must be included in the Project WQMP.	Verify that occupants / tenants comply with the applicable restrictions as indicated in the lease documents. Monthly verification of compliance with WQMP or per local standards.	City of Anaheim

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	**N3. Common Area Landscape Management** Identify on-going landscape maintenance requirements that are consistent with those in the County Water Conservation Resolution (or city equivalent) that include fertilizer and/or pesticide usage consistent with Management Guidelines for Use of Fertilizers (DAMP Section 5.5).	Manage landscaping in accordance with applicable ordinances and with management guidelines for use of fertilizers and pesticides. Every two weeks and when new field landscaping personnel are hired.	City of Anaheim
YES	**N4. BMP Maintenance** The Project WQMP shall identify responsibility for implementation of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities.	Updated only if changes made to WQMP. Ongoing maintenance.	City of Anaheim
NO	**N5. Title 22 CCR Compliance**		
NO	**N6. Local Water Quality Permit Compliance**		
NO	**N7. Spill Contingency Plan**		
NO	**N8. Underground Storage Tank Compliance**		
NO	**N9. Hazardous Materials Disclosure Compliance**		
NO	**N10. Uniform Fire Code Implementation**		

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** For industrial/commercial developments and for developments with POAs, the owner/POA should be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The owner/POA may contract with their landscape maintenance firms to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations by tenants/homeowners or businesses and reporting the violations to the owner/POA for investigation.	Inspect daily for, remove and properly dispose of litter.	City of Anaheim
YES	**N12. Employee Training** Education program (see N1) as it would apply to future employees of individual businesses. Developer either prepares manual(s) for initial purchasers of business site or for development that is constructed for an unspecified use makes commitment on behalf of POA or future business owner to prepare. An example would be training on the proper storage and use of fertilizers and pesticides, or training on the implementation of hazardous spill contingency plans.	Consisting at a minimum of the distribution of educational materials contained herein and material made available by municipalities. Training to be conducted every two years.	City of Anaheim

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
NO	**N13. Housekeeping of Loading Docks** Loading docks typically found at warehousing facilities should 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. Cleanup procedures should minimize or eliminate the use of water if plumbed to the sewer. If wash water is used, it must be disposed of in an approved manner and not discharged to the storm drain system.		
YES	**N14. Common Area Catch Basin Inspection** All privately maintained drainage systems will be inspected monthly and, if necessary, cleaned and more frequently during the rainy season (October 1 – April 30). At a minimum, all privately maintained drainage systems will be cleaned once a year prior to the rainy season and no later than October 1 of each year.	Drainage facilities, including catch basins, trash capture screen devices within side opening catch basins, area drains, and open drainage channels must be cleaned and maintained. Post construction: monthly inspection and, if necessary, cleaned and more frequently during the rainy season (October 1 – April 30). Cleaned at a minimum once a year prior to the rainy season, no later than October 1st of each year.	City of Anaheim
YES	**N15. Street Sweeping Private Streets and Parking Lots** Streets and parking lots are required to be swept prior to the storm season, in late summer or early fall, prior to the start of the rainy season or equivalent as required by the governing jurisdiction.	A typical weekly sweeping program will be developed for the property.	City of Anaheim

Structural Source Control BMPs			
YES	**S1. Provide Storm Drain System Stenciling and Signage** Storm drain stencils are highly visible source control messages, typically placed directly adjacent to storm drain inlets. The stencils contain a brief statement that prohibits the dumping of improper materials into the municipal storm drain system. Graphical icons, either illustrating anti-dumping symbols or images of receiving water fauna, are effective supplements to the antidumping message. Stencils and signs alert the public to the destination of pollutants discharged into stormwater.	Assure that stenciling is legible but re-stencil once every five years at minimum. Maintain twice a year and no later than October 1st of each year.	City of Anaheim
NO	**S2. Design Outdoor Hazardous Material Storage Areas to Reduce Pollutant Introduction**		
NO	**S3. Design Trash Enclosures to Reduce Pollutant Introduction**		
YES	**S4. Use Efficient Irrigation Systems and Landscape Design** Irrigation systems shall be installed and programmed to apply proper volume of water and avoid excess runoff through use of efficient irrigation systems & landscape design, water conservation, smart controllers, and source control.	Verify that runoff minimizing landscape design continues to function by checking that water sensors are functioning properly, that irrigation heads are adjusted properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather and day or nighttime temperatures. Weekly maintenance.	City of Anaheim
NO	**S5. Protect Slopes and Channels**		
NO	**S6. Loading Dock Areas**		

NO	**S7. Maintenance Bays and Docks**		
NO	**S8. Vehicle Wash Areas**		
NO	**S9. Outdoor Processing Areas**		
NO	**S10. Equipment Wash Areas**		
NO	**S11. Fueling Areas**		
NO	**S12. Site Design and Landscape Planning**		
NO	**S13. Wash Water Controls for Food Preparation Areas**		
NO	**S14. Community Car Wash Racks**		

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		
Hydrologic Source Control BMP # 1	Not applicable	Not applicable
Miscellaneous BMP # 1	Not applicable	Not applicable

Infiltration BMP # 1 INF-7: Underground Infiltration Underground Infiltration Gallery (5' Diameter Perforated CMP) See attached BMP fact sheet and Contech O&M Plan after 18 of 18.	Inspect inlet and equalizer pipes for damage and clogging. Inspect infiltration CMP for deflection, cracks or corrosion. Inspect pipe joint connections for separation. Record depth of sediment buildup. Vacuum out infiltration gallery and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the infiltration gallery until the invert of the CMP is visible and clean. If maintenance is not performed as recommended, sediment and trash may accumulate and block perforations to provide proper infiltration and drawdown. Manhole covers should be securely seated following cleaning activities. Remove and replace CMP showing excessive deflection, cracking and joint separation to prevent failure of facility and caving. Contact Contech for guidance and/or product replacement. Inspections should be completed quarterly. Remove sediment from gallery when average depth of sediment exceeds 3 inches. CMP infiltration systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice. Repairs shall be completed immediately.	City of Anaheim
Infiltration BMP # 2	Not applicable	Not applicable

Harvest and use BMP # 1	Not applicable	Not applicable

BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Biotreatment BMP # 1	Not applicable	Not applicable
Treatment Control BMPs		
Treatment Control BMP # 1	Not applicable	Not applicable
Pre-treatment/Gross Solids Removal BMPs		

Pre-treatment BMP #1 BIO-7: Proprietary Biotreatment used for Pre-treatment Contech Modular Wetlands System (MWS-L-18-12) See attached BMP fact sheet and Contech O&M Plan after page 18 of 18.	Observe the inside of the system through access covers. Look for any out of the ordinary obstructions in the inflow pipe, pretreatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre- treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in the pre-treatment chamber. Record this depth on the inspection form. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes. Look for any plants that are dead or showing signs of disease or other negative stressors. The discharge chamber houses the control riser. Check to ensure the orifice is in proper operating condition and free of any obstructions. Upon determining that the vault is safe for entry, remove all access covers and position the vacuum truck accordingly. With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridges.	Not applicable

	Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the floor is visible and clean. After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lids from the pre-filter cartridges by removing the two thumb screws. Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge. Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.	

	In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones. Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed. Once maintenance is complete, replace all access covers. REPLACING BIOFILTRATION MEDIA IF REQUIRED VACUUM EXISTING BIOFILTRATION MEDIA: Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer. INSTALLING NEW BIOFILTRATION MEDIA: Ensure that the chamber is fully cleaned prior to installation of new media into the media	

	containment cages. Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cages up to the same level as the old media. REPLANT VEGETATION: Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media. The first year of inspections shall be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. At minimum, inspections shall be done annually and before October 1st of each year. Replace biofiltration as needed. General life of media is 10 to 20 years depending on site specific conditions and pollutant loading.	

Pre-treatment BMP #2 PRE-2: Catch Basin Insert Hydra TMDL Systems Connector Pipe Screen (CPS) See attached BMP fact sheet and Contech O&M Plan after page 18 of 18.	Inspect catch basins and CPS devices. Remove manhole or access port and identify trash accumulation within catch basin and trash screen system. Documentation required includes photos of accumulation of debris (ensure date stamp) and document accumulation percent. Within 1 week of inspection, remove all trash and debris in catch basins. Remove trash and any accumulated debris and vegetation growing across or blocking catch basin opening. Remove debris that covers the perforated openings of the CPS. Ensure there is no standing water inside of catch basin, which would indicate that the device may not be draining properly. Documentation required includes photos of removed trash and debris (ensure date stamp), cleaned interior and screen (ensure date stamp) and list of staff and vendor (if applicable) involved in cleaning activity, a description of activities completed, and date the work was performed. If CPS is damaged (e.g., broken, obstructed, not attached properly, or otherwise not functioning as originally intended), repair or replace within 1 month. Documentation required includes photos of damaged and repaired items (ensure date stamp), details of damage and repair, including date of identified efficiency and repair date, as well as staff and vendor (if applicable) involved in repair work. Inspection 1x/yr in the months of August or September. If trash accumulation exceeds 40% of device capacity, increase frequency of inspection to 2x/yr.	Not applicable

	Maintenance 1x/yr; sites with large amounts of foliage, high sediments load, or small CPS devices might need to be cleaned more frequently as identified above. Corrective maintenance repair shall be provided as needed. Repairs must be implemented within 1 month of any damages or failure of the CPS.	

Required Permits

This section must list any permits required for the implementation, operation, and maintenance of the BMPs. Possible examples are:

- Permits for connection to sanitary sewer
- Permits from California Department of Fish and Game
- Encroachment permits

If no permits are required, a statement to that effect should be made.

No permits are required for the implementation, operation, and maintenance of the BMP.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached, page 18 of 18.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

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

INF-7: Underground Infiltration

Underground infiltration is a vault or chamber with an open bottom that used to store runoff and percolate into the subsurface. A number of vendors offer proprietary infiltration products that allow for similar or enhanced rates of infiltration and subsurface storage while offering durable prefrabricated structures. There are many varieties of proprietary infiltration BMPs that can be used for roads and parking lots, parks and open spaces, single and multi-family residential, or mixed-use and commercial uses.

Also known as:

- *Infiltration vault*
- *Recharge vault*

Underground Infiltration

Source: http://www.contech-cpi.com

Feasibility Screening Considerations

- Infiltration bains shall pass infeasible screening criteria to be considered for use.
- Underground infiltration galleries pose a potential risk of groundwater contamination; pretreatment should be used.

Opportunity Criteria

- Soils are adequate for infiltration or can be amended to provide an adequate infiltration rate.
- Appropriate for sites with limited surface space.
- Can be placed beneath roads, parking lots, parks, and athletic fields.
- Potential for groundwater contamination can be mitigated through isolation of pollutant sources, pretreatment of inflow, and/or demonstration of adequate treatment capacity of underlying soils.
- Infiltration is into native soil, or depth of engineered fill is ≤ 5 feet from the bottom of the facility to native material and infiltration into fill is approved by a geotechnical professional.
- Tributary area land uses include mixed-use and commercial, sngle-family and multi-family, roads and parking lots, and parks and open spaces. High pollutant land uses should not be tributary to infiltration BMPs.

OC-Specific Design Criteria and Considerations

- ☐ Placement of BMPs should observe geotechnical recommendations with respect to geological hazards (e.g. landslides, liquefaction zones, erosion, etc.) and set-backs (e.g., foundations, utilities, roadways, etc.)
- ☐ Minimum separation to mounded seasonally high groundwater of 10 feet shall be observed.
- ☐ Minimum pretreatment should be provided upstream of the infiltration facility, and water bypassing pretreatment should not be directed to the facility.
- ☐ Underground infiltration should not be used for drainage areas with high sediment production potential unless preceded by full treatment control with a BMP effective for sediment removal.
- ☐ Design infiltration rate should be determined as described in **Appendix VII**.
- ☐ Inspection ports or similar design features shall be provided to verify continued system performance and identify need for major maintenance.

☐ For infiltration facilities beneath roads and parking areas, structural requirements should meet H-20 load requirements.

Computing Underground Infiltration Device Size

Underground infiltration devices vary by design and by proprietary designs. The sizing method selected for use must be based on the BMP type it most strongly resembles.

- For underground infiltration devices with open pore volume (e.g., vaults, crates, pipe sections, etc), sizing will be most similar to infiltration basins.
- For underground infiltration devices with pore space (e.g., aggregate reservoirs), sizing will be most similar to permeable pavement.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 5: **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**

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**

PRE-2: Catch Basin Insert Fact Sheet

Also known as:
- *Drop Inlet Filters*
- *Catch Basin Filters*

Catch Basin Insert (DrainPac™)

Catch basin inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris and may include sorbent media (oil absorbent pouches) to remove floating oils and grease. Catch basin inserts are selected specifically based upon the orientation of the inlet and the expected sediment and debris loading.

Opportunity Criteria

- Catch basin inserts come in such a wide range of configurations that it is practically impossible to generalize the expected performance. Inserts should mainly be used for catching coarse sediments and floatable trash and are effective as pretreatment in combination with other types of structures that are recognized as water quality treatment BMPs. Trash and large objects can greatly reduce the effectiveness of catch basin inserts with respect to sediment and hydrocarbon capture.
- Catch basin inserts are applicable for drainage area that include parking lots, vehicle maintenance areas, and roadways with catch basins that discharge directly to a receiving water.

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 of catch basin inserts.

☐ Catch basin inserts can be installed with specific media for pollutants of concern.

Proprietary Manufacturer / Supplier Websites

- Table XIV.2 is a list of manufacturers that provide catch basin inserts. The inclusion of these manufacturers does not represent an endorse of their products. Other devices and manufacturers may be acceptable for pretreatment.

Table XIV.2: Proprietary Catch Basin Insert Manufacturer Websites

Device	Manufacturer	Website
AbTech Industries Ultra-Urban Filter™	AbTech Industries	www.abtechindustries.com
Aquashield Aqua-Guardian™ Catch Basin Insert	Aquashield™ Inc.	www.aquashieldinc.com
Bowhead StreamGuard™	Bowhead Environmental & Safety, Inc.	http://www.shopbowhead.com/
Contech® Triton Catch Basin Filter™	Contech® Construction Products Inc.	www.contech-cpi.com
Contech® Triton Curb Inlet Filter™	Contech® Construction Products Inc.	www.contech-cpi.com

Table XIV.2: Proprietary Catch Basin Insert Manufacturer Websites

Device	Manufacturer	Website
Contech® Triton Basin StormFilter™	Contech® Construction Products Inc.	www.contech-cpi.com
Contech® Curb Inlet StormFilter™	Contech® Construction Products Inc.	www.contech-cpi.com
Curb Inlet Basket	SunTree Technologies Inc.	www.suntreetech.com
Curb Inlet Grates	EcoSense International™	http://www.ecosenseint.com/
DrainPac™	United Storm Water, Inc.	http://www.unitedstormwater.com
Grate Inlet Skimmer Box	SunTree Technologies Inc.	www.suntreetech.com
KriStar FloGard+PLUS®	KriStar Enterprises Inc.	www.kristar.com
KriStar FloGard®	KriStar Enterprises Inc.	www.kristar.com
KriStar FloGard LoPro Matrix Filter®	KriStar Enterprises Inc.	www.kristar.com
Nyloplast Storm-PURE Catch Basin Insert	Nyloplast Engineered Surface Drainage Products	www.nyloplast-us.com
StormBasin®	FabCo® Industries Inc.	www.fabco-industries.com
Stormdrain Solutions Interceptor	FabCo® Industries Inc.	www.fabco-industries.com
Stormdrain Solutions Inceptor®	Stormdrain Solutions	www.stormdrains.com
StormPod®	FabCo® Industries Inc.	www.fabco-industries.com
Stormwater Filtration Systems	EcoSense International™	http://www.ecosenseint.com/
Ultra-CurbGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-DrainGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-GrateGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-GutterGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-InletGuard®	UltraTech International Inc.	www.spillcontainment.com

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, quarterly inspections. The rate at which the system collects pollutants will depend more on site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

Maintenance

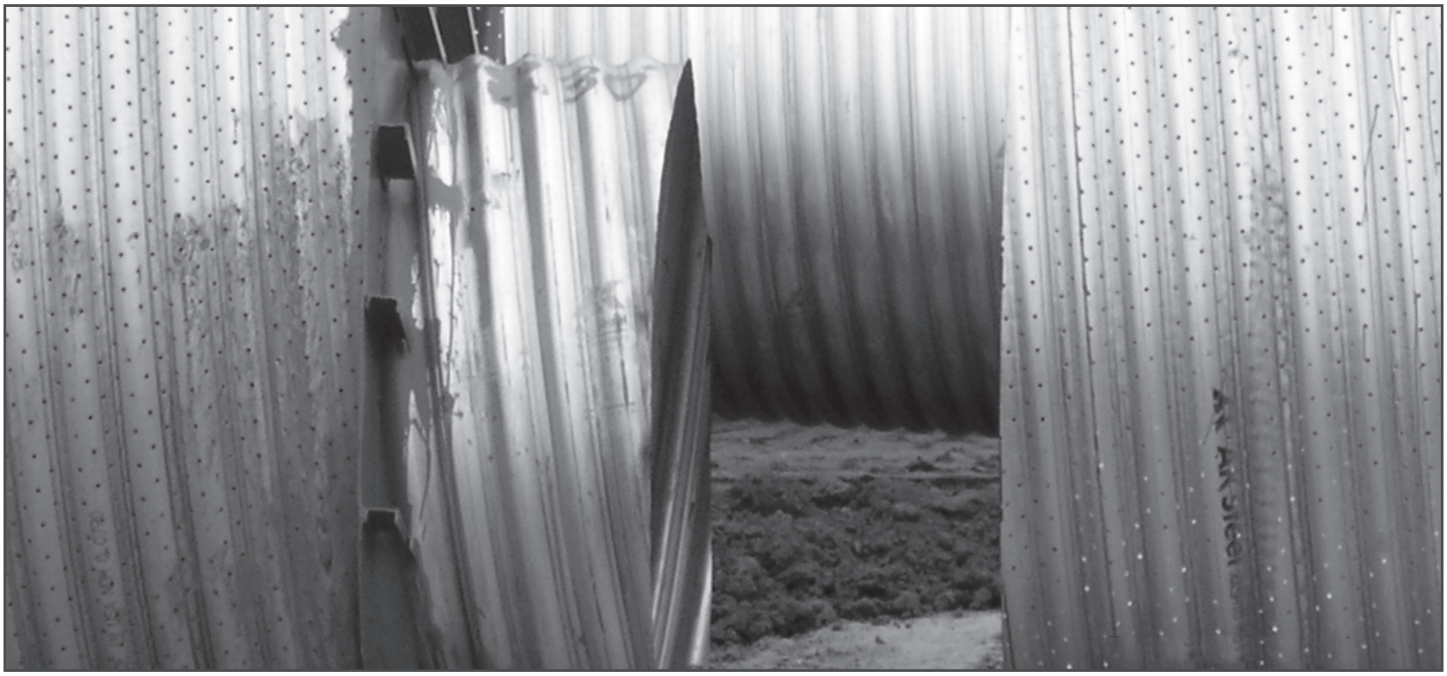
CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice.

Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Systems are to be rinsed, including above the spring line, annually soon after the spring thaw, and after any additional use of salting agents, as part of the maintenance program for all systems where salting agents may accumulate inside the pipe.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.



CMP MAINTENANCE GUIDE 2/17 PDF

CONTECH®
CMP DETENTION SYSTEMS

CONTECH®
ENGINEERED SOLUTIONS

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ENGINEERED SOLUTIONS

Modular Wetlands® Linear Operatons & Maintenance Manual

MODULAR WETLANDS®

MODULAR WETLANDS LINEAR
OPERATION & MAINTENANCE MANUAL

TABLE OF CONTENTS

OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.

WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.

Safety Boots

Gloves

Hard Hat

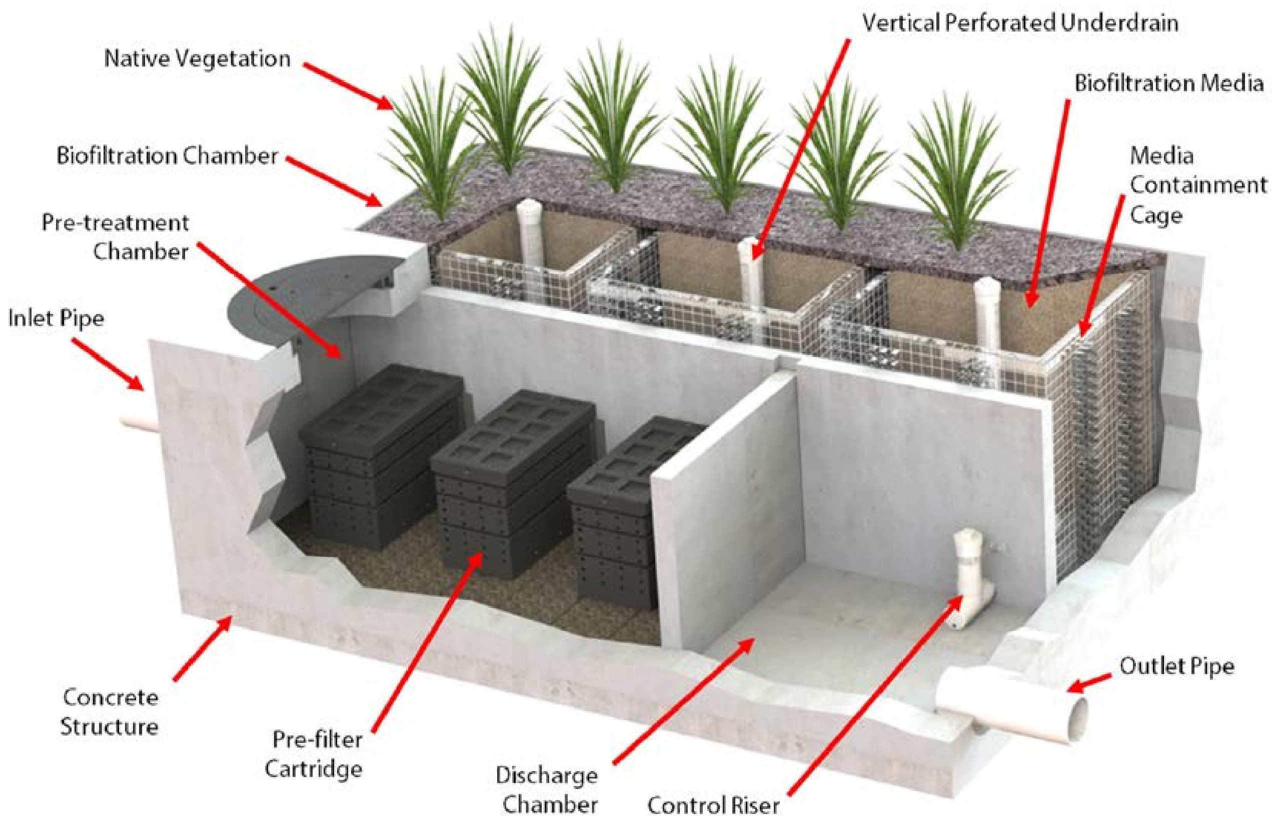
Eye Protection

Maintenance and Protection of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



INSPECTION SUMMARY & EQUIPMENT LIST

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 the site-specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:

Modular Wetlands Linear Inspection Form

Flashlight

Tape Measure

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that 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 not require irrigation after initial establishment.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.
7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.
8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

MAINTENANCE INDICATORS

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

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
    - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:

Modular Wetlands Linear Maintenance Form

Flashlight

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

Vacuum Assisted Truck with Pressure Washer

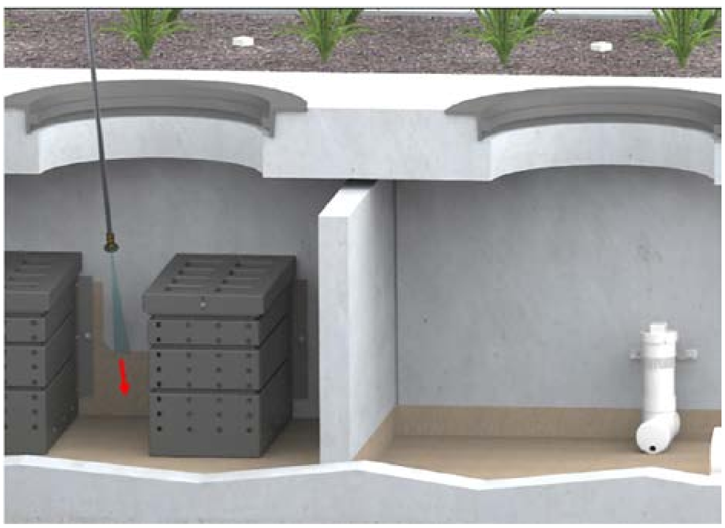
Replacement BioMediaGREEN
(If Required)

(order BioMediaGREEN from Contech's Maintenance Team members at https://www.conteches.com/maintenance)

MAINTENANCE INSTRUCTIONS

1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



2. PRESSURE WASH SYSTEM CHAMBERS

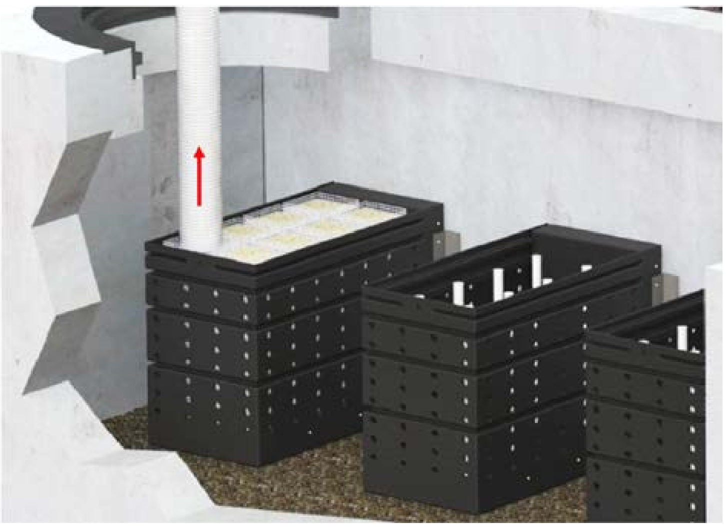
With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).

3. VACUUM SYSTEM CHAMBERS

Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. (**MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4.** If not, replace the access cover(s) and proceed to **Step 7**.

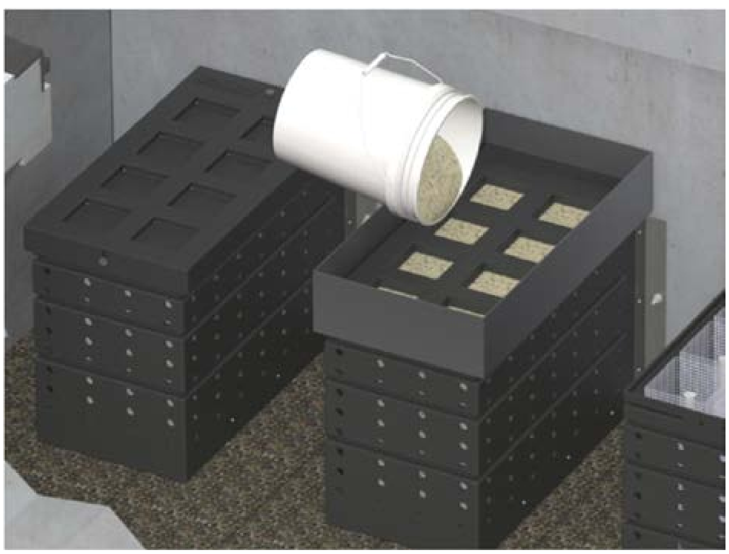
4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)



5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.

7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

8. INSPECT UNDERDRAIN SYSTEM

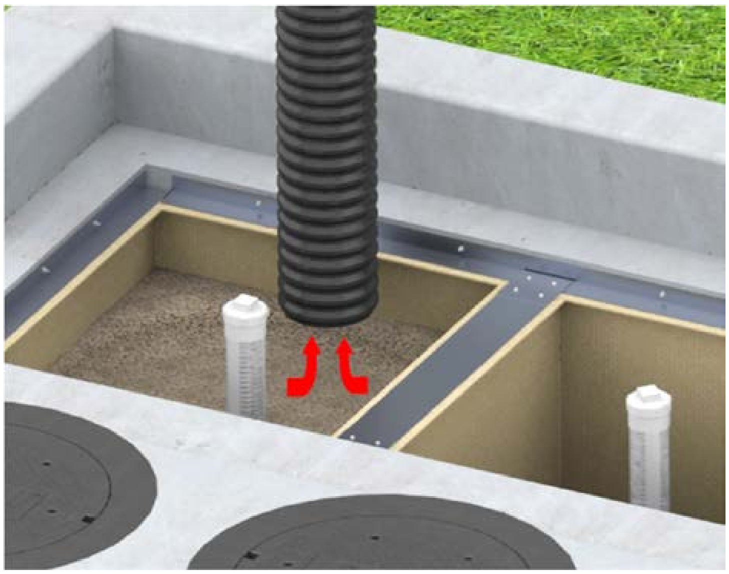
Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.

9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



1. **VACUUM EXISTING BIOFILTRATION MEDIA**

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.

2. **INSTALLING NEW BIOFILTRATION MEDIA**

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.

3. REPLANT VEGETATION

Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media.

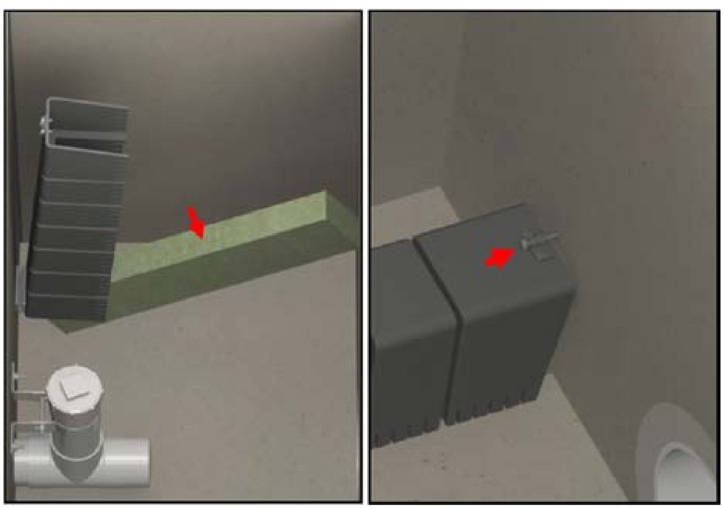
REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

NOTE: The drain down filter is only found on units installed in California prior to 2023

If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new media.

1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.

NOTES

CONTECH ENGINEERED SOLUTIONS

Inspection Report
Modular Wetlands Linear

Project Name ____________________

Project Address ____________________ (city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone ( ) –

Inspector Name ____________________ Date ___/___/___ Time ______ AM / PM

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

Weather Condition ____________________ Additional Notes ____________________

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

Inspection Checklist

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: ____________________

Cleaning and Maintenance Report
Modular Wetlands Linear

CONTECH ENGINEERED SOLUTIONS

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:

800-338-1122

WWW.CONTECHES.COM

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SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

ModWetLinear OM Manual 03/24

A Forterra Company

Bio Clean CPS

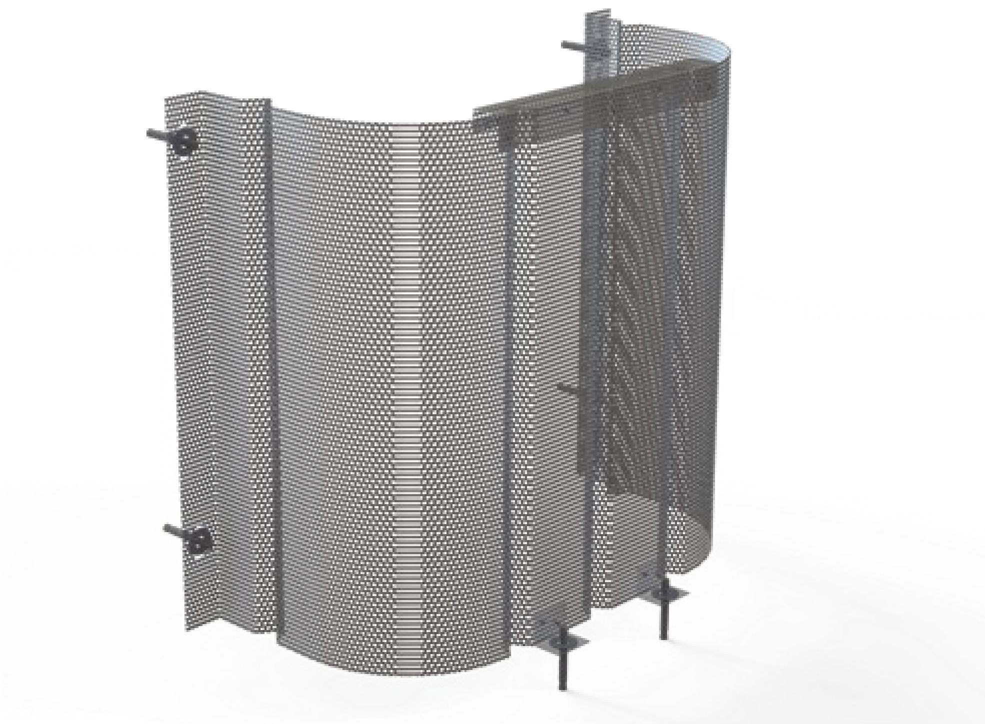
A Stormwater Trash Capture Solution

OPERATION & MAINTENANCE MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938
stormwater@forterrabp.com | biocleanenvironmental.com

OPERATION & MAINTENANCE

CPS devices should be maintained by individuals who are trained in proper disposal procedures, confined space entry and traffic safety regulations. When servicing a Bio Clean CPS device be sure to follow all safety and traffic control protocols as well as wearing all proper personal protection equipment such as gloves, safety glasses, hard-hat, safety vest and work boots.



Visual Inspection

1. Begin by inspecting the inflow of the catch basin where the Bio Clean CPS device is located. Check for any obstructions to inflow of the CB unit. If any large obstructions are found, have them removed. Once the inflow inspection is completed, remove the man-hole cover for further inspection. (Note: Confined Space Entry Procedures may apply if trained personnel intend to enter the interior space of any Catch Basin. Please follow all applicable confined space entry procedures)

2. Remove the manhole cover and visually estimate the amount and types of debris found in the CB unit. Look for any visual signs of damage that may compromise the CB unit to function properly. Inspect for any standing water in the CB unit as well as for large amounts of sediment and debris surrounding the CPS device. If standing water and high sediment volume is found, remove water, sediment and debris by vacuum truck or by other debris removal methods.

Cleaning Procedures and Frequencies

1. Like all other storm water BMP's, Bio Clean CPS devices require periodic maintenance. Routine inspection and maintenance intervals for all CPS devices are typically twice per year for inspections and once per year for maintenance service. Bio Clean CPS devices may require more frequent maintenance service if the device is located in a high debris loading drainage area, such as certain downtown areas, retail/restaurant, or residential areas where a significant amount of vegetation/foliage is located. In such cases, Bio Clean CPS devices may require more frequent inspection and maintenance service, which could range from twice per year to monthly inspection and maintenance service, depending on pollutant load conditions.

2. To begin Bio Clean CPS cleaning procedures, conduct a visual inspection of the CPS device and the surrounding area to ensure a safe working environment. Setup appropriate barriers and signage as necessary to establish a work zone surrounding the catch basin. Once the work zone has been established, remove the manhole cover from the catch basin.

3. Once the manhole cover is removed from the basin the Bio Clean CPS is ready for servicing. All debris can be removed by either a vacuum truck or manually removing sediment and debris by hand.

4. Bio Clean CPS devices shall be cleaned using a pressure washer as may be necessary if any materials are found to cause occlusion or clogging of the screen.

Disposal

1. All trash and debris removed from the Bio Clean CPS unit shall be disposed of in accordance with local, state and federal regulation.

2. Solid waste disposal can be coordinated with local landfills. Liquids may need to be disposed of by wastewater treatment plant, municipal vacuum truck decant facility or approved facility.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

Attachment C

Geotechnical Report

GEOTECHNICAL INVESTIGATION REPORT

for

Proposed OCVIBE Parking Structure A
1725 South Douglass Road
Anaheim, California

Prepared For:

Bomel Construction Company, Inc.
96 Corporate Park
Irvine, CA 92606

Prepared By:

Langan CA, Inc.
18575 Jamboree Road, Suite 150
Irvine, California 92612

June 10, 2025
Langan Project No.: 700170401

LANGAN

June 10, 2025

Garret Hoffman, Business Development and Preconstruction
Nick Barlow, Project Executive
Bomel Construction Company, Inc.
96 Corporate Park
Irvine, California 92606

Geotechnical Investigation Report
Proposed OCVIBE Parking Structure A
1725 South Douglass Road
Anaheim, California
Langan Proposal No. 700170401

Dear Garret and Nick:

Langan CA, Inc. is pleased to submit this geotechnical investigation report for proposed Parking Structure A that is planned to be constructed at 1725 South Douglass Road in Anaheim, California.

This report was prepared in general accordance with our proposal dated December 12, 2024 and our existing agreement for professional services that was executed on April 10, 2025.

♦ ♦ ♦

We sincerely appreciate the opportunity to be of service to you. Please contact us if you have questions regarding this report.

Sincerely,
Langan CA, Inc.

Christopher J. Zadoorian, PE, GE, F. ASCE
Associate Principal/Vice President

cc: Darren King, Culp and Tanner

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1.0 INTRODUCTION

Langan CA, Inc. is pleased to submit this report summarizing our geotechnical investigation for proposed Parking Structure A that will be constructed at 1725 South Douglass Road in Anaheim, California. Parking Structure A is planned as part of the OCVIBE master development and will be constructed at the southwestern limit of the OCVIBE. The site location is shown on Figure 1.

The site is approximately three acres and is located on the west side of South Douglass Road. The site is bound on the west and south by the 57 Freeway off-ramp to Katella Avenue, and on the north by the Ayres Hotel development.

The site is developed with five, one-story commercial buildings that will be demolished to allow for the proposed parking structure development. Site pavement and landscaping are also present at the site.

The ground surface level at the site slopes gently from the northerly side to the southerly of the site and ranges from approximately Elevation 161 to Elevation 157.

Darren King of Culp and Tanner furnished us with preliminary plans for the proposed development. Based on our review of the plans, the proposed development will include an approximately 93,000 ground square foot, six-level parking structure.

The proposed parking structure will be established at approximately the existing ground surface level and the lowest finish floor elevation of the ground level floor slab will range from approximately Elevation 159 to 161.

Mr. King also furnished us with column loading for the proposed parking structure and indicated dead-plus-live interior and exterior column loading on the order of 1,100 and 700 kips, respectively and typical and heavy girder dead-plus-live column loading on the order of 1,600 to 2,100 kips, respectively.

An approximately 221-foot-long pedestrian access bridge is also planned to connect the ground level of the proposed parking garage to the second level of the ARCTIC train station that will be designed and constructed by others.

Edward Perez of Stantec furnished us within working civil engineering plans that show the proposed locations of infiltration basins that will consist of perforated, large diameter corrugated metal pipe holding tanks at the approximate location shown on Figure 2. The invert of the CMPs will be established approximately ten to thirteen feet below the existing ground surface (bgs) level. Sizing of the tanks is reportedly in-progress.

We performed a preliminary geotechnical investigation and summarized the results in a report dated October 31, 2019, and you also furnished us with a report of a prior geotechnical investigation dated October 7, prepared by NMG Geotechnical, Inc. (NMG). We reviewed the data presented in the prior NMG report and we assume professional responsibility for the use and interpretation of the prior data.

To supplement that data from our preliminary investigation and the prior NMG investigation, we performed additional explorations to aid in the development of this design-level geotechnical report.

An overview of our current and the prior site explorations and laboratory testing is presented below, followed by conclusions and recommendations for the proposed development.

2.0 SUBSURFACE EXPLORATIONS AND CONDITIONS

2.1 Current Borings

To supplement the data from the prior investigations, we drilled four borings (B-1 through B-4) and two field percolation tests (FP-1 and FP-2) at the approximate locations shown on the Figure 2.

The borings were drilled to depths of approximately 36½ feet below ground surface (bgs) using truck-mounted hollow-stem auger drill rig equipment. The field percolation tests were drilled to depths of approximately 12 to 16 feet bgs using truck-mounted hollow-stem auger drill rig equipment.

During drilling, our field representative maintained a log of the subsurface conditions encountered in each boring, collected relatively undisturbed, and performed standard penetration tests (SPT) at regular depth intervals. We also collected bulk samples from near surface soils in borings across the site.

Upon completion of drilling, the borings were backfilled with soil cuttings, tamped, and patched with asphalt concrete.

The locations of our current borings and field percolation test wells are shown on Figure 2. Logs of our current borings are presented in Appendix A.

2.2 Prior Investigations

As part of our prior investigation, we advanced three cone penetration test soundings (CPT-A1 through CPT-A3) at the approximate locations shown on Figure 2. The CPTs were advanced to depths of approximately 45½ to 46½ feet bgs. Shear wave velocity measurements were collected in CPT-A1.

The prior geotechnical investigation performed by NMG included two hollow-stem auger borings (H-1 and H-2) at the approximate locations shown on Figure 2. The prior borings were drilled to depths ranging from approximately 51½ to 56½ feet below ground surface (bgs) using hollow-stem auger drilling equipment.

Logs of our prior CPTS are presented in Appendix B and logs of the prior NMG explorations are presented in Appendix C.

2.3 Subsurface Conditions

Asphalt concrete (AC) typically five inches in thickness and ranging from four to seven inches in thickness was encountered in the current and prior borings. Base materials were not logged beneath the AC pavement in any of the current or prior exploration borings.

Fill soils were logged in our current borings B-1 through B-4 ranging in depth from approximately 1½ to 3 feet in thickness. The fill consisted of fine to medium silty sand and sand with silt. Fill soils were not logged in the prior NMG borings.

The native soils underlying the fill in our current borings and underlying the pavement section in the prior NMG explorations generally consisted of dry, loose to medium dense silty sand and poorly graded sand in the upper 15 to 20 feet.

Within the upper deposits, intermittent and discontinuous clay and silt lenses, typically on the order of one foot in thickness, or less, were encountered between depths of 11 to 16 feet bgs.

The upper alluvial sand and silt were typically underlain by medium dense to dense silty sand and medium stiff silts and clays to depths to the depths explored.

Generalized depictions of subsurface conditions at the site are shown on Cross Sections A-A', B-B', and C-C' presented in Figures 3 through 5.

2.4 Groundwater

Regional groundwater mapping available from the Orange County Water Department (OCWD) indicates the groundwater level at the site is approximately 75 feet bgs (corresponding to approximately Elevation 85) as shown on Figure 6A.

The OCWD mapping includes data available from State of California Department of Water Resources (DWR) groundwater well 04S10W25G001S located approximately 0.25 mile south of the site and DWR groundwater well 04S10W25D001S located approximately 0.35 miles west of the site at the locations shown on Figure 6B. Based on the data from these wells, the groundwater level in the general site vicinity is on the ranges from approximately 51 to 74 feet bgs (corresponding to approximately Elevations 109 and 86, respectively).

Groundwater data is also available from the current and prior explorations. Groundwater was not encountered to a maximum depth of 36½ feet in the current subsurface explorations nor was groundwater encountered to the maximum depth of 56½ feet in the prior subsurface explorations by NMG in 2020.

We also reviewed groundwater maps prepared by Mendenhal (1905) and based on our review, the depth to groundwater at the site is on the order of 70 feet bgs (corresponding to approximately Elevation 90).

Based on our review of the *Seismic Hazard Report* for the *Anaheim 7.5-Minute Quadrangle, Orange County, California* (California Geologic Survey, CGS, 2001), the historical high groundwater level (HHGWL) at the site is on the order of 25 feet bgs as shown on the Historical High Groundwater Map, Figure 6C. However, it’s likely this data is based on localized perched groundwater conditions, noting the above regional summary.

2.5 Shear Wave Velocity Measurements

As part of our current investigation, we performed geophysical testing at the site to obtain more precise shear-wave velocity data than available from our prior investigation.

We performed an active-source surface wave array consisting of the multi-channel analysis of surface waves (MASW) and a passive-source surface wave technique consisting of the array micrometer method.

The results of the testing indicated a shear wave velocity within the upper 30 meters, V_{s30}, equal to 914 feet per second (277 meters per second).

The results of the geophysical testing are summarized in Appendix D for reference.

2.6 Field Percolation Testing

We performed field percolation testing at two locations (FP-1 and FP-2) in general conformance with the *County of Orange, Technical Guidance Document (TGD)* dated December 20, 2013.

Our field percolation test borings were drilled to depths of approximately 12 feet and 16 feet bgs. These depths correspond with the proposed five- and eight-foot-diameter underground storage tanks being considered by the project civil engineer and include the depth of the proposed soil amendments under the infiltration systems.

Test wells were constructed in each boring by installing four-inch outside-diameter perforated PVC pipe to the bottom of each boring. Three inches of ¾-inch gravel were placed at the bottom of the well prior to installing the pipe. The annular space between the boring side walls and the perforated pipe was filled with ¾-inch gravel. The PVC pipe was also wrapped in filter fabric to reduce the potential for sand migration.

Water was introduced to the subsurface soils through the PVC pipe and allowed to pre-soak for a period of approximately one hour.

Percolation testing consisted of introducing water to the subsurface soil through the PVC pipe and measuring the rate at which the water level dropped within the pipe.

We calculated the infiltration rate by means of the Porchet Method, as specified in the referenced TGD. A factor of safety has *not* been applied to these rates. We have applied a correction factor to the calculated infiltration rates to account for the gravel used in the annular space of the test wells.

Table 1 summarizes the current field infiltration test results. Please note that these values do not include reduction factors for the test procedure, site variability and long-term siltation plugging that are required for the design infiltration rate.

Table 1 – Field Percolation Test Results

Field Percolation Test	Approximate Test Depth (Feet)	Approximate Ground Surface Elevation (feet)	Approximate Test Elevation (feet)	Unfactored Infiltration Rate (in/hr)
FP-1	12	159	147	6.7
FP-2	16	160	144	7.0

Our percolation test results are summarized in Appendix E.

Our recommendations for storm water infiltration including factor of safety recommendations are presented in Section 6.3.

3.0 GEOTECHNICAL LABORATORY TESTING

3.1 Current Investigation

As part of our current investigation, we performed the following geotechnical laboratory testing:

- Maximum Dry Density and Optimum Moisture Content
- In-situ Moisture Content and Dry Density
- Direct Shear
- Consolidation
- Corrosion
- Atterberg Limits
- Percent Passing No. 200
- R-Value
- Expansion Index

The results of our current laboratory testing are presented in Appendix A.

3.2 Prior Investigation

As part of their prior investigation, NMG performed the following geotechnical laboratory testing:

- Moisture Content and Dry Density
- Atterberg Limit
- Consolidation
- Grain Size Analysis

The results of the prior geotechnical laboratory testing are presented in Appendix C.

4.0 GEOLOGIC AND SEISMIC HAZARDS EVALUATION

4.1 General

We evaluated the geologic and seismic hazards at the site in general accordance with California Geological Survey (CGS) Special Publication 117A, "*Guidelines for Evaluating and Mitigating Seismic Hazards in California.*" The results of our evaluation are summarized below.

4.2 Regional Tectonic and Local Geologic Setting

The subject site is located at the eastern end of the Los Angeles Basin, a northwest trending, alluviated lowland situated at the north end of the Peninsular Ranges geomorphic province of coastal southern California. This basin, which is the surface expression of a deep structural trough, has been subdivided into four primary structural blocks distinguished from one another by contrasting basement rock types and stratigraphy. These structural blocks are generally separated by zones of faulting along which movement has been occurring intermittently since middle Miocene time (Yerkes and others, 1965). The site is located on the southeastern side of the Central Block of the Los Angeles Basin, a wedge-shaped area that extends from the Santa Monica Mountains at its northwest end to the San Joaquin Hills at its southeast end.

Based on the subsurface profile observed in exploratory borings, the site is underlain by a relatively thin veneer of artificial fill. The artificial fill, likely associated with the current site improvements was observed to a maximum depth of approximately three feet bgs. Native soils, classified as alluvium (young alluvial fan deposits, Morton and Miller, 2006) were observed underlying the artificial fill to the maximum depth explored (56½ feet). Morton and Miller describe these soils as 'Holocene and latest Pleistocene unconsolidated deposits of alluvial fans and headward drainages of fans. Alluvium near the site consists predominately of sand, gravel, and silt.

The data from our exploration borings is generally consistent with the geologic conditions summarized by Morton and Miller.

Figure 7 presents a regional geologic map of the area by Morton and Miller (2006).

4.3 Regional Faulting and Seismicity

The site is located within a seismically active region of Southern California, surrounded by several active faults. According to the 2010 California Geological Survey Fault Activity Map (FAM) of California, the closest known Holocene-active fault to the site is the Whittier fault zone, located approximately 8.7 miles northeast of the site. However, the USGS Quaternary Fault and Fold database indicates that the surface projection of the Peralta Hills blind thrust fault is located approximately 3 miles northeast of the site.

The location of the site with respect to nearby mapped faults is presented in Figures 8A and 8B.

The site in an active seismic area that has historically been affected by generally moderate to occasionally high levels of ground motion. Therefore, the proposed development will probably experience moderate to occasionally high levels of ground motion from nearby faults as well as ground motions from other active seismic areas of the southern California region.

A search of the USGS ANSS Comprehensive Earthquake Catalog (ComCat) using a web-based Earthquake Archive Search and URL builder tool, found that as of April 28, 2025, 55 earthquakes with magnitudes of 5.0 or greater have occurred within a 100-km radius of the site since 1800 as shown on Figures 7A and 7B.

The USGS indicates that the probability of a magnitude 6.7 or greater earthquake to occur in the Los Angeles region in the next 30 years is 60 percent. The probability of a magnitude 7.0 or 7.5 or greater earthquake in the next 30 years for the Los Angeles region is 46 and 31 percent, respectively

4.4 Ground Surface Rupture Potential

The site is not located within an Alquist-Priolo Earthquake Fault Zone based on a review of the CGS Earthquake Zones of Required Investigation map.

The potential for ground surface rupture from faulting is very low.

4.5 Liquefaction Potential

Liquefaction generally occurs in saturated, loose to medium dense, granular soil and in saturated, soft to moderately firm silt because of strong ground shaking. As the density and/or particle size of the soil increases and as the confinement (overburden pressure) increases, the potential for liquefaction decreases. Typically, saturated soil within the upper 50 feet of the ground surface or lowest adjacent grade is considered subject to liquefaction.

The site is located within a State-designated liquefaction hazard zone, as shown on the Seismic Hazard Zone Map, Figure 9.

We performed a liquefaction analysis using the methods presented in the 1996 National Center for Earthquake Engineering Research (NCEER) and subsequent updates in conjunction with methods presented by Boulanger and Idriss, 2006, for evaluating the liquefaction potential for fine-grained (silt and clay) soils. Based on the groundwater data available at the site, we utilized a depth to groundwater of 40 feet bgs in our analysis.

The primary seismic input in liquefaction analysis includes the peak ground acceleration modified for site conditions (PGA_M) and the predominant earthquake magnitude, M_W. We determined the PGA_M to be 0.679g and the predominant earthquake magnitude M_W to be 7.3 based on our stie specific response spectrum that is summarized in Section 6.2.

The results of our liquefaction analysis indicate a low potential for liquefaction based on the above input parameters.

4.6 Lateral Spreading and Ground Lurching Potential

Lateral spreading can occur when a sloping ground surface is present with an unsupported (aka 'open') face is present and potentially liquefiable soils are present within the slope.

The existing and proposed ground surface at the site is relatively level so an unsupported face condition is not present at the site. The Santa Ana riverbank is located more than 500 feet from the site. Therefore, the potentially for lateral spreading is considered negligible.

4.7 Seismic (aka 'Dry') Settlement

Seismic (dry) settlement can occur in loose to medium dense, granular soil because of strong ground shaking.

Loose sand and silty sand were encountered in the upper approximately fifteen feet bgs at the site.

If unmitigated, these soils are subject to seismically induced settlement on the order of approximately one inch. Please note, however, the recommended remedial grading will mitigate this potential, as discussed in Section 6.1.

4.8 Earthquake-Induced Landslides

The site is not located in a zone of required investigation for Earthquake-Induced Landslides per CGS's Earthquake Zones of Required Investigation, Anaheim Quadrangle, as shown on Figure 8.

The site is relatively flat. The slope on the west side of the subject property is an embankment made of man-made fill associated with the 57 freeway. Thus, the potential for earthquake-induced landsliding is negligible at the site.

4.9 Hydrocollapse

Hydro-collapse is a phenomenon that occurs when loose, predominately sandy soils are subjected to saturated conditions. The loose nature of these soils undergo a decrease in volume (i.e., densification) when the particle-to-particle contact is disturbed with the introduction of pore water, resulting in settlement that could manifested to the ground surface.

Based on data available from the current and prior laboratory testing, the native soil at the site is not subject to hydrocollapse.

4.10 Flood Mapping

Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the proposed development is located within the area with reduced risk due to levee (shaded zone X). The Santa Ana river located approximately 600 feet southeast of the site is mapped as a special flood hazard area subject to inundation by the one percent annual chance flood (Zone A). Water within the Santa Ana river channel is typically controlled by the nearby Prado Dam.

4.11 Tsunamis, Seiche, and Dam Inundation

Based on information and maps available from the CGS, the site is not located within a Tsunami inundation hazard zone.

Based on review of adjacent water bodies, the site is not subject to inundation from seiche.

A review of the California Dam Breach Inundation Maps hosted by the California Division of Safety of Dams shows that the site is not located within an inundation boundary in the case of dam breach.

However, the site is located downstream from Prado Dam, which is operated by the US Army Corps of Engineers. A review of the Prado Dam Emergency Plan Inundation Map (USACE, 1985) indicates that the project site is within the limits of flood due to dam failure. Recent updates to the dam may have made this map obsolete, however, a revised map has not been published yet.

4.12 Subsidence

Land subsidence may be induced from withdrawal of oil, gas, or water from wells. Based on a search of the CalGEM (formerly known as Division of Oil, Gas, and Geothermal Resources [DOGGR]) GIS Well Finder online tool, there are no wells within a half mile of the site and the site is not located in an oil/gas field. Thus, the likelihood of land subsidence caused by oil or gas withdrawal from oil wells is very low.

4.13 Expansive Soils

Expansive soils swell and shrink when the moisture content in the soil changes because of cyclic wet/dry weather cycles, installation of irrigation systems, change in landscape plantings, or changes in grading. Swelling and shrinking soils can result in differential movement of structures including floor slabs and foundations, and site work including hardscape, utilities, and sidewalks.

Based on the results of testing performed on samples collected from our current borings, the upper on-site soils have a very low potential for expansion (expansion index between 0 and 20).

5.0 CONCLUSIONS

5.1 General

The proposed development is feasible from a geotechnical perspective and the planned work will not adversely impact adjacent properties nor developments. Additionally, adjacent properties and developments will not have an adverse impact on the proposed development.

The site is subject to strong ground shaking that would result from an earthquake occurring on a nearby or distant fault source; however, this hazard is common in Southern California and can be mitigated by following the seismic design requirements of the 2022 California Building Code (CBC).

The upper soils present at the site are subject to seismically induced settlement, however, the recommended removal and recompaction presented in Section 6.1 will mitigate this potential to a sufficient degree to allow the use of spread and continuous footings as discussed in Sections 5.2 and 6.1.

5.2 Foundations

The upper soils at the site generally consist of loose to medium dense silty sand and sand with silt. These soils are not considered suitable for foundation support.

The proposed parking structure may be supported on spread and continuous footings established on sufficient layer of properly compacted fill as recommended in Section 6.1.

5.3 Seismic Design Considerations

Data available from the prior and current geotechnical investigations indicates the shear wave velocity within the upper 30 meters (Vs_{30}) at the site is approximately 914 feet per second. Based on this analysis, the site may be designated as Site Class D in accordance with Table 20.3-1 of ASCE 7-16.

5.4 Floor Slab Support

The proposed parking garage floor slab may be supported on properly compacted fill materials that will be present within the proposed building footprint as indicated in Section 5.2

It is our understanding that finish flooring is not currently planned within the parking structure. If finish flooring is added later, a capillary break section should be installed to minimize the potential for moisture transmission through the floor slab that could damage finish flooring.

5.5 Temporary Excavations

Temporary excavations are feasible in the on-site soils provided the recommendations presented herein are followed. Due to the granular nature of near-surface soil, temporary vertical cuts will not be feasible. Recommendations for temporary excavations are provided in Section 6.4.

5.6 Corrosion Potential

The results of the corrosion testing are summarized in Table 2.

Table 2 – Corrosion Test Results

Boring	Depth (feet bgs)	Soil Type	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
B-1	0-5	Silty Sand	8000	8.0	139	22

The results of the sulfate testing indicates that the on-site soils be classified as exposure category S_0 for sulfates and exposure category C_1 for chlorides in accordance with American Concrete Institute (ACI) Table 19.3.1.1.

5.7 Expansive Soils

Expansive soils were not encountered during the current or prior investigations at the site and are not anticipated to impact the proposed development.

5.8 Materials for Fill

On-site undocumented fill and native materials are suitable for reuse in the required fills provided the recommendations presented herein are implemented.

5.9 Groundwater

The groundwater level at the site is estimated to be at a depth of approximately 75 feet bgs based on the information summarized in Section 2.4. As such, groundwater will not impact the current planned development.

Discontinuous, localized perched water may be encountered where fine-grain deposits are present, typically at depths of 25 feet bgs or below.

5.10 Shrinkage and Subsidence

Typically, excavation of native materials and replacement of those materials as compacted fill results in a nominal loss of volume (shrinkage) because the materials are typically placed at a higher density than in their naturally deposited state.

Subsidence may occur when the weight of the properly compacted fill is greater than the weight of the pre-existing soil conditions, due to the increased density and/or local grade changes above existing ground surface level.

We estimate the combined shrinkage and subsidence due to the recommended removal and recompaction to be on the order of ten to 15 percent

5.11 Storm Water Infiltration

On-site storm water infiltration is feasible provided the recommendations presented herein are followed.

Storm water infiltration recommendations are presented in Section 6.3.

6.0 RECOMMENDATIONS

6.1 Foundations

The proposed parking structure may be supported on spread and continuous footings established in properly compacted fill materials. A minimum of three feet of properly compacted fill should be provided below the bottom of all foundations noting that based on our discussions with you, the total overall excavation may be on the order of nine feet bgs to achieve this requirement.

Based on the foundation soils shear strength data, an ultimate bearing pressure of 34,000 pounds per square foot (psf) can be computed using Terzaghi's equation for foundations established at least two feet below the lowest finish floor level or adjacent grade and a minimum of two feet wide.

For allowable stress design, a net allowable bearing pressure of 5,000 psf may be used for dead-plus-live column loading greater than 750 kips and a net allowable bearing pressure of 7,500 psf for dead-plus-live column loading less than or equal to 750 kips.

These allowable bearing pressures correspond to factors of safety of 6.8 and 4.5, respectively for dead-plus-live loads.

The recommended allowable bearing pressures for total loads (wind/seismic) may be increased by one-third resulting in corresponding factors of safety of 5.1 and 3.4, respectively.

We estimate that static settlement of the spread and continuous footings due to gravity loading will be on the order of 1.5 inches or less, and seismically induced (dynamic) settlement will be on the order of ½ inch or less. Total static-plus-dynamic settlement is expected to be within 2.0 inches or less, which is considered acceptable for typical building performance criteria.

Please note also, that based on our review of the column loading information provided, the lower dead-plus-live column loading generally resides around the perimeter columns and utilizing higher allowable bearing pressures at these locations will promote compatibility and further reduce differential settlement.

To resist lateral loading, an ultimate coefficient of friction of 0.6 may be used in conjunction with a reduced ultimate passive pressure of 400 psf per foot of embedment. The reduction accounts for the deformation required to mobilize the full passive resistance. For working stress/allowable conditions, an allowable coefficient of friction of 0.4 may be used together with an allowable passive pressure of 400 psf per foot of embedment. These allowable values do not require further reduction.

When computing passive resistance, the contribution of the upper one foot of soil should be neglected. This results in a trapezoidal-shaped passive pressure distribution.

6.2 Seismic Design

We developed site-specific response spectra for two levels of ground shaking, which correspond to the Risk-Targeted Maximum Considered Earthquake (MCE_R) and Design Earthquake (DE), determined in accordance with ASCE 7-16. The MCE_R corresponds to the lesser of two percent probability of exceedance in 50 years (2,475-year return period) or 84th percentile of the controlling deterministic event both considering the maximum direction as described in ASCE 7-16, with appropriate lower limit checks. The DE corresponds to 2/3 of the MCE_R.

6.2.1 Probabilistic Seismic Hazard Analysis

Because of the uncertainty of the location, recurrence intervals, and magnitude of future earthquakes, we performed a PSHA, which systematically accounts for these uncertainties. The results of a PSHA define a uniform hazard for a site in terms of a probability that a particular level of shaking will be exceeded during the given life of the structure

Performing a PSHA requires information regarding the seismicity, location, and geometry of each source, along with empirical relationships that describe the rate of attenuation of strong ground motion with increasing distance from the source. The assumptions necessary to perform the PSHA are that:

- the geology and seismic tectonic history of the region are sufficiently known, such that the rate of occurrence of earthquakes can be modeled by historic or geologic data
- the level of ground motion at a particular site can be expressed by an attenuation relationship that is primarily dependent upon earthquake magnitude and distance from the source of the earthquake.
- the earthquake occurrence can be modeled as a Poisson process with a constant mean occurrence rate.

As part of the development of the site-specific spectra, we performed a PSHA to develop a site-specific response spectrum for 2 percent probability of exceedance in 50 years using the computer code, *NSHMP-HAZ*, developed by the U.S. Geological Survey (USGS) National Seismic Hazard Mapping Project (NSHMP). The approach used in the *NSHMP-HAZ* code is based on the probabilistic seismic hazard model developed by Cornell (1968) and McGuire (2004; 2007). The NSHMP code models the faults in the Salt Lake City area as linear sources, and earthquake activities were assigned to the faults based on historical and geologic data. We estimated the levels of shaking using ground motion models that are primarily dependent upon the style of faulting, the magnitude of the earthquake, the distance from the site to the fault, and the average shear wave velocity in the upper 30 meters of the soil profile, Vs_{30}.

6.2.2 Probabilistic Model

In probabilistic models, the occurrence of earthquake epicenters on a given fault is assumed to be uniformly distributed along the fault. The model considers ground motions produced from the part of the fault rupture closest to the site rather than from the epicenter. Fault rupture lengths were modeled using fault rupture length-magnitude relationships published in Petersen et al. (2018).

The probability of exceedance, $P_e(Z)$, at a given ground-motion, Z, at the site within a specified time period, T, is given as:

$$P_e(Z) = 1 - e^{-V(z)T}$$

where V(z) is the mean annual rate of exceedance of ground motion level Z. V(z) can be calculated using the total-probability theorem.

$$V(z) = \sum_i v_i \iint P[Z > z \mid m, r] f_{M_i}(m) f_{R_i|M_i}(r; m) dr\, dm$$

where:

- v_i = the annual rate of earthquakes with magnitudes greater than a threshold M_{oi} in source i
- P [Z > z | m,r] = probability that an earthquake of magnitude m at distance r produces ground motion amplitude Z higher than z
- f_{Mi} (m) and $f_{Ri|Mi}$ (r;m) = probability density functions for magnitude and distance

Z represents peak ground acceleration, or spectral acceleration values for a given frequency of vibration. The peak ground accelerations and spectral accelerations are assumed to be log-normally distributed about the mean with a standard error that is dependent upon the magnitude and attenuation relationship used.

6.2.3 Source Modeling and Characterization

We used the 2018 U.S. National Seismic Hazard Maps (NSHM) seismic source model identified as *NSHMP-HAZ*. Each segment is characterized with multiple magnitudes, occurrence or slip rates and weights. This approach considers the epistemic uncertainty associated with the various seismic sources in our model.

6.2.4 Ground Motion Models

We used the NGA-West2 ground motion models (GMM) by Abrahamson et al. (2014), Boore et al. (2014), Campbell and Bozorgnia (2014), and Chiou and Youngs (2014) for shallow crustal sources. The mean of the relationships was used to develop the spectra. The NGA-West2 ground motion models were developed for the Rot_{D50} component of the data.

Site parameters, Vs_{30}, and depths to shear wave velocity of 1 kilometer per second, Z_1 and 2.5 kilometers per second, $Z_{2.5}$, are required as inputs for the NGA-West2 relationships. The Vs_{30} for the site is approximately 280 meters per second (910 feet per second). Therefore, the site profile is classified as Site Class D. According to the Southern California Earthquake Center Community Velocity Model (CVM-S4.26) (Small et al. 2017), the values for Z_1 and $Z_{2.5}$ are approximately 450 meters and 4.20 kilometers, respectively. These values were used in the development of the site-specific spectra.

6.2.5 Near-Fault Effects

It has been recognized that ground motions recorded in the near-field regions (distances less than 10 to 15 kilometers from the fault) show rupture directivity and near-source effects such as velocity and displacements pulses (sometimes referred to as "fling"). In general, such effects tend to increase the long period portion of the acceleration response spectrum when compared to the average spectrum. For the probabilistic analysis we used the methodology outlined by Mazzoni et al. (2023) to quantify near-fault average directivity effects. For the deterministic analysis, we averaged the results from Bayless and Somerville (2020) and Watson-Lamprey (2018) to achieve the same quantification.

6.2.6 Maximum Direction

ASCE 7-16 specifies the development of MCE_R site-specific response spectra in the maximum direction. Shahi and Baker (2014) provide scaling factors that modify the Rot_{D50} spectra to provide spectral values for the maximum response (maximum direction). The average or mean of the Rot_{D50} component of the ground motion models referenced herein was adjusted for the maximum response using the scaling factors presented in Shahi and Baker (2014), represented as the ratios of $Sa_{RotD100}/Sa_{RotD50}$, to modify the mean PSHA results which included average directivity effects.

6.2.7 PSHA Results

The Rot_{D50} results of the PSHA for the 2 percent probability of exceedance in 50 years hazard level (2,475-year return period) using the four GMMs discussed above as well as the average of these models and the average in the maximum direction are presented in Figure 10.

The magnitude-distance deaggregation plots of the PSHA results for the 2 percent probability of exceedance in 50 years hazard level are presented in Figure 11. Figure 12 shows the PSHA Rot_{D50}, Rot_{D50} with directivity and the mean maximum direction values with average directivity.

6.2.8 Deterministic Analysis

We performed a deterministic analysis to develop the 84th percentile deterministic spectrum in the maximum direction. In a deterministic analysis, a given magnitude earthquake occurring at a certain distance from the source is considered as input into an appropriate ground motion model. We considered a deterministic scenario for the Compton Fault with a mean magnitude of 7.3 and a Joyner-Boore rupture distance (R_{JB}) of 9.3 km, the Puente Hills (Coyote Hills Segment) Fault with a mean magnitude of 7.3 and a Joyner-Boore rupture distance (R_{JB}) of 8.0 km, and the Whittier Fault with a mean magnitude of 7.6 and a Joyner-Boore rupture distance (R_{JB}) of 13.8 km. Figure 13 through 15 present the 84th percentile deterministic results using the four NGA-West2 ground motions models previously discussed and the average of these relationships for the deterministic scenarios considered in our analysis. Figure 16 presents the comparison of average 84th percentile deterministic results for the three faults mentioned above and the deterministic envelope.

6.2.9 Recommended Spectra

The MCE_R as defined in ASCE 7-16 is the lesser of the maximum direction PSHA spectrum having a two percent probability of exceedance in 50 years (2,475-year return period) or the maximum direction 84th percentile deterministic spectrum of the governing earthquake scenario and the DE spectrum is defined as 2/3 times the MCE_R spectrum.

Furthermore, the MCE_R spectrum is defined as Risk-Targeted response spectrum, which corresponds to a targeted collapse probability of 1 percent in 50 years. Risk coefficients, C_R, obtained from the online USGS Risk-Targeted Ground Calculator (ASCE 7-16 Section 21.2.1.2), varying from 0.89 to 0.98 were used to develop the Risk-Targeted PSHA spectrum.

We followed the procedures outlined in Chapter 21 of ASCE 7-16 and Supplement No. 1 to develop the site-specific spectra for MCE_R and DE. Chapter 21 of ASCE 7-16 requires the following checks:

- The largest spectral response acceleration of the resulting 84^{th} percentile deterministic ground motion response spectra shall not be less than $1.5 \times F_a$ where F_a is equal to 1.0.
- The DE spectrum shall not fall below 80 percent of S_a determined in accordance with Section 11.4.6, where F_a is 1.0 and F_v is taken as 2.5 for $S_1 \geq 0.2$ (Section 21.3 of Chapter 21 ASCE 7-16).
- The site-specific MCE_R spectral response acceleration at any period shall not be taken as less than 150 percent of the site-specific design response spectrum determined in accordance with Section 21.3.

Figure 17 and Table 3 present the comparison of the site-specific spectra in the maximum direction for the Risk-Targeted PSHA 2,475-year return period and the 84^{th} percentile deterministic. The largest spectral response acceleration of the 84^{th} percentile deterministic spectrum is 2.120g and is greater than $1.5xF_a$; therefore, scaling of the 84^{th} percentile deterministic spectrum is not needed.

In comparison, the Risk-Targeted PSHA spectrum is less than 84^{th} percentile deterministic spectrum at all periods and is therefore used as the basis of the development of the MCE_R spectrum. The DE spectrum is defined as 2/3 times the MCE_R; however, the DE spectrum shall not be less than 80 percent of the general design spectrum for Site Class D. As shown on Figure 17 and Table 3, the 2/3 of the MCE_R spectrum is greater than 80 percent of the general design spectrum for Site Class D at all periods; therefore, the recommended DE should be taken as 2/3 of the MCE_R at all periods.

The recommended MCE_R and DE spectra are presented on Figure 18 and Table 3 noting we included specific period intervals of 0.86 seconds and 1.1 seconds as requested by Culp and Tanner. The recommended seismic design criteria parameters are presented in Table 4.

Table 3 – Comparison of Site-Specific and Code Spectra for Development of Recommended Site-Specific MCE_R and DE Spectra

Period (sec)	S_a (g) for 5 percent damping						
	Risk-Targeted PSHA – 2,475 Year Return Period Max. Dir.	84th Deterministic Percentile – Max. Dir.	Initial MCE_R	2/3 of Initial MCE_R (Initial DE)	80 percent of ASCE 7-16 Design Earthquake for Site Class E	Recommended Spectra	
						DE	MCE_R
0.01	0.793	0.808	0.793	0.529	0.328	0.529	0.793
0.10	1.413	1.250	1.250	0.833	0.558	0.833	1.250
0.20	1.891	1.753	1.753	1.168	0.756	1.168	1.753
0.30	2.023	2.059	2.023	1.349	0.756	1.349	2.023
0.40	1.954	2.120	1.954	1.303	0.756	1.303	1.954
0.50	1.829	2.053	1.829	1.219	0.756	1.219	1.829
0.75	1.494	1.726	1.494	0.996	0.756	0.996	1.494
0.86	1.381	1.611	1.381	0.921	0.719	0.921	1.381
1.00	1.238	1.465	1.238	0.825	0.671	0.825	1.238
1.10	1.162	1.386	1.162	0.775	0.626	0.775	1.162
1.50	0.861	1.072	0.861	0.574	0.447	0.574	0.861
2.00	0.637	0.825	0.637	0.425	0.335	0.425	0.637
3.00	0.410	0.549	0.410	0.273	0.224	0.273	0.410
4.00	0.290	0.391	0.290	0.193	0.168	0.193	0.290
5.00	0.217	0.304	0.217	0.145	0.134	0.145	0.217

Notes:
1. MCE_R = Risk-Targeted Maximum Considered Earthquake. DE = Design Earthquake.
2. Risk-Targeted PSHA – 2,475 Year Return Period and Deterministic 84th Percentile spectra include maximum direction factors based on Shahi and Baker (2014) and include average directivity effects based on Mazzoni et al. (2023) for the probabilistic analysis and the average of Bayless and Somerville (2020) and Watson-Lamprey (2018) for the deterministic analysis.

6.2.10 Recommended Seismic Design Criteria

The values of S_{MS}, S_{M1}, S_{DS}, S_{D1}, and PGA_M as determined per ASCE 7-16 should be used as shown below.

Table 4 – Recommended Seismic Design Criteria

Criteria	Value (g)
MCE_R Spectral Response Acceleration at Short Periods, S_{MS}	1.821
MCE_R Spectral Response Acceleration at 1 second period, S_{M1}	1.291
Design Spectral Response Acceleration at short periods, S_{DS}	1.214
Design Spectral Response Acceleration at 1 second period, S_{D1}	0.861
MCE_G Peak Ground Acceleration, PGA_M	0.679

Notes:
1. Recommended S_{DS} taken as 90 percent of the maximum spectral acceleration between 0.2 and 5 seconds.
2. Recommended S_{D1} governed by 1.5 x spectral acceleration value at 1.5 seconds.
3. Recommended S_{MS} and S_{M1} taken as 150 percent of S_{DS} and S_{D1}.
4. Recommended PGA_M is governed by 80% of the PGA_M for Site Class D.

6.3 Storm Water Infiltration

The results of the field percolation testing are considered representative of soils present at the bottom of the proposed BMP system noting that varying amounts of silt and gravel will result in lower (more silt) and higher (more gravel) infiltration rates.

As stated previously, intermittent and discontinuous clay and silt lenses up to approximately one foot in thickness were observed in the upper 11 to 16 feet bgs. We should be present during excavation of the BMP system to confirm that the removal bottom does not expose silt or clay lenses. The removal bottom may need to be deepened into sandy soil to utilize the infiltration rates recommended herein.

Based on the results of the field percolation testing, we recommend utilizing the lowest value from the current percolation tests performed within the limits of the proposed infiltration area.

The lowest of the two field percolation tests within the planned infiltration area is approximately 6.7 inches per hour and we recommend using this value in design.

Worksheet H of the Orange County TGD for WQMP requires selection of factors of safety for various site conditions. Factor Category A references geotechnical parameters and Factor Category B references general site development parameters.

Table 5 presents our recommended factors of safety for use in determining a design (factored) infiltration rate.

Table 5 – Worksheet H – Excerpt for Geotechnical-related Parameters

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p= w x v
A	Suitability Assessment	Soil Assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.50
		Depth to groundwater/impervious layer	0.25	2	0.50
		Suitability Assessment Safety Factor, $S_A=\sum p$			1.50

The above values should be used in conjunction with Factor Category B parameters (to be determined by Stantec).

6.4 Floor Slab Support

Existing undocumented fill, if encountered, should be removed beneath the building floor slab to a minimum of 12 inches and replaced with properly compacted, engineered fill materials.

6.5 Temporary Excavations and Vertical Cuts

Temporary vertical cuts are not feasible in the on-site granular soils.

Temporary, unsurcharged slopes may be excavated into the on-site soil and these slopes should not exceed a 1H:1V gradient and should not exceed 20 feet in height.

Temporary construction slopes should be protected from erosion by directing surface water away from the top of the slope, by placing sandbags at the top of the slopes, and/or covering the slopes with plastic sheeting during rain.

6.6 Pavement Design

6.6.1 General

New pavement sections should be established on at least 12 inches of properly compacted non-expansive fill soils. Placement of fill will require the removal of the top 12 inches.

The required pavement and base thicknesses will depend on the expected wheel loads, traffic index (TI), and the R-value of the subgrade soils. Based on laboratory test results, the R-value of the on-site subgrade soils is on the order of 74; however, based on the guidelines presented in the Caltrans Highway Design Manual, the R-value to be used in design should be limited to no more than 50.

Therefore, an R-value of 50 was used for the design of pavement sections established near existing grade. Additionally, the pavement design recommendations for asphalt concrete and aggregate base are based on the minimum requirements established by the City of Anaheim.

Our pavement design recommendations for asphalt concrete (AC) and Portland cement concrete (PCC) are provided below.

6.6.2 Asphalt Concrete Pavement Design

AC pavement for surface parking shall be designed in accordance with the CALTRANS method. Table 6 below summarizes our AC pavement recommendations for assumed TIs of 4, 5 and 7.

Table 6 – AC Pavement Design Recommendations

Traffic Use	TI	AC (inches)	AB (inches)
Parking Areas	4	4.5	4.5
Vehicle Drive Lanes	5	4.5	4.5
Loading Docks and Fire Lanes	7	4.5	5

We can determine the recommended pavement and aggregate base thickness for other TIs if required. Careful inspection is recommended to confirm that the recommended thickness or greater is achieved and their proper construction procedures are followed.

The base should conform to requirements of Section 26 of State of California Standard Specifications for Public Works Construction (Green Book). The aggregate base should be compacted to at least 95 percent relative compaction.

6.6.3 Portland Cement Concrete Pavement Design

Table 7 summarizes our PCC pavement recommendations for assumed TI of 4, 5, and 7 based on minimum compressive strength of 3,000 psi for the PCC.

Table 7 – PCC Pavement Design Recommendations

Traffic Use	TI	PCC (inches)	AB (inches)
Parking Areas	4	3	3
Vehicle Drive Lanes	5	3	4
Loading Docks and Fire Lanes	7	4	5

Reinforcing steel should be included in the PCC pavement sections and should consist of No. 4 bars placed 24-inches on center in each orthogonal direction. Careful inspection is recommended to check that the recommended PCC thickness or greater is achieved and that proper construction procedures are followed.

Control joints should be installed at 15-foot intervals and cold joint should be spaced at approximately 45-foot intervals.

State of California Department of Transportation Type 2 base, or equivalent, should be used in the required sections. The base should be compacted to at least 95 percent relative compaction.

6.7 Earthwork Considerations

6.7.1 General

Exposed excavation bottoms should be evaluated by our field representative. Any zones of loose, soft, excessively moist, or otherwise unsuitable materials should be removed and replaced with suitable fill materials including compacted fill, CMB, and/or sand-cement slurry. We will review such occurrences on a case-by-case basis.

All deleterious materials should be removed from excavation bottoms prior to placement fill.

6.7.2 Subgrade Preparation

Exposed excavation bottoms of the mass excavation should be scarified to a depth of at least 8 inches, moisture conditioned as necessary and compacted as recommended herein.

All excavation bottoms should be observed by our field representative to ensure the bottom is suitable for support of new fill.

Foundation excavation bottoms will be excavated into properly compacted fill soils and the exposed foundation excavation bottoms do not require any preparation.

Foundation excavation bottoms should also be observed by our representative to confirm the exposed properly compacted select fill is not disturbed or otherwise unsuitable for foundation support.

6.7.3 Materials for Fill

On-site soils are suitable for re-use in the required fills. Additionally, CMB or crushed PCC and AC may also be used provided the recommendations presented herein are followed.

In general, all fill soils should be free of organic and other deleterious materials and have a maximum particle size no greater than six inches.

Imported fill materials should be primarily non-expansive and granular in nature and reviewed by our field technician prior to import to the site.

6.7.4 Fill Placement and Compaction

Fill soils shall be moisture conditioned as recommended herein, placed in loose lifts not exceeding 8-inches in thickness and mechanically compacted.

Fine-grained fill soils should be moisture conditioned to 2 to 4 percent above the optimum moisture content and compacted to at least 90 percent of the maximum dry density obtainable per ASTM D-1557. We recommend that relatively light-weight compaction equipment be utilized when working in fine-grained soils.

Granular soils should be moisture conditioned to 0 to 2 percent above the optimum moisture content and compacted to at least 95 percent of the maximum dry density obtained per ASTM D-1557.

6.7.5 Shrinkage and Subsidence

We estimate that the total combined shrinkage and subsidence resulting for the planned grading outside the building footprint will be on the order of 15 percent by volume.

Subsidence due to the placement of new fill will be on the order of 2 to 5 percent of the fill material thickness, depending on the fill material thickness.

6.7.6 Site Drainage

Proper drainage should be always maintained. Ponding or trapping of water in localized areas can cause differing moisture levels in the subsurface soil. Drainage should be directed away from the tops of slopes. Erosion protection and drainage control measures should be implemented during periods of inclement weather. While raining, backfill operations may need to be restricted to allow for proper moisture control during fill placement.

7.0 CONSTRUCTION OBSERVATION AND TESTING

Geotechnical observation and testing during construction are considered an on-going part of our geotechnical consultation. We anticipate the geotechnical observation and testing will include the following:

- Observation and documentation of any removal and re-compaction of onsite soil
- Placement and compaction of backfill materials
- Installation of capillary break sections
- Subgrade preparation and placement of aggregate base materials for pavement sections
- Observation and approval of foundation excavation bottoms
- Placement and compaction of utility trench backfill

In addition, development of a load test program in collaboration with the foundation contractor will be required and we will need to issue a supplemental letter summarizing the results of the load testing.

We will prepare daily field reports and summary reports at the end of the project that document that geotechnical related construction work as performed in general accordance with the approved geotechnical recommendations.

8.0 LIMITATIONS

The conclusions and recommendations provided in this report are based on subsurface conditions inferred from available boring data, as well as project information provided to date.

This report was prepared for Bomel Construction Company, Inc and other members of the project team for use in the proposed development.

If changes to the proposed development are made, we should be notified to review our conclusions and recommendations.

We should be retaining during the construction phase to perform necessary geotechnical observations and testing in accordance with good geotechnical engineering practice.

Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of investigation.

9.0 CLOSING

We sincerely appreciate the opportunity to provide professional services for this project and look forward to working with you on this project.

Sincerely,

Langan CA, Inc.

signed 6/10/25

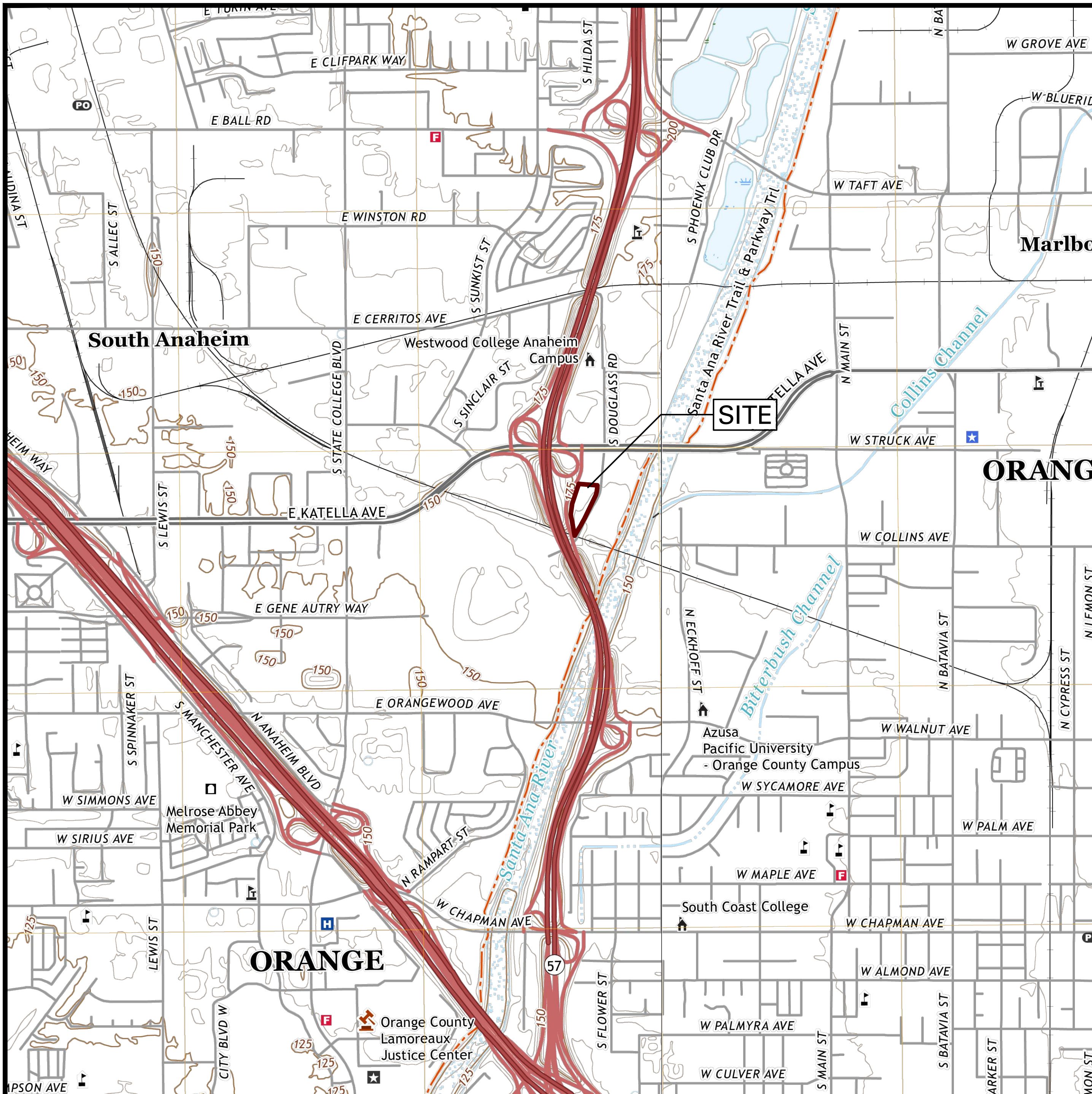
Claudia Rangel
Staff Engineer

Shaun Wilkins
Senior Project Geologist

signed 6/10/25

Christopher J. Zadoorian, F. ASCE
Associate Principal/Vice President

FIGURES



LEGEND:

SITE LIMITS

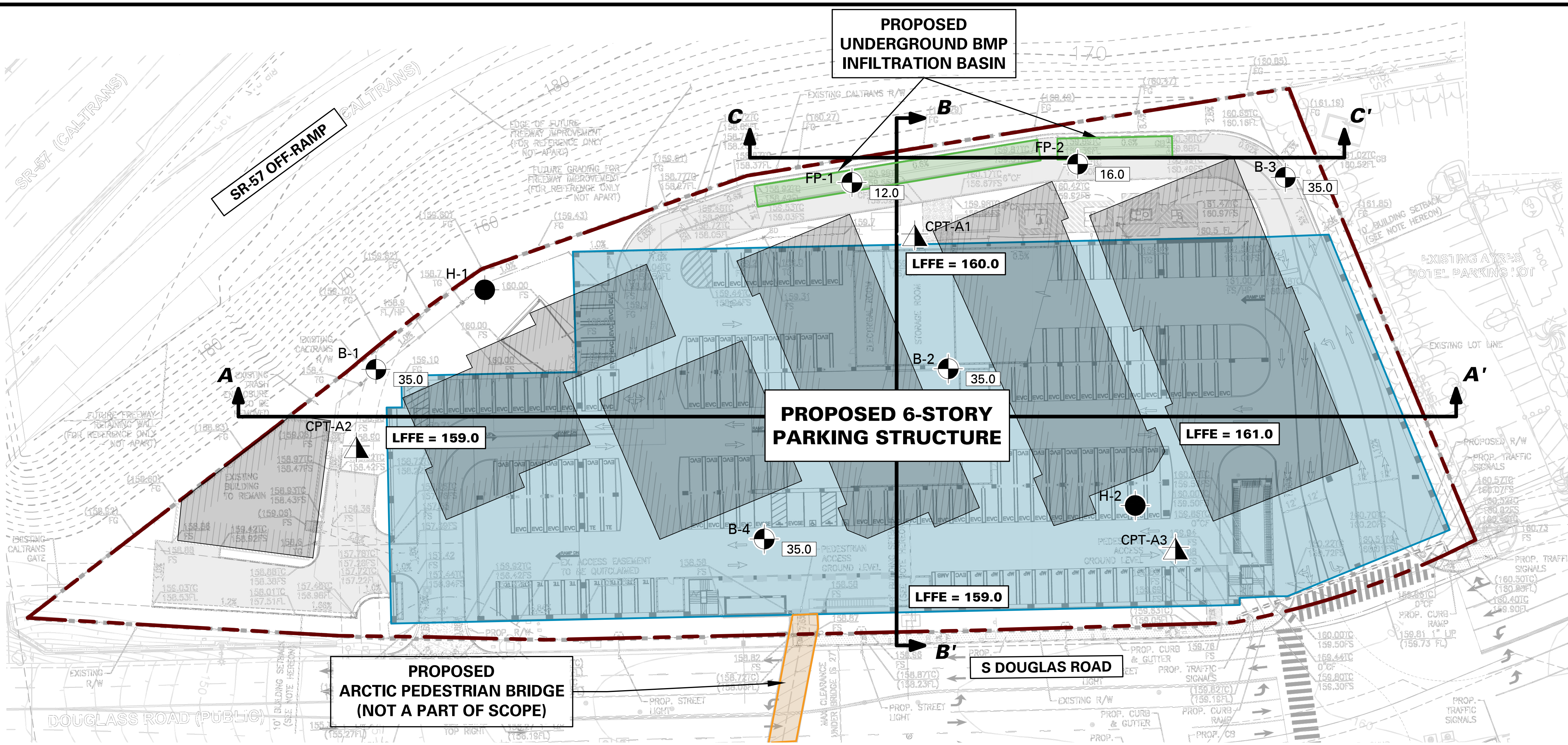
2000 1000 0 2000

SCALE IN FEET

REFERENCE: USGS 7.5-MINUTE TOPOGRAPHIC MAP OF THE ANAHEIM AND ORANGE, CA QUADRANGLES (2022).

LANGAN	Project	Figure Title	Project No.	Figure No.
Langan CA, Inc. 18575 Jamboree Road, Suite 150 Irvine, CA 92612	**OC VIBE PARKING STRUCTURE A** 1725 S DOUGLASS ROAD ANAHEIM	**SITE LOCATION MAP**	700170401	**1**
			Date: JUNE 2025	
			Scale: AS SHOWN	
T:949.561.9200 F: 949.561.9201 www.langan.com	ORANGE COUNTY CALIFORNIA		Drawn By: CR	

Filename: \\langan.com\data\IRV\data4\700170401\Project Data_Discipline\Geotechnical\CAD\OTHER GEOTECHNICAL FIGURES\OTHER GEOTECHNICAL FIGURES.dwg Date: 6/6/2025 Time: 15:50 User: crangel Style Table: Langan.stb Layout: SLM



LEGEND:

- SITE LIMITS
- PROPOSED BUILDING
- PROPOSED UNDERGROUND INFILTRATION BASIN
- PROPOSED ARCTIC PEDESTRIAN BRIDGE (NOT A PART OF SCOPE)
- EXISTING BUILDING
- LFFE = 161.0 — LOWEST FINISHED FLOOR ELEVATION
- B-1 — BORING LOCATION (CURRENT INVESTIGATION)
- FP-1 — PERCOLATION TEST LOCATION (CURRENT INVESTIGATION)

PRIOR EXPLORATIONS

- H-1 — PRIOR BORING LOCATION (NMG, 2020)
- CPT-A1 — PRIOR CONE PENETRATION TEST LOCATION (LANGAN, 2019)

NOTES:

1. BACKGROUND SITE PLAN AND PROPOSED DEVELOPMENT REFERENCED FROM OC VIBE 3RD FSP SUBMITTAL FINAL SITE PLAN DEV2024-00077 LOT B & PARKING DECK A " PRELIMINARY GRADING PLAN", SHT C-120, PREPARED BY STANTEC, DATED MAY 2025.
2. PRIOR EXPLORATIONS REFERENCED FROM "DRAFT SUPPLEMENTAL GEOTECHNICAL EXPLORATION AND PLANNING STUDY, OC VIBE MIXED-USE COMMUNITY AND LIVE ENTERTAINMENT REDEVELOPMENT, PLATINUM TRIANGLE, CITY OF ANAHEIM, CALIFORNIA", PROJECT NO.: 20065-01, NMG GEOTECHNICAL, INC., DATED OCTOBER 7, 2020.

60 30 0 60

SCALE IN FEET

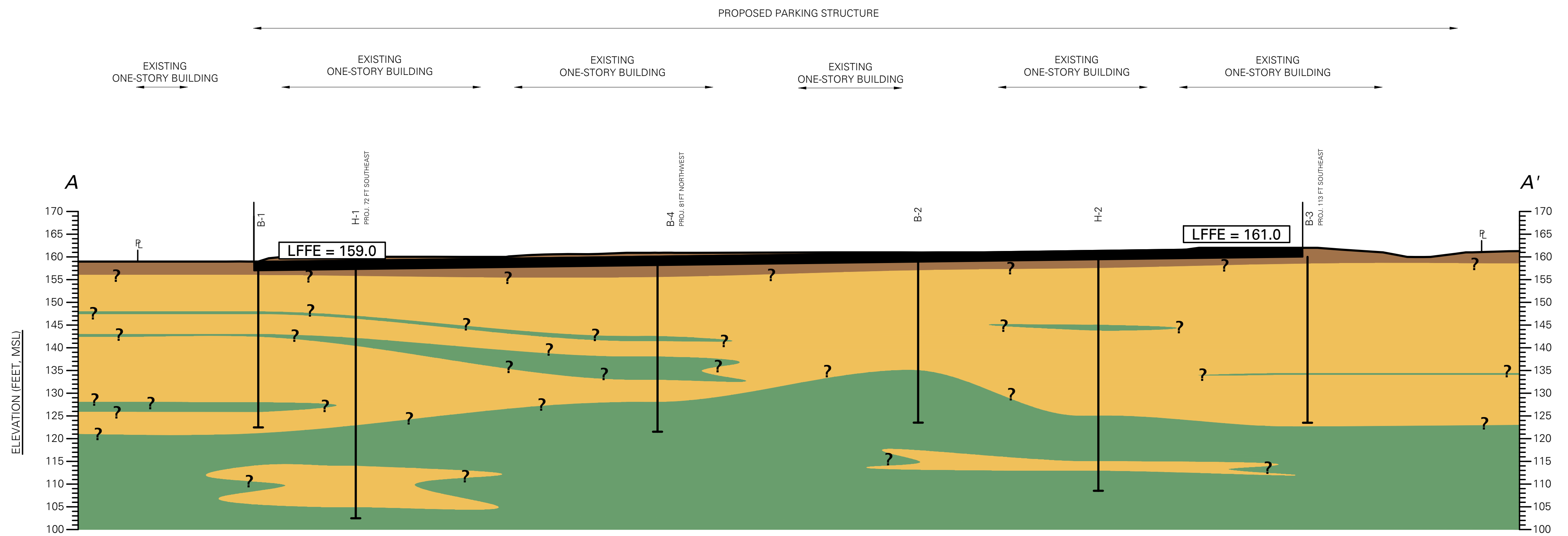
LANGAN

LANGAN Langan CA, Inc. 18575 Jamboree Road Suite 150 Irvine, CA 92612 T: 949.561.9200 F: 949.561.9201 www.langan.com	Project **OC VIBE PARKING STRUCTURE A** 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	Figure Title **SITE PLAN**	Project No. 700170401 Date JUNE 2025 Scale AS SHOWN Drawn By CR	Figure No. **2**

Filename: \\langan.com\data\IRV\data4\700170401\Project Data_Discipline\Geotechnical\CAD\GEOTECHNICAL FIGURES.dwg Date: 6/9/2025 Time: 16:19 User: crangel Style Table: Langan.stb Layout: SP

CROSS SECTION A-A'

N28E



LEGEND:

	EXISTING GROUND SURFACE
	EXISTING FILL
	PREDOMINATELY FINE GRAINED SOIL
	PREDOMINATELY GRANULAR SOIL
LFFE = 159.0	LOWEST FINISHED FLOOR ELEVATION (FEET)

NOTES:

1. CROSS SECTION DISPLAYS GENERALIZED SUBSURFACE CONDITIONS; FOR A DETAILED DESCRIPTION OF CONDITIONS ENCOUNTERED REFER TO BORING LOGS.
2. REFER TO SITE PLAN FOR LOCATION OF CROSS SECTION.
3. GROUND SURFACE INFERRED FROM CA WILDFIRES 2018 SURFACE CONTOURS ACCESSED FROM NOAA ON MAY 5, 2025.

30 15 0 30

SCALE IN FEET (VERTICAL)

60 30 0 60

SCALE IN FEET (HORIZONTAL)

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Langan CA, Inc.

18575 Jamboree Road Suite 150
Irvine, CA 92612

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Project	Figure Title	Project No.	Figure No.
OC VIBE PARKING STRUCTURE A 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	CROSS SECTION A-A'	700170401	3
		Date: JUNE 2025	
		Scale: AS SHOWN	
		Drawn By: CR	

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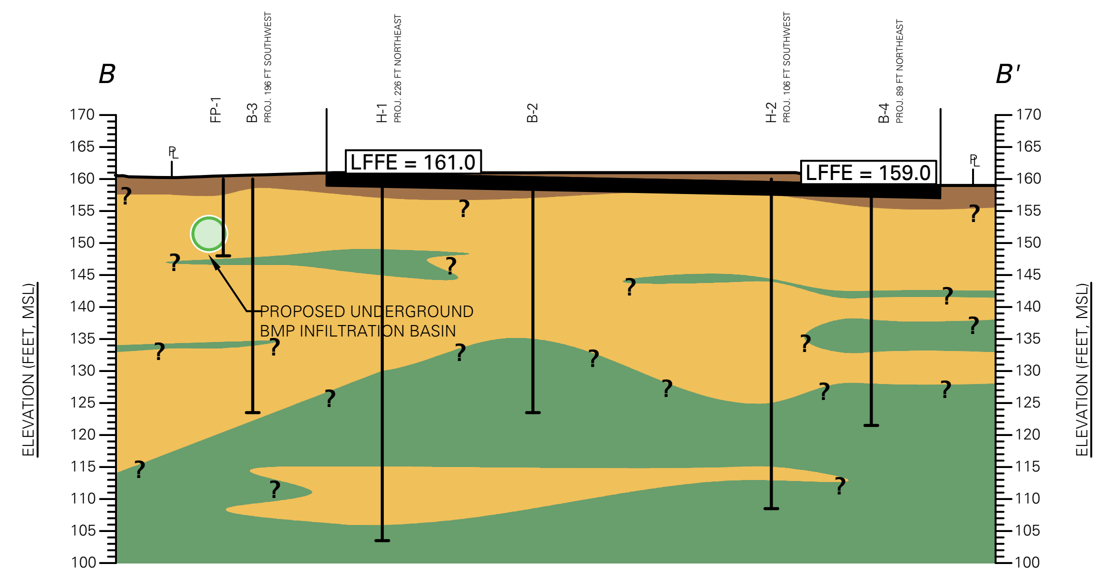
LANGAN

CROSS SECTION B-B'

N64W



LEGEND:

	EXISTING GROUND SURFACE
	EXISTING FILL
	PREDOMINATELY FINE GRAINED SOIL
	PREDOMINATELY GRANULAR SOIL
	PROPOSED UNDERGROUND BMP INFILTRATION BASIN
LFFE = 159.0	LOWEST FINISHED FLOOR ELEVATION (FEET)

NOTES:

1. CROSS SECTION DISPLAYS GENERALIZED SUBSURFACE CONDITIONS; FOR A DETAILED DESCRIPTION OF CONDITIONS ENCOUNTERED REFER TO BORING LOGS.
2. REFER TO SITE PLAN FOR LOCATION OF CROSS SECTION.
3. GROUND SURFACE INFERRED FROM CA WILDFIRES 2018 SURFACE CONTOURS ACCESSED FROM NOAA ON MAY 5, 2025.

30 15 0 30

SCALE IN FEET (VERTICAL)

60 30 0 60

SCALE IN FEET (HORIZONTAL)

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Project

OC VIBE PARKING STRUCTURE A

1725 S DOUGLASS ROAD
ANAHEIM

ORANGE COUNTY CALIFORNIA

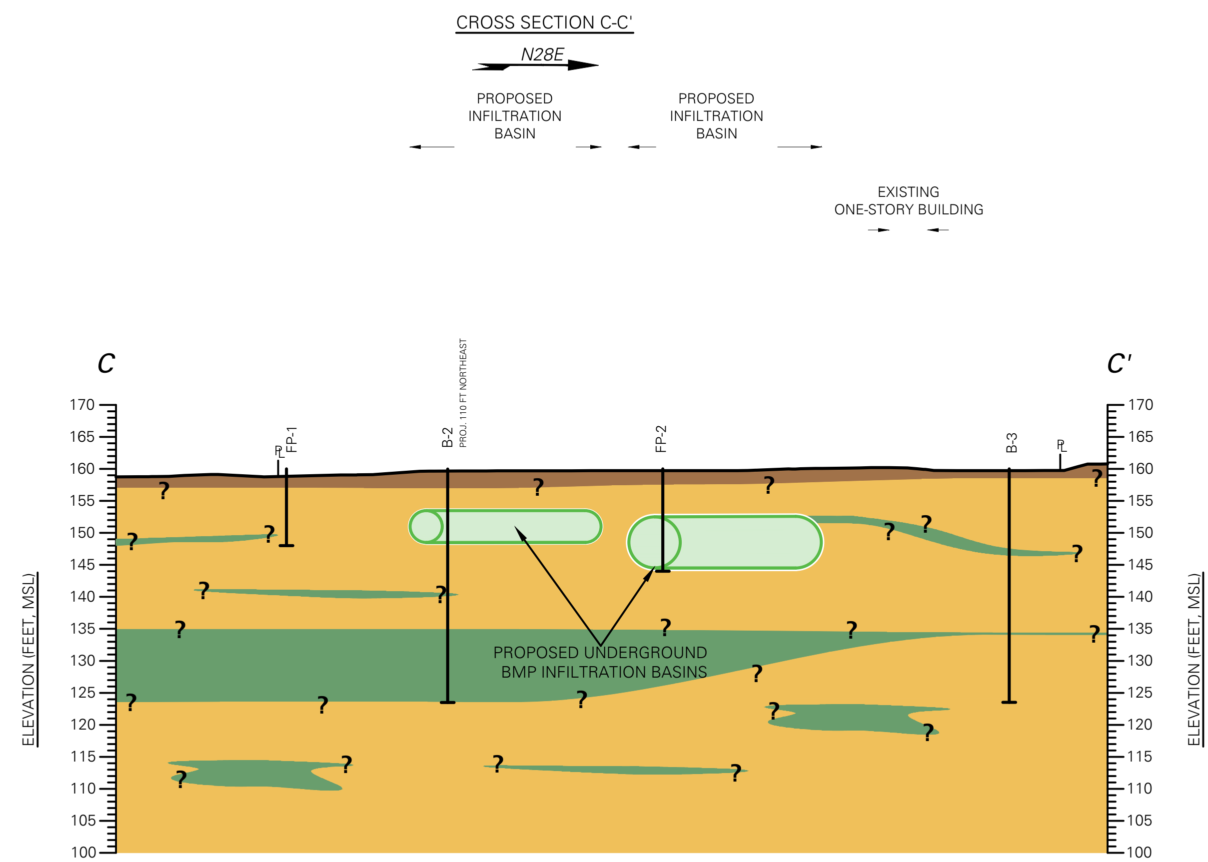
Figure Title

CROSS SECTION B-B'

Project No.	700170401
Date	JUNE 2025
Scale	AS SHOWN
Drawn By	CR
Figure No.	4

Filename: \\langan.com\data\IRV\data4\700170401\Project Data_Discipline\Geotechnical\CAD\GEOTECHNICAL FIGURES.dwg Date: 6/9/2025 Time: 16:28 User: crangel Style Table: Langan.stb Layout: XSB

LANGAN

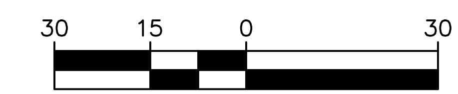


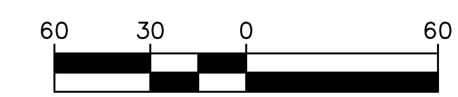
LEGEND:

- EXISTING GROUND SURFACE
- EXISTING FILL
- PREDOMINATELY FINE GRAINED SOIL
- PREDOMINATELY GRANULAR SOIL
- PROPOSED UNDERGROUND BMP INFILTRATION BASIN

NOTES:

1. CROSS SECTION DISPLAYS GENERALIZED SUBSURFACE CONDITIONS; FOR A DETAILED DESCRIPTION OF CONDITIONS ENCOUNTERED REFER TO BORING LOGS.
2. REFER TO SITE PLAN FOR LOCATION OF CROSS SECTION.
3. GROUND SURFACE INFERRED FROM CA WILDFIRES 2018 SURFACE CONTOURS ACCESSED FROM NOAA ON MAY 5, 2025.





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Project	Figure Title	Project No.	Figure No.
OC VIBE PARKING STRUCTURE A 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	CROSS SECTION C-C'	700170401 Date: JUNE 2025 Scale: AS SHOWN Drawn By: CR	5

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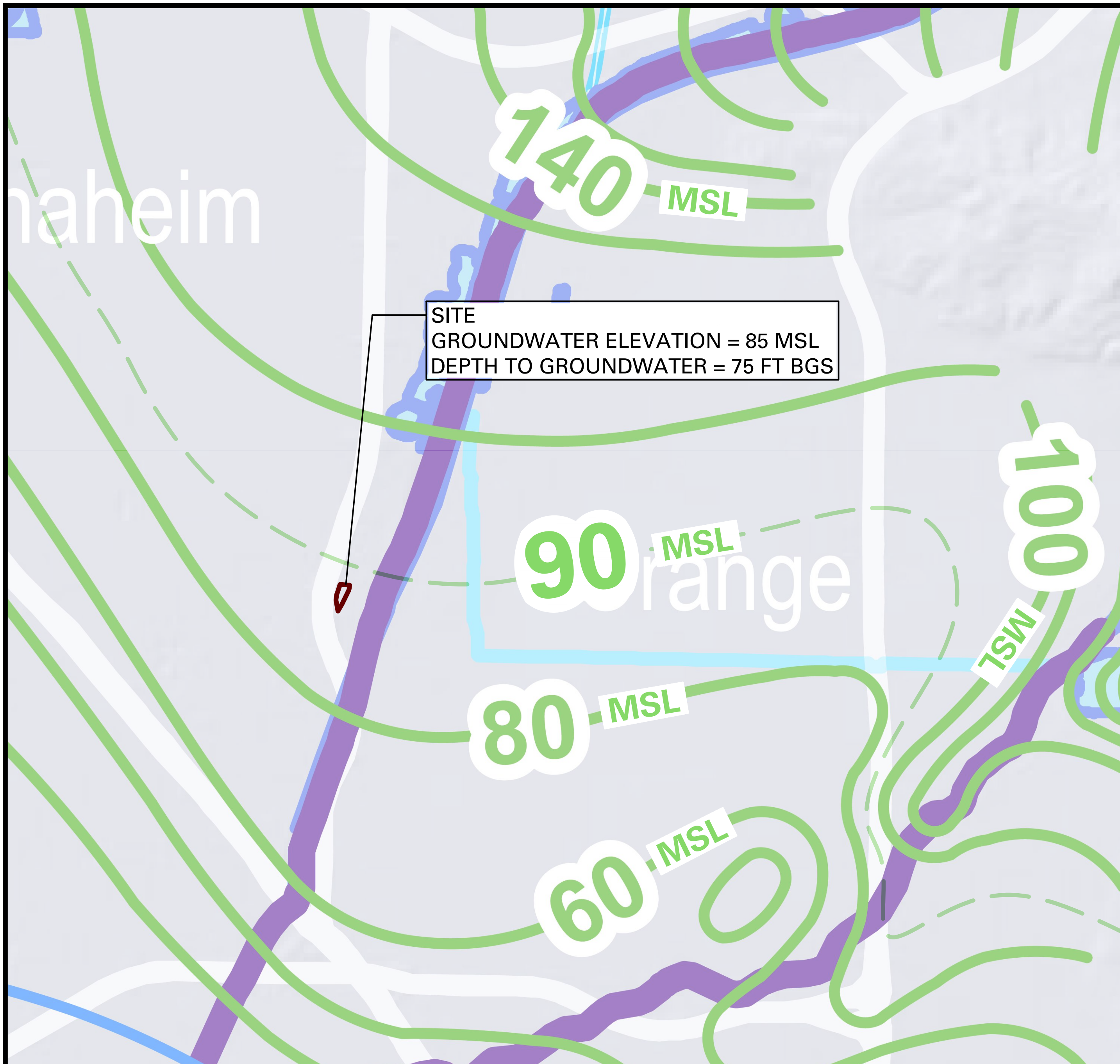


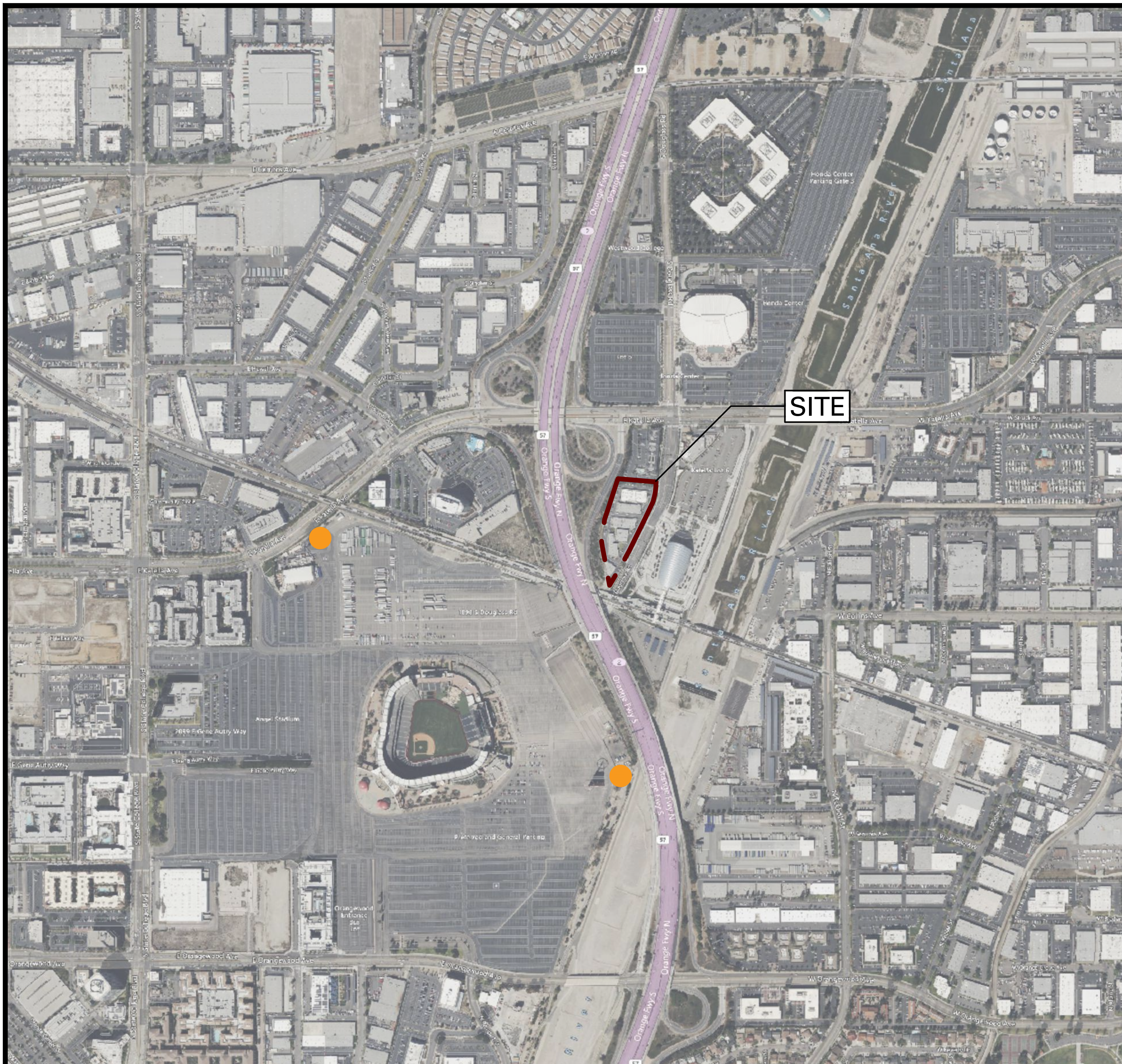
LEGEND:

SITE LIMITS
20 MSL TO 300 MSL
90 MSL (70 FEET BELOW EXISITNG GROUND SURFACE)

4000 2000 0 4000
SCALE IN FEET

REFERENCE: ORANGE COUNTY WATER DISTRICT GROUNDWATER ELEVATION CONTOURS FOR THE PRINCIPAL AQUIFER FOR JUNE 2024 (DECEMBER 18, 2024).

LANGAN Langan CA, Inc. 18575 Jamboree Road, Suite 150 Irvine, CA 92612 T:949.561.9200 F: 949.561.9201 www.langan.com	Project **OC VIBE PARKING STRUCTURE A** 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	Figure Title **GROUNDWATER ELEVATION CONTOURS**	Project No. 700170401 Date JUNE 2025 Scale AS SHOWN Drawn By CR	Figure No. **6A**



LEGEND:

SITE LIMITS

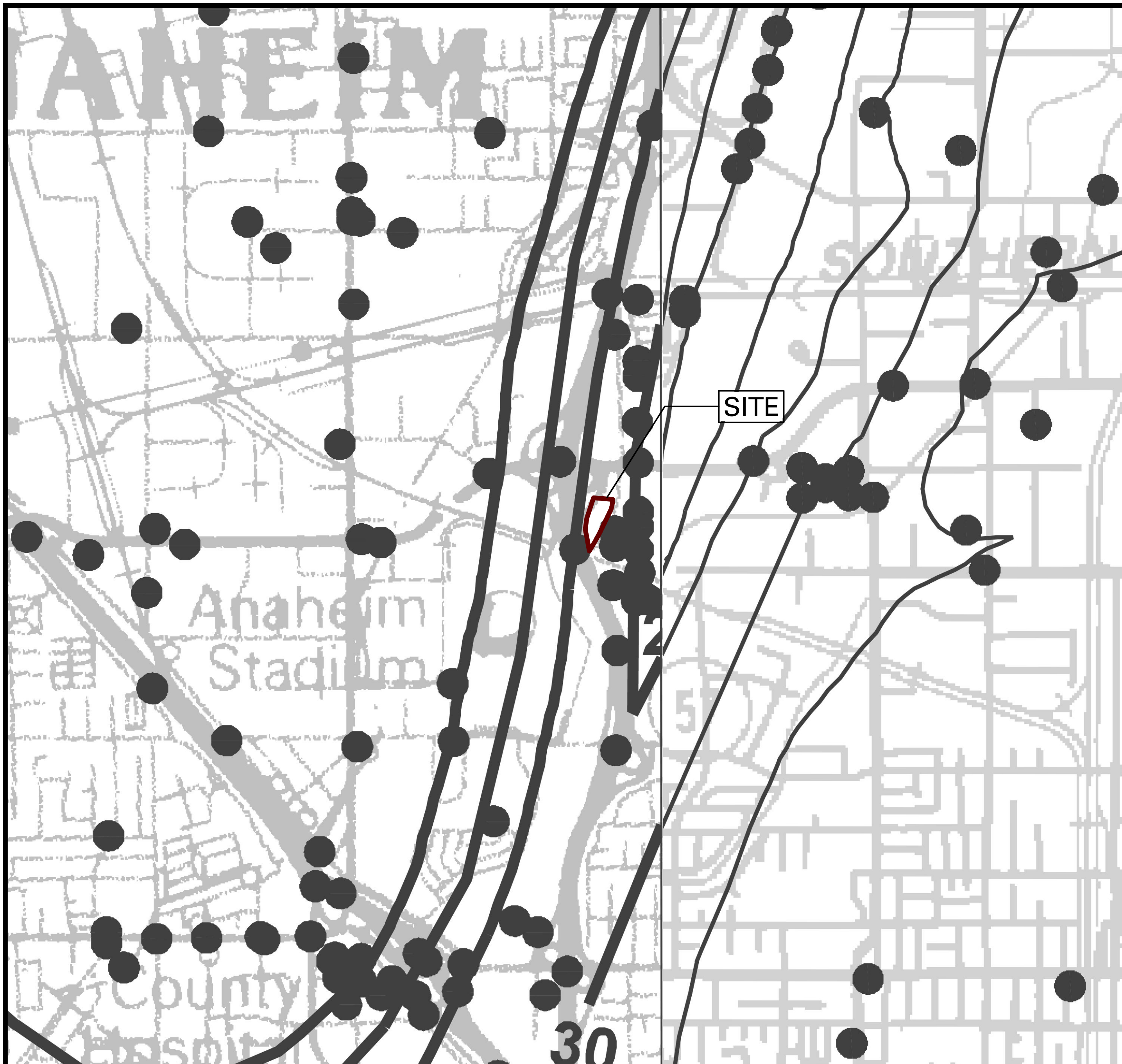
WELL LOCATION

1000 500 0 1000

SCALE IN FEET

REFERENCE: CALIFORNIA DEPARTMENT OF WATER RESOURCES WATER DATA LIBRARY (WDL) STATION MAP ACCESSED ON JUNE 6, 2024.

LANGAN Langan CA, Inc. 18575 Jamboree Road, Suite 150 Irvine, CA 92612 T:949.561.9200 F: 949.561.9201 www.langan.com	Project **OC VIBE PARKING STRUCTURE A** 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	Figure Title **GROUNDWATER WELL LOCATIONS**	Project No. 700170401 Date JUNE 2025 Scale AS SHOWN Drawn By CR	Figure No. **6B**



LEGEND:

SITE LIMITS

Borehole Site

30 Depth to ground water in feet

N

2000 1000 0 2000

SCALE IN FEET

REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY - SEISMIC HAZARD REPORT FOR THE ANAHEIM AND NB AND ORANGE, CALIFORNIA 7.5-MINUTE QUADRANGLES, PLATE 1.2 (SHZR 03 AND 11), (1997).

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Project

OC VIBE PARKING STRUCTURE A

1725 S DOUGLASS ROAD
ANAHEIM

ORANGE COUNTY CALIFORNIA

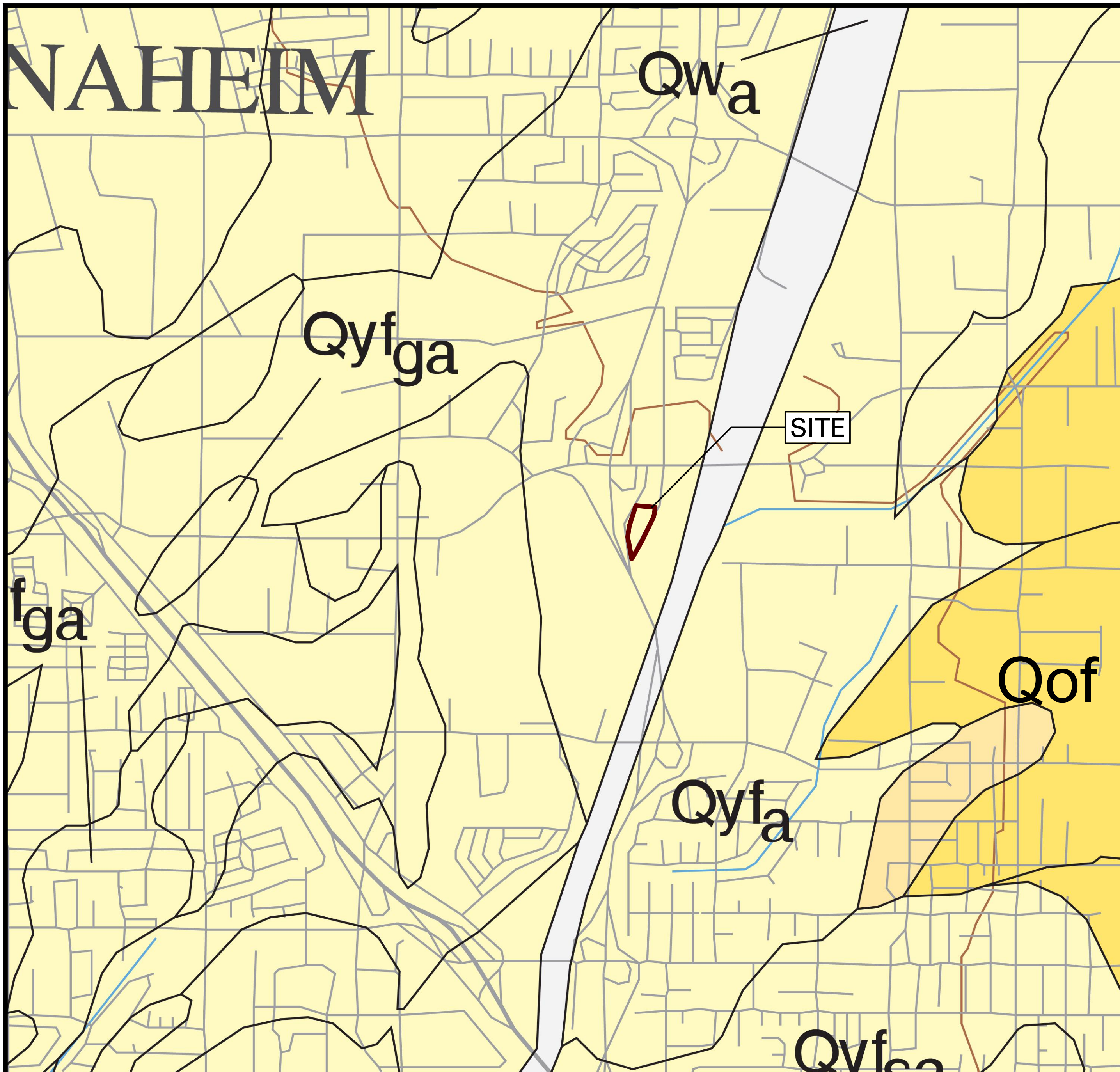
Figure Title

HISTORICAL HIGH GROUNDWATER MAP

Project No.	700170401
Date	JUNE 2025
Scale	AS SHOWN
Drawn By	CR

Figure No.

6C



LEGEND:

SITE LIMITS

Qw HOLOCENE-AGE WASH DEPOSITS

Qyf HOLOCENE-AGE ALLUVIAL FAN DEPOSITS

Qof PLEISTOCENE-AGE OLD ALLUVIAL FAN DEPOSITS

REFERENCE: USGS GEOLOGIC MAP OF THE SAN BERNARDINO AND SANTA ANA 30' x 60' QUADRANGLES, CALIFORNIA (MORTON AND MILLER, 2006).

2000 1000 0 2000

SCALE IN FEET

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Project

OC VIBE PARKING STRUCTURE A

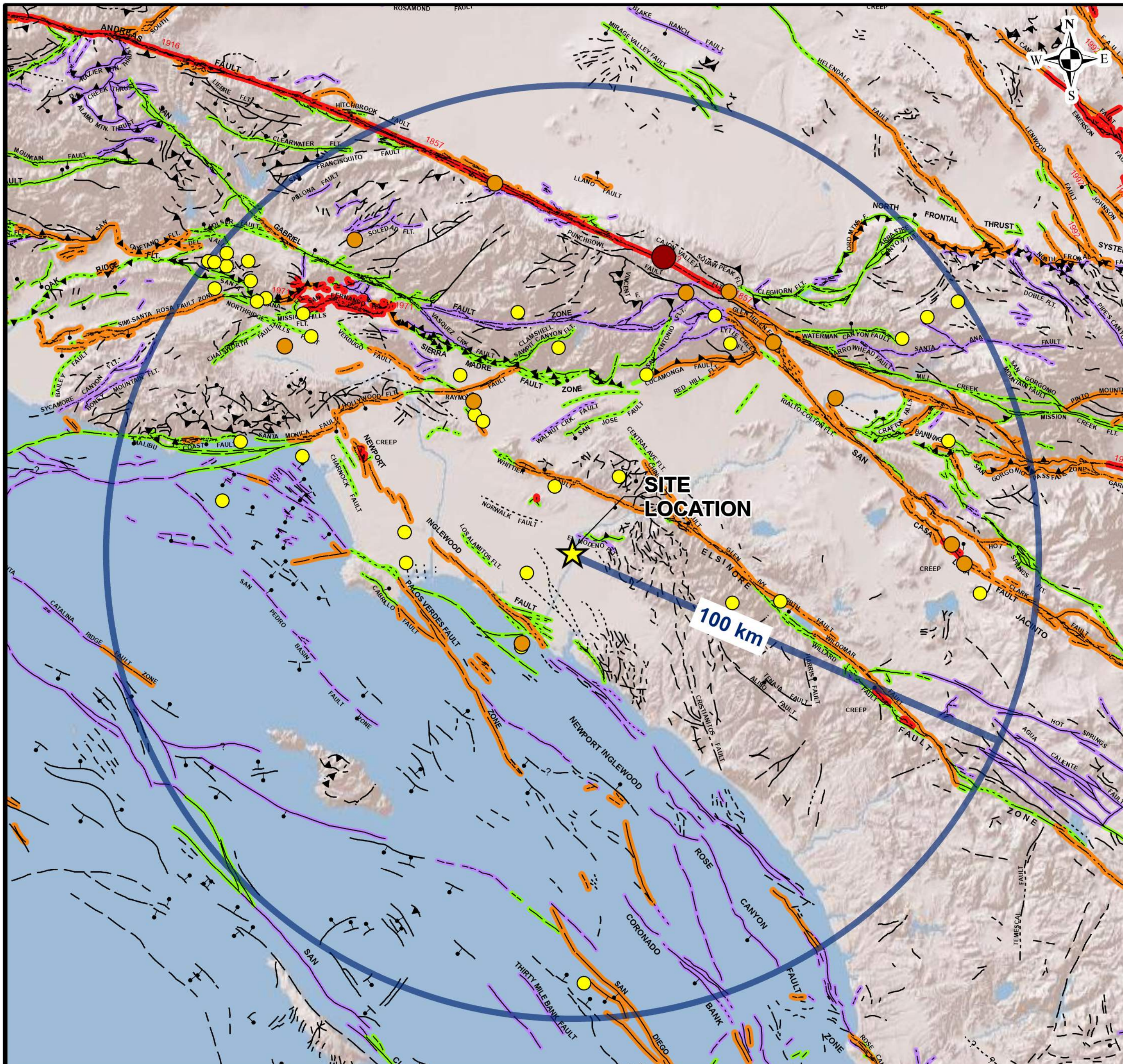
1725 S DOUGLASS ROAD
ANAHEIM

ORANGE COUNTY CALIFORNIA

Figure Title

REGIONAL GEOLOGIC MAP

Project No.	Figure No.
700170401	7
Date	
JUNE 2025	
Scale	
AS SHOWN	
Drawn By	
CR	



Notes:
1. Base figure reproduced from Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
2. Shaded relief basemap is provided through Langan's ESRI ArcGIS software licensing and ArcGIS online developed by ESRI using GTOPO30, Shuttle Radar Topography Mission (SRTM) and National Elevation Data (NED) data from USGS.
3. Refer to "An Explanatory Text to Accompany the Fault Activity Map of California" compiled and interpreted by Jennings, C.W. and Bryant, W.A., digital preparation by Patel, M., Sander, E., Thompson, J., Wanish, B., and Fonseca, M., for additional fault information.
4. Quaternary-aged faults not included on the 2010 CGS Fault Activity Map have been recreated from the USGS Quaternary Faults Map.
5. Earthquakes queried within 100 km of site location with a magnitude of 5+ from 01/01/1800 to present, from the ANSS Comprehensive Earthquake Catalog (ComCat), downloaded 4/28/2025.
6. Refer to Figure 8B for Legend.

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Langan CA, Inc. 18575 Jamboree Road, Suite 150 Irvine, CA 92612 T: 949.561.9200 F: 949.561.9201 www.langan.com	OC VIBE PARKING STRUCTURE A 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS	700170401 Date: JUNE 2025 Scale: 1 inch = 20 miles Drawn By: AC	8A

Path: \\langan.com\data\IRV\data4\700170401\Project Data\ArcGIS\APRX\700170401.aprx Date: 4/28/2025 Time: 4:32 PM

LEGEND:

Site Location

Fault Age

Historic

Holocene

Late Quaternary

Early Quaternary

Pre-Quaternary Fault

100 km Search Radius

Earthquake Epicenter

Magnitude 5.0 to 5.9

Magnitude 6.0 to 6.9

Magnitude 7.0 to 7.4

Magnitude 7.5 to 8.0

Fault Symbols

Bar and ball on downthrown side (relative or apparent).

Relative or apparent direction of lateral movement.

Direction of dip.

Low angle fault (barbs on upper plate). Fault surface generally dips less than 45° but locally may have been subsequently steepened.

491 Numbers refer to annotations listed in the appendices of the accompanying report.

Structural discontinuity (offshore) separating differing Neogene structural domains.

Brawley Seismic Zone.

Fault Classification

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:
(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.
(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.
(c) displaced survey lines.

1906 1906 A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

1906 Date bracketed by triangles indicates local fault break.

1906 No triangle by date indicates an intermediate point along fault break.

CREEP Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

1906 1906 Square on fault indicates where fault creep slippage has occurred that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

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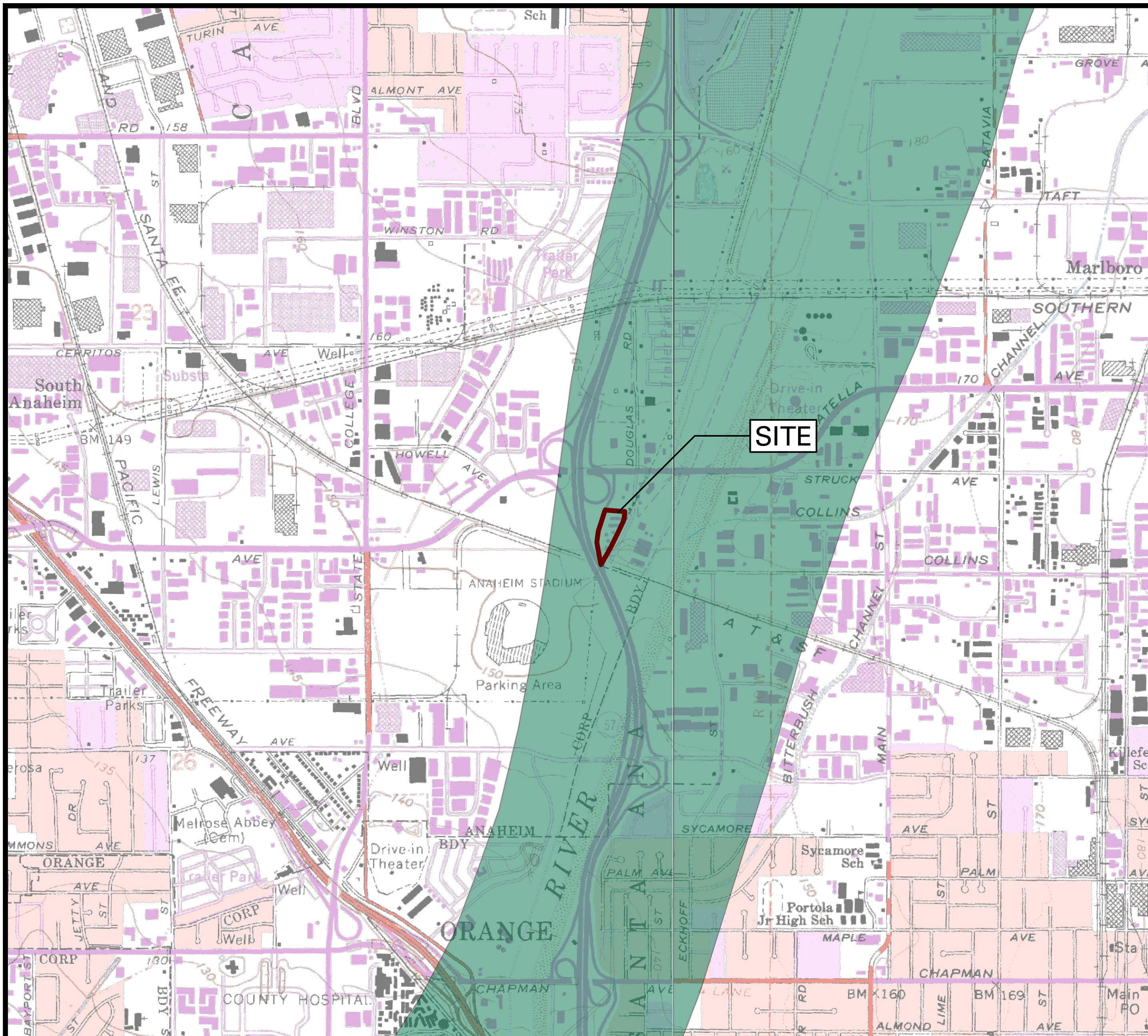
Path: \\langan.com\data\IRV\data4\700170401\Project Data\ArcGIS\APRX\700170401.aprx



LEGEND:

SITE LIMITS

Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

2000 1000 0 2000
SCALE IN FEET

REFERENCE: CGS EARTHQUAKE ZONES OF REQUIRED INVESTIGATION FOR THE ANAHEIM AND ORANGE, CALIFORNIA 7.5-MINUTE QUADRANGLES (1998).

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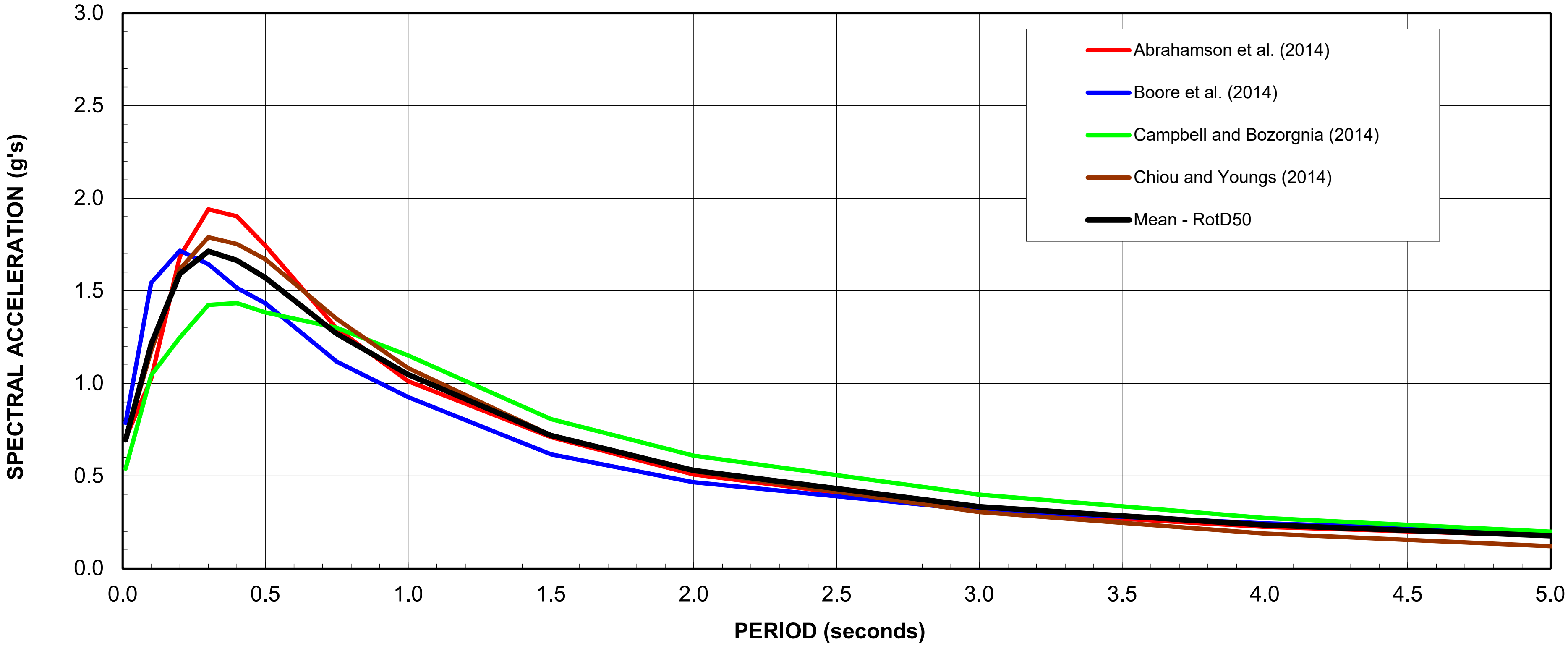
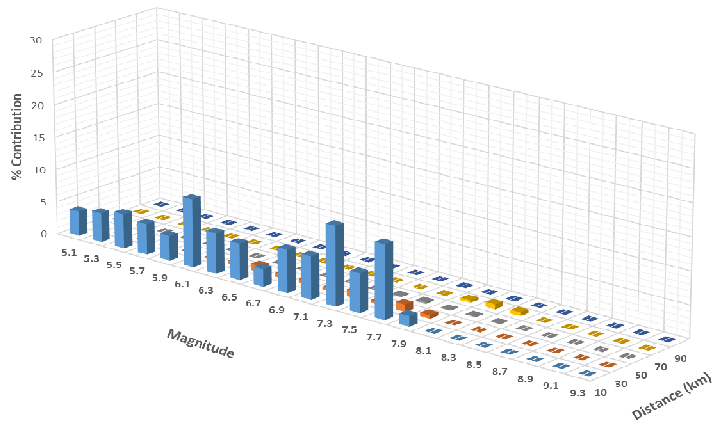
Langan CA, Inc. 18575 Jamboree Road, Suite 150 Irvine, CA 92612 T:949.561.9200 F: 949.561.9201 www.langan.com	**OC VIBE PARKING STRUCTURE A** 1725 S DOUGLASS ROAD ANAHEIM ORANGE COUNTY CALIFORNIA	**SEISMIC HAZARD ZONES MAP**	700170401 Date: JUNE 2025 Scale: AS SHOWN Drawn By: CR	**9**



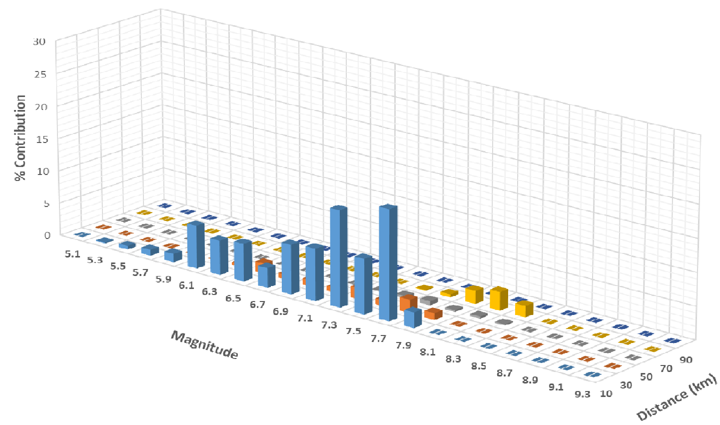
Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. Probabilistic seismic hazard analysis based on 2018 USGS seismic source model.

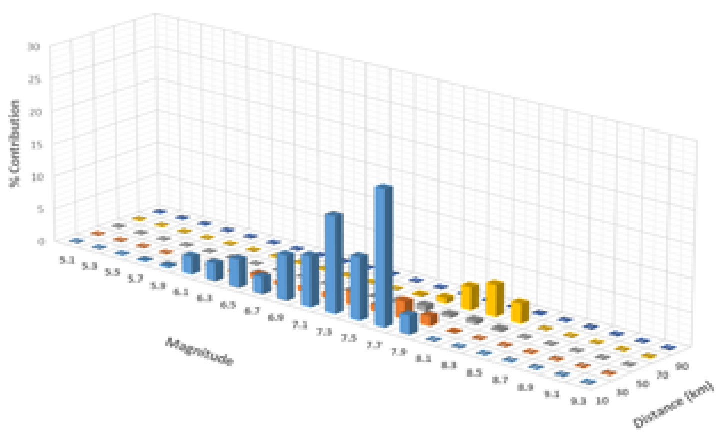
LANGAN 18575 Jamboree Road Suite 150 Irvine, CA 92612 T: 800.952.6426 www.langan.com LANGAN CA, INC.	Project OCVIBE PARKING STRUCTURE A ANAHEIM ORANGE COUNTY CALIFORNIA	Figure Title RESULTS OF PSHA: 2 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS	Project No. 700170401 Date JUNE 2025 Scale AS SHOWN Prepared By: CR	Figure No. 10



(a) T = PGA, M_{mean} =7.3, R_{mean} = 12.8 km, ε_{mean} = 1.4

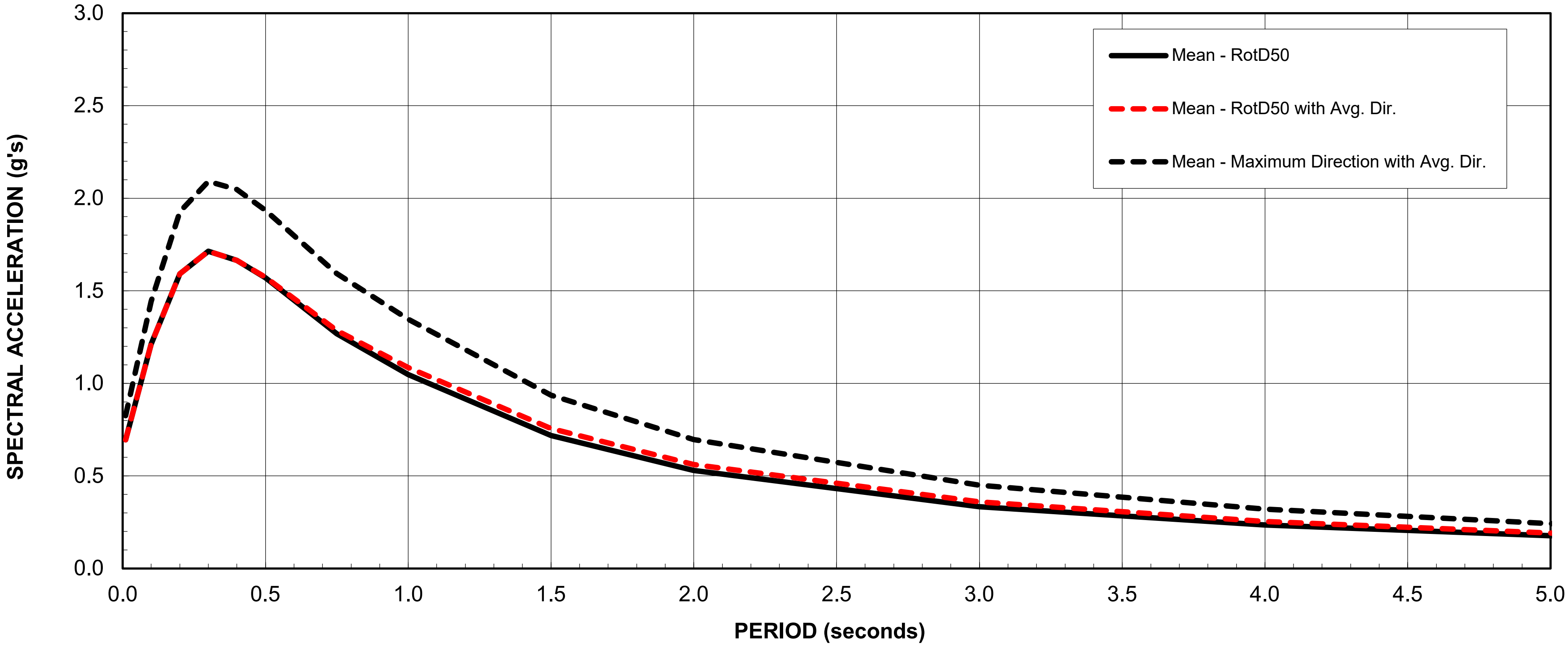


(b) T = 1.0 second, M_{mean} =7.2, R_{mean} = 17.6 km, ε_{mean} = 1.3



(c) T = 2.0 seconds, M_{mean} = 7.4, R_{mean} = 21.1 km, ε_{mean} = 1.3

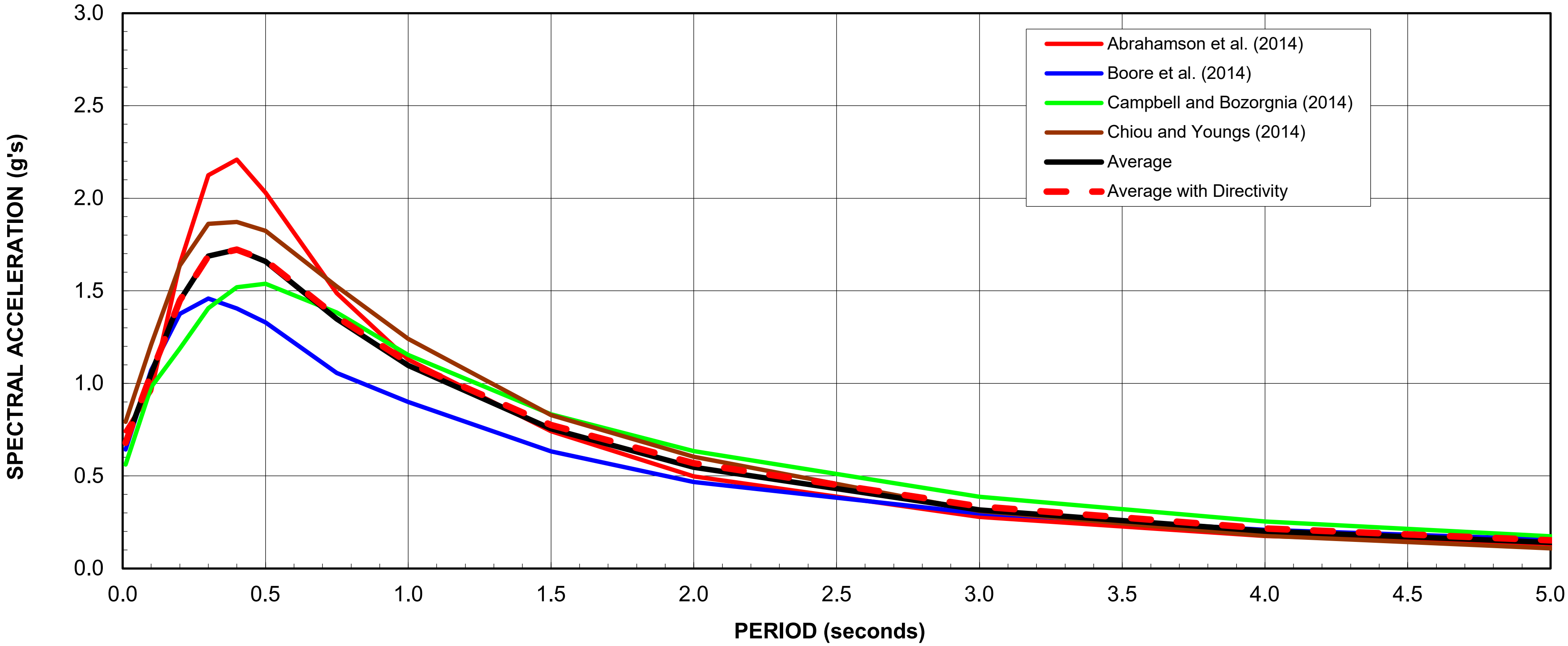
LANGAN	Project	Figure Title	Project No.	Figure No.
18575 Jamboree Road Suite 150 Irvine, CA 92612 T: 800.952.6426 www.langan.com LANGAN CA, INC.	**OCVIBE PARKING STRUCTURE A** ANAHEIM ORANGE COUNTY CALIFORNIA	**PSHA MAGNITUDE-DISTANCE DEAGGREGATION RESULTS: 2 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS**	700170401 Date: JUNE 2025 Scale: AS SHOWN Prepared By: CR	**11**



Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. Maximum direction factors from Shahi and Baker (2014).
3. Directivity adjustment factors based on a weighted average of Mazzoni et al. (2023).
4. Probabilistic seismic hazard analysis based on 2018 USGS seismic source model.

	Project	Figure Title	Project No.	Figure No.
LANGAN 18575 Jamboree Road Suite 150 Irvine, CA 92612 T: 800.952.6426 www.langan.com LANGAN CA, INC.	**OCVIBE PARKING STRUCTURE A** ANAHEIM ORANGE COUNTY CALIFORNIA	**RESULTS OF PSHA WITH DIRECTIVITY: 2 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS**	700170401 Date JUNE 2025 Scale AS SHOWN Prepared By: CR	12



Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. Deterministic scenario is for a moment magnitude 7.3 on the Compton Fault approximately 9.3 km (Joyner-Boore distance) from the site.
3. Directivity adjustment factors based on a weighted average of Bayless et al. (2020) and Watson-Lamprey (2018).

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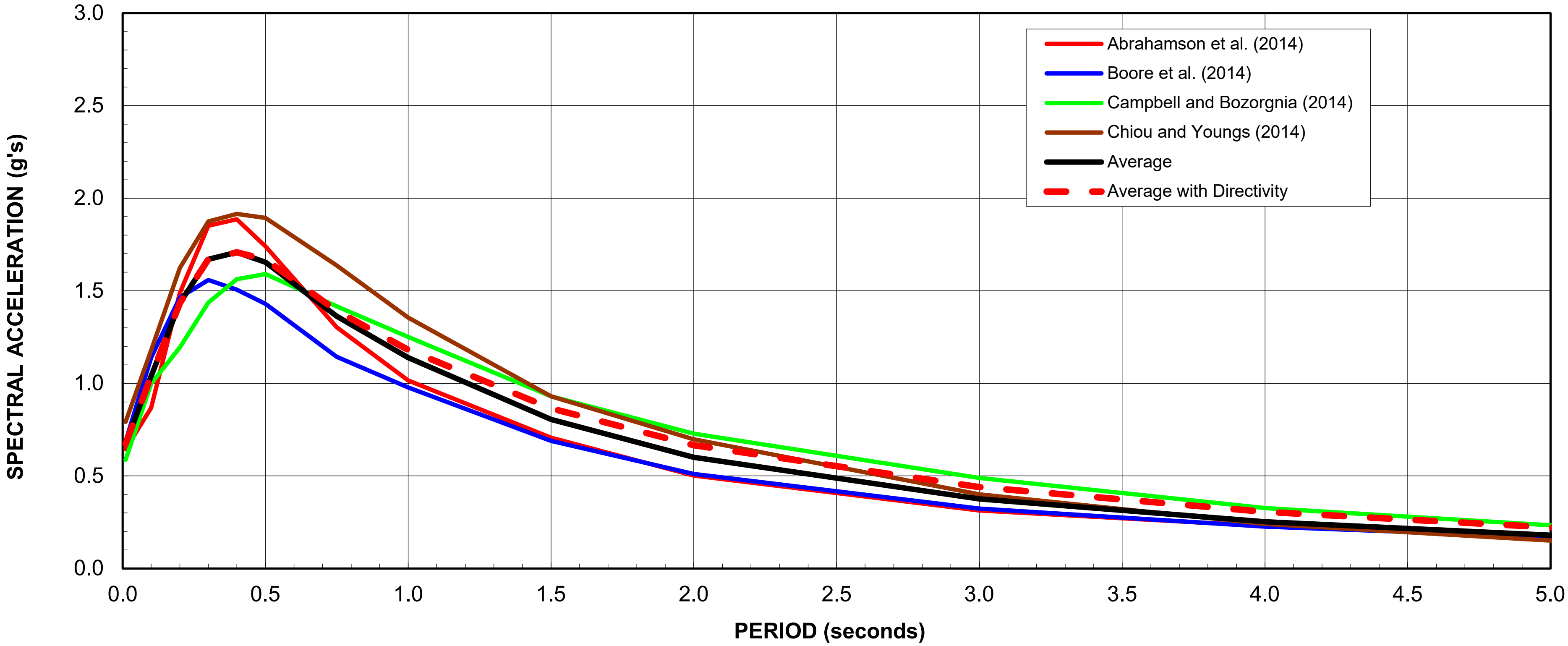

Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. Deterministic scenario is for a moment magnitude 7.3 on the Puente Hills (Coyote Hills) Fault approximately 8.0 km (Joyner-Boore distance) from the site.
3. Directivity adjustment factors based on a weighted average of Bayless et al. (2020) and Watson-Lamprey (2018).

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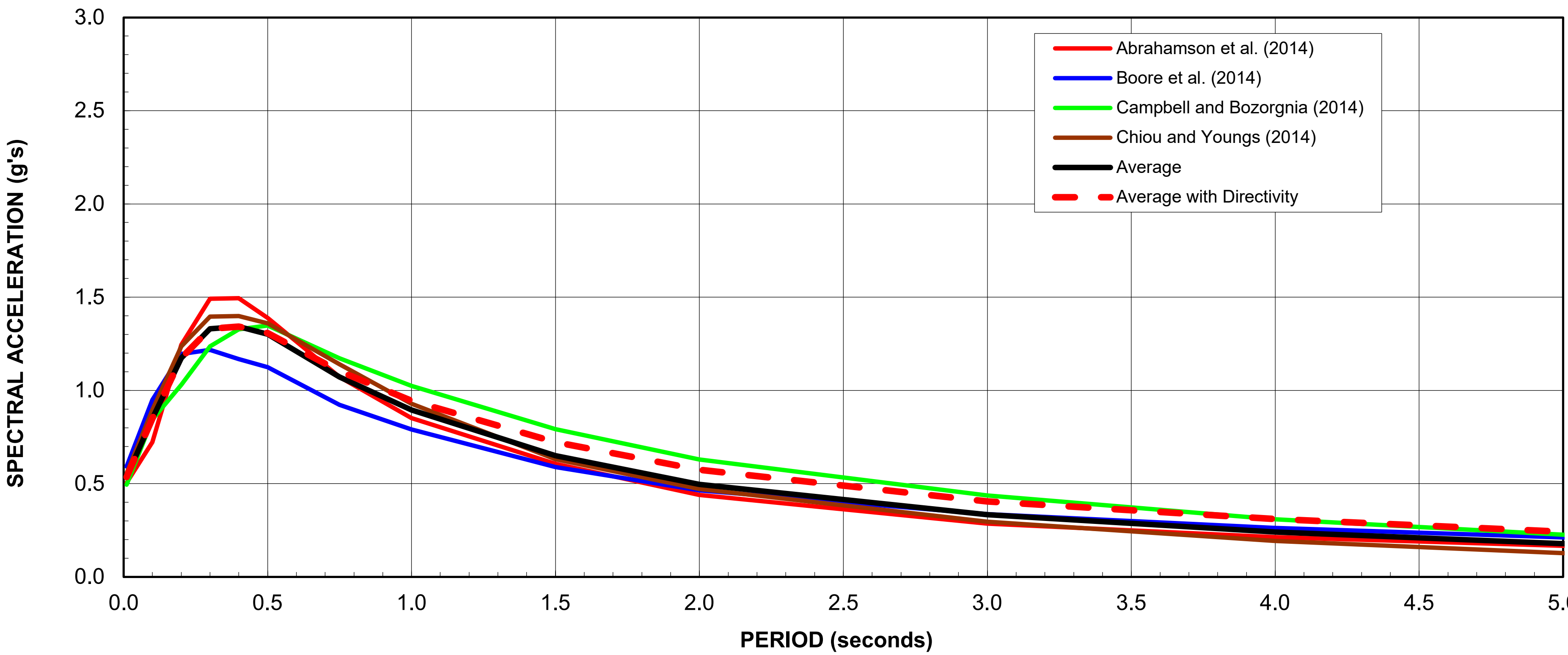

Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. Deterministic scenario is for a moment magnitude 7.6 on the Whittier Fault approximately 13.8 km (Joyner-Boore distance) from the site.
3. Directivity adjustment factors based on a weighted average of Bayless et al. (2020) and Watson-Lamprey (2018).

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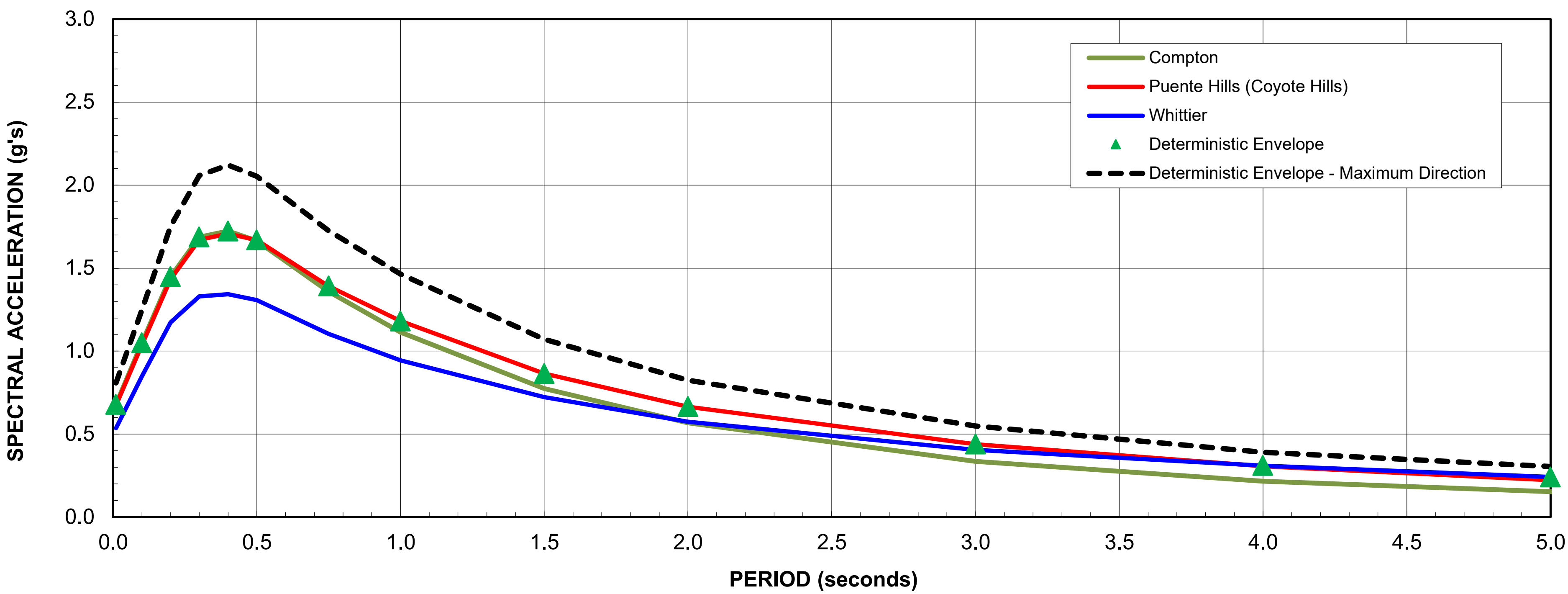

Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. Maximum direction factors from Shahi and Baker (2014).
3. Directivity adjustment factors based on a weighted average of Bayless et al. (2020) and Watson-Lamprey (2018).

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OCVIBE PARKING STRUCTURE A

ANAHEIM

ORANGE COUNTY CALIFORNIA

Figure Title

COMPARISON OF 84TH PERCENTILE DETERMINISTIC ANALYSIS WITH DIRECTIVITY

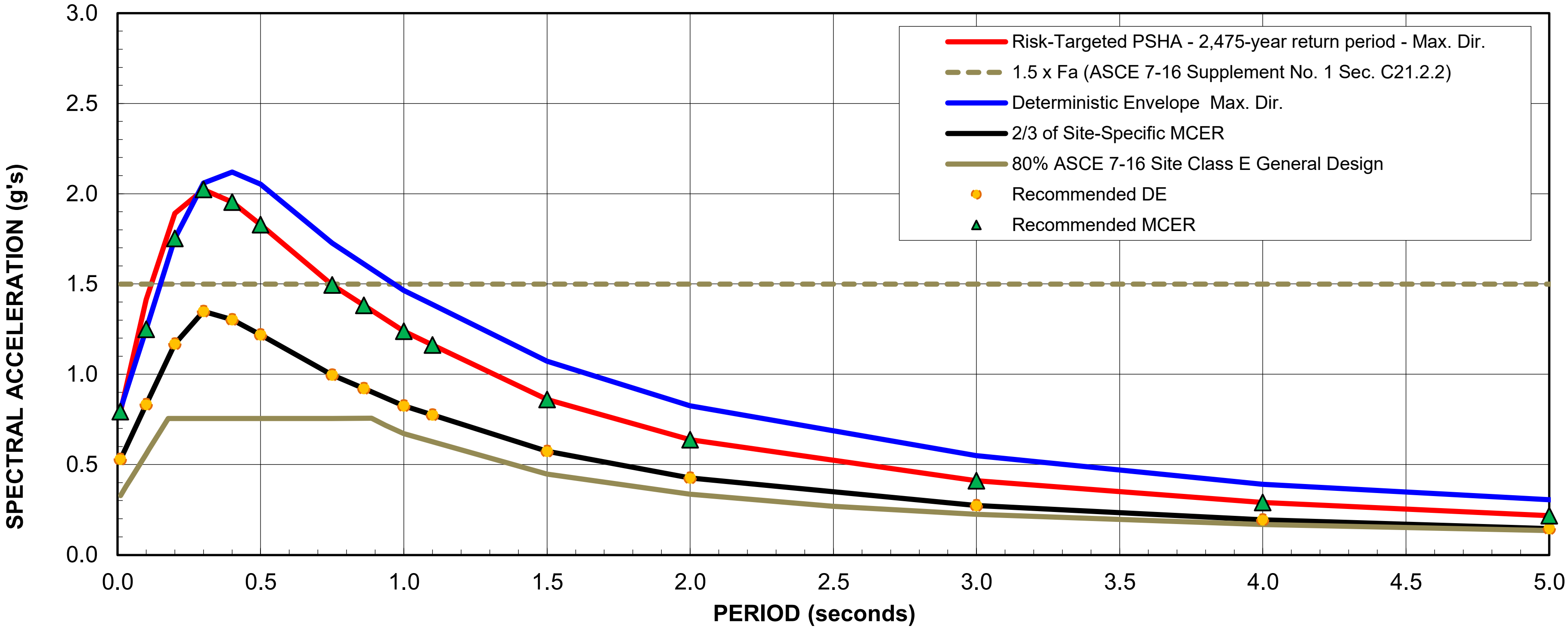
Project No. 700170401

Date JUNE 2025

Scale AS SHOWN

Prepared By: CR

Figure No. 16



Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. MCE_R = Risk-Targeted Maximum Considered Earthquake. DE = Design Earthquake.
3. Maximum spectral ordinate of 84th Percentile Deterministic spectra shown as greater than 1.5 x F_a, where F_a = 1.0 for Site Class D and S_S = 1.418 g.
4. Recommended MCE_R taken as 150% of Recommended DE.
5. 80% of the ASCE 7-16 General Design spectrum based on Site Class D, where F_a = 1.0 and F_v = 2.5.
6. Risk-Targeted PSHA - 2,475 Year Return Period spectra includes risk coefficients ranging from 0.89 to 0.98, determined in accordance with ASCE 7-16 Sec. 21.2.1.2

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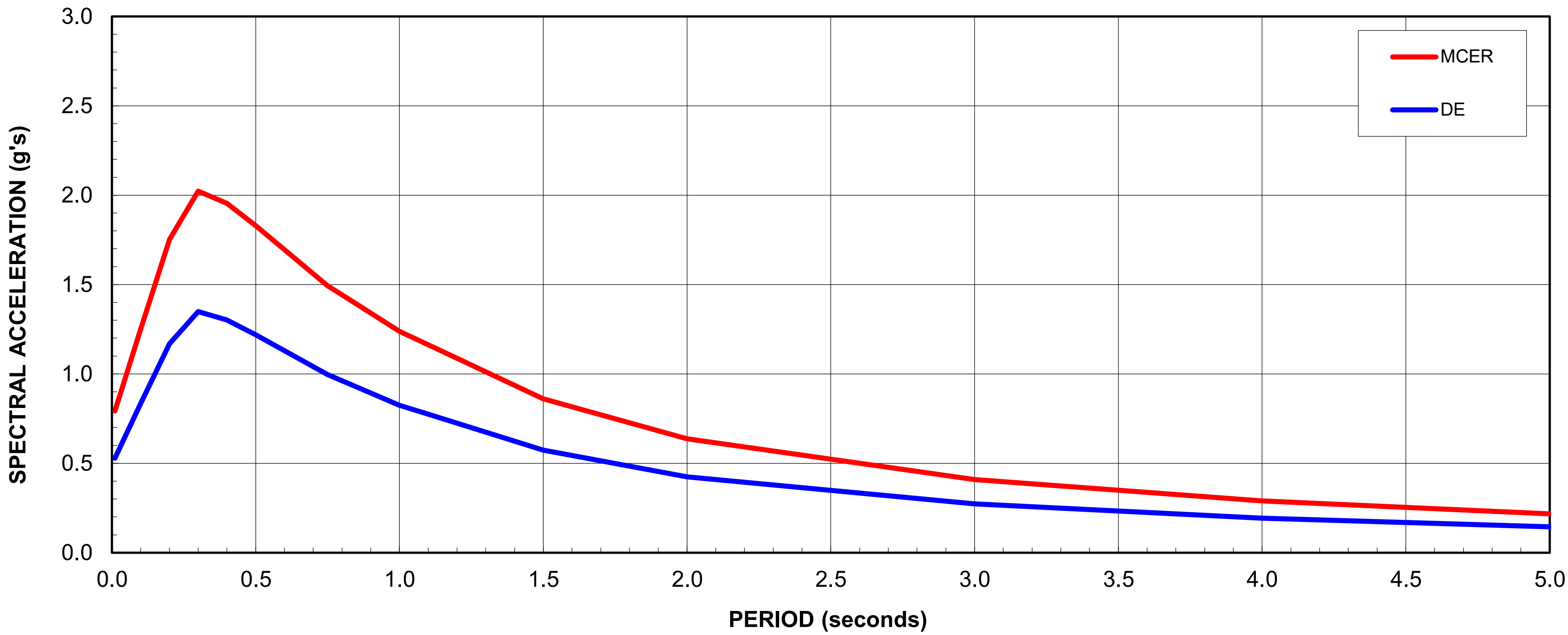
Project	Figure Title	Project No.	Figure No.
OCVIBE PARKING STRUCTURE A ANAHEIM ORANGE COUNTY CALIFORNIA	COMPARISON OF ASCE 7-16, PROBABILISTIC, AND DETERMINISTIC SPECTRA	700170401 Date: JUNE 2025 Scale: AS SHOWN Prepared By: CR	17



Notes:

1. Damping Ratio = 5 percent; Measured V_{S30} = 280 m/s.
2. MCE_R = Risk-Targeted Maximum Considered Earthquake. DE = Design Earthquake.

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APPENDIX A

Current Field Investigation and Geotechnical Laboratory Testing

APPENDIX A

SUBSURFACE EXPLORATIONS

We explored the subsurface conditions at the site by drilling four borings (B-1 through B-4), installed two field percolation test wells (FP-1 and FP-2) the approximate locations shown on the Figure 2.

The borings were drilled on April 19, 2025 and May 10, 2025, by 2R Drilling to depths between approximately 12 and 36½ feet below ground surface (bgs) using track-mounted hollow-stem auger drill rig equipment.

During drilling, our field representative maintained a log of the subsurface conditions encountered in each boring, collected relatively undisturbed, and performed standard penetration tests (SPT) at regular depth intervals. We also collected bulk samples from near surface soils in borings across the site.

Upon completion of drilling, the borings were backfilled with soil cuttings and/or bentonite cement grout mix.

SOIL SAMPLING

Samples were collected from the borings using modified California split-spoon samplers in general accordance with ASTM D3550 and we performed Standard Penetration Tests (SPTs) in general accordance with ASTM D1586.

The modified California samplers and SPTs were driven using a 140-pound hammer free falling 30 inches. The samplers were driven a total distance of 18 inches or to refusal. The number of blow counts required to drive the sampler for each 6-inch segment was recorded (or less if refusal is met) on the exploration logs. Sampling methods and intervals are shown on the exploration logs.

The samples collected from the borings were transported to our office for further review and for assignment of geotechnical laboratory testing.

SOIL CLASSIFICATION

The soil samples were described in accordance with the classification legend that is included in this appendix prior to the exploration logs. The exploration logs indicate the depths at which the soils or their characteristics change, although the change may be gradual. If the change occurred between sample locations, the depth was interpreted. Changes between geologic units or soil types on the boring logs are represented with a solid line if observed directly in the samples, and with a dashed line if inferred between sample depths. Classifications are shown on the exploration logs.

LABORATORY TESTING

Moisture Content and In-place Dry Density

The natural moisture content of select soil samples were performed in general accordance with ASTM D2216. The natural moisture content is a ratio of the weight of the water to soil in a test sample and is expressed as a percentage.

Select soil samples were tested to determine the in situ dry density. The tests were performed in general accordance with ASTM D2937. The dry density is defined as the ratio of the dry weight of the soil sample to the volume of that sample. The dry density typically is expressed in units of pounds per cubic foot (pcf).

The test results are presented in this appendix.

Maximum Dry Density-Optimum Moisture Content

Selected bulk samples were tested to evaluate the maximum dry density and its optimum moisture content. The test was performed in general accordance with ASTM test method D1557. The results are attached below.

Percent Passing No. 200 Sieve

Select soil samples were tested to determine the percentage of fine-grained material, defined as the amount of material finer than 75-μm (No. 200) sieve in the soil. The tests were performed in general accordance with ASTM D6913.

The test results are presented in this appendix.

Atterberg Limits

Atterberg Limits tests were completed on select samples obtained from the explorations. The tests were performed in general accordance with ASTM D4318. The test measures the liquid limit and plastic limit of the sample.

The test results are presented in this appendix.

Consolidation Testing

One-dimensional consolidation testing was performed in general accordance with ASTM D2435 on relatively undisturbed soil samples. The test measures the volume change of a soil sample under predetermined loads.

The test results are presented in this appendix.

Strength Testing

Direct shear tests were completed on select samples obtained from the explorations. The tests were performed in general accordance with ASTM D3080. The test determines the effects upon shear resistance and displacement, and strength properties such as Mohr strength envelopes.

The test results are presented in this appendix.

Corrosion Testing

Corrosion testing was performed on one selected sample. The testing was completed in general accordance with California Test Methods 634, 417, and 422 for pH value, sulfate content, and chloride content, respectively.

The test results are presented in this appendix.

R-Value Testing

R-Value tests were completed on select bulk samples obtained from the explorations. The tests were conducted in general accordance with ASTM D 2844. The test is used to measure the potential strength of subgrade, subbase, and base course materials for use in road and airfield pavements. The test results are presented in this appendix.

Expansion Index

Expansion index tests were performed on selected bulk samples of the on-site soils in accordance with the latest version of Test Method ASTM D4829. The test results are presented in this appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soil (more than half of soil is larger than the no. 200 sieve size)	**Gravels** (more than half of coarse fraction is retained/> no. 4 sieve size)	**GW**	Well-graded GRAVELS with less than 5% fines or gravel-sand mixtures
		GP	Poorly-graded GRAVELS with less than 5% fines or gravel-sand mixtures
		GM	Silty gravels, gravel-sand-silt mixtures;GRAVELS with greater than 12% ML or MH fines
		GC	Clayey gravels, gravel-sand-clay mixtures; GRAVELS with greater than 12% CL or CH
	Sands (more than half of coarse fraction passes/< no. 4 sieve size)	**SW**	Well-graded sands with less than 5% fines or gravelly sands, little or no fines
		SP	Poorly-graded sands with less than 5% fines or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures; SANDS with greater than 12% ML or MH fines
		SC	Clayey sands, sand-clay mixtures; SANDS with greater than 12% CL or CH fines
Fine-Grained Soils (more than half of soil is smaller than the no. 200 sieve size)	**Silts and Clays** LL = < 50	**ML**	Inorganic silts and clayey silts of low plasticity, sandy non-plastic SILT, gravelly SILT
		CL	Inorganic clays of low to medium plasticity, silty CLAY, trace fines, sand
		OL	Organic silts and organic silt-clays of non-plastic to medium plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic medium plastic silts, medium plastic to very plastic clayey silts.
		CH	Inorganic plastic to very plastic CLAYS, sandy plastic CLAY
		OH	Organic medium plastic to plastic silty CLAYS, and very plastic CLAYS
Highly Organic Soils		**PT**	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	**Grain Size in Millimeters**
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel coarse fine	3" to No. 4 3" to ¾" ¾" to No.4	76.2 to 4.75 76.2 to 19.1 19.1 to 4.75
Sand coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.240 to 0.075
Silt and Clay	Below No. 200	Below 0.075

SOIL DESCRIPTIONS/SYMBOLS

- Well-graded GRAVEL (GW)
- Poorly-graded GRAVEL (GP)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- Well-graded SAND (SW)
- Poorly-graded SAND (SP)
- Silty SAND (SM)
- Clayey SAND (SC)
- AGGREGATE BASE
- Low-Plasticity SILT (ML)
- High-Plasticity SILT (MH)
- Low-Plasticity CLAY (CL)
- High-Plasticity CLAY (CH)
- SANDSTONE
- CLAYSTONE
- SILTSTONE
- FILL
- ASPHALT

GROUNDWATER READING

- Groundwater encountered during drilling
- Groundwater at completion
- Groundwater at 24 hours

SAMPLER TYPE

CR - Modified California (CR) split-barrel ring sampler with 3.0-inch outside diameter and a 2.5-inch inside diameter.

SPT - Standard Penetration Test (SPT) split-barrel sampler with a 2.00-inch outside diameter with a 1.5-inch inside diameter

ST - Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

BAG - Bulk Sample

C - Core Barrel

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Figure Title

BORING LOG LEGEND

Figure No.

APPENDIX A

Filename: \\Langan.com\data\IRV\other\CAD Library Irvine\Titleblocks (LANGAN)\GEOTECH TITLEBLOCK\Classification Legend\Classification Legend.dwg Date: 6/18/2021 Time: 11:52 User: mgalvan Style Table: Langan.stb Layout: Legend

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Log of Boring **B-1** Sheet 1 of 2

Project: OC Vibe Parking Structure A		Project No.: 700170401	
Location: 1725 South Douglass Road		Elevation and Datum: Approx. 159	
Drilling Company: 2R Drilling		Date Started: 04/19/2025	Date Finished: 04/19/2025
Drilling Equipment: CME 75 Truck Mounted		Completion Depth: 36.5 ft	Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow-Stem Auger		Number of Samples: Disturbed 4; Undisturbed 3; Core	
Casing Diameter (in):	Casing Depth (ft):	Water Level (ft.): First; Completion -; 24 HR.	
Casing Hammer:	Weight (lbs): ; Drop (in):	Drilling Foreman: Ish	
Sampler: Bulk; 2-inch SPT Split Barrel; 2.5-inch Cal Mod		Field Engineer: B. Dilloughery	
Sampler Hammer: Auto	Weight (lbs): 140; Drop (in): 30		

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+159.0	AC = 5 inches thick; No Base.	0						
+158.6	**Artificial Fill (af)** Silty Sand (SM), brown to dark brown, slightly moist, fine sand.	0–3		BAG	60			Maximum Dry Density and Optimum Moisture Content Corrosivitiy Expansion Index = 0% Remolded Direct Shear Remolded Consolidation
+156.0	**Alluvium (Qal)** Silty Sand (SM), light brown to brown, medium dense, slightly moist, some clay.	3–11						
		5–6.5		SPT	18	1 / 3 / 8		
		10–11.5		CR	18	2 / 3 / 5		Consolidation DD = 85.1 pcf MC = 36.2%
+148.0	Sandy Clay (CL), dark brown, medium stiff, moist, fine sand, numerous red sand veins.	11						
+147.5	Silty Sand (SM), light brown to brown, loose, slightly moist, some clay.	11.5–16						
		15–16.5		SPT	18	2 / 2 / 3		
+143.0	Sandy Silt (ML), brown, medium stiff, slightly moist, fine sand.	16						
+142.5	Silty Sand (SM), light brown to brown, loose, slightly moist, some clay.	16.5–20						

\\LANGAN.COM\DATA\IRV\DATA4\700170401\PROJECT DATA_DISCIPLINE\GEOTECHNICAL\GINTLOGS\700170401 - OC VIBE PARKING STRUCTURE A LOGS - 04.24.25 - BD.GPJ ... 6/9/2025 2:39:36 PM ... Report: Log - LANGAN

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Log of Boring B-1 Sheet 2 of 2

Project	Project No.
OC Vibe Parking Structure A	700170401
Location	**Elevation and Datum**
1725 South Douglass Road	Approx. 159

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+139.0	Becomes dark brown, medium dense.	20		CR	18	7 8 10		DD =110 pcf MC =6.1%
		25		SPT	18	4 7 11		
+133.0	Poorly Graded Sand to Silty Sand (SP-SM), light brown, medium dense, slightly moist, fine sand, trace silt.	26						
+129.0	Silty Sand (SM), brown and light gray, medium dense, slightly moist, very fine sand.	30		CR	18	6 5 10		Direct Shear DD = 87.3 pcf MC = 35.3%
+128.0	Silt with Sand (ML), brown, stiff, wet, very fine sand, interbedded with thin silty sand lenses	31						
+126.0	Silty Sand (SM), brown and light gray, medium dense, slightly moist, very fine sand.	33						
	Becomes loose.	35		SPT	18	2 3 5		
+122.5	Total Depth = 36.5 Feet Groundwater Not Encountered Caving Not Encountered Boring Backfilled with Cuttings, Tamped, and AC Patched	36.5						

Project: OC Vibe Parking Structure A		Project No.: 700170401	
Location: 1725 South Douglass Road		Elevation and Datum: Approx. 160	
Drilling Company: 2R Drilling		Date Started: 04/19/2025	Date Finished: 04/19/2025
Drilling Equipment: CME 75 Truck Mounted		Completion Depth: 36.5 ft	Rock Depth
Size and Type of Bit: 8-inch O.D. Hollow-Stem Auger		Number of Samples: Disturbed 4; Undisturbed 5; Core	
Casing Diameter (in)	Casing Depth (ft)	Water Level (ft.): First ▽; Completion ▼ -; 24 HR. ▼	
Casing Hammer	Weight (lbs); Drop (in)	Drilling Foreman: Ish	
Sampler: Bulk; 2-inch SPT Split Barrel; 2.5-inch Cal Mod		Field Engineer: B. Dilloughery	
Sampler Hammer: Auto	Weight (lbs): 140; Drop (in): 30		

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+160.0	AC = 5 inches thick; No Base.	0						
+159.6	**Artificial Fill (af)** Silty Sand (SM), brown, slightly moist, fine sand.	0.4–3		BAG	60			Maximum Dry Density and Optimum Moisture Content; Remolded Direct Shear; Remolded Consolidation; R-Value
+157.0	**Alluvium (Qal)** Poorly Graded Sand (SP), light brown, slightly moist, fine to medium grained sand.	3						
	Becomes medium dense.	5		CR	18	6 7 10		DD = 101.2 pcf; MC = 5%
+152.5	Sand (SP), brown, loose, slightly moist, fine sand.	7.5		SPT	18	2 3 3		%Pass#200= 7%
+150.0	Poorly Graded Sand (SP), light brown to light gray, loose, slightly moist, trace subangular gravel.	10		CR	18	3 4 8		%Pass#200= 9%; Direct Shear; DD = 101.4 pcf; MC = 3.3%
+147.5	Silty Sand (SM), brown and light gray, loose, slightly moist, fine to medium sand, trace fine subangular gravel.	12.5		SPT	18	3 4 4		%Pass#200= 33%
	Becomes brown with trace light gray.	15		CR	18	4 5 6		DD = 106.5 pcf; MC = 9.2%
+140.0		20						

Project	Project No.
OC Vibe Parking Structure A	700170401
Location	**Elevation and Datum**
1725 South Douglass Road	Approx. 160

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+140.0	Silty Sand (SM), brown, loose, slightly moist, very fine sand.	20		SPT	18	3 / 4 / 4		%Pass#200= 28%
+135.0	Sandy Silt (ML), brown, stiff, dry to slightly moist, very fine sand.	25		CR	18	4 / 7 / 12		Atterberg Limits: LL= 25 , PL= 22 , PI= 3 %Pass#200= 52% Consolidation DD = 108.9 pcf MC = 14.8%
	Becomes slightly more cohesive, silt content increases, trace clay.	30		SPT	18	3 / 5 / 6		
	Becomes more cohesive.	35		CR	18	3 / 5 / 8		Direct Shear DD = 97.0 pcf MC = 20.1%
+123.5	Total Depth = 36.5 Feet Groundwater Not Encountered Caving Not Encountered Boring Backfilled with Cuttings, Tamped, and AC Patched	36.5						

Project: OC Vibe Parking Structure A		Project No.: 700170401	
Location: 1725 South Douglass Road		Elevation and Datum: Approx. 160	
Drilling Company: 2R Drilling		Date Started: 04/19/2025	Date Finished: 04/19/2025
Drilling Equipment: CME 75 Truck Mounted		Completion Depth: 36.5 ft	Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow-Stem Auger		Number of Samples: Disturbed 5; Undisturbed 4; Core	
Casing Diameter (in):	Casing Depth (ft):	Water Level (ft.): First ▽; Completion ▼ -; 24 HR. ▼	
Casing Hammer:	Weight (lbs): ; Drop (in):	Drilling Foreman: Ish	
Sampler: 2-inch SPT Split Barrel; 2.5-inch Cal Mod		Field Engineer: B. Dilloughery	
Sampler Hammer: Auto	Weight (lbs): 140; Drop (in): 30		

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+160.0	AC = 5 inches thick; No Base.	0						
+159.6	**Artificial Fill (af)** Silty Sand (SM), brown, slightly moist, fine sand.							
+158.5	**Alluvium (Qal)** Poorly Graded Sand (SP), light gray, dry to slightly moist, fine to medium sand.							
+155.0	Silty Sand (SM), light brown and light gray, medium dense, slightly moist, fine to medium sand.	5		SPT	18	2 / 4 / 7		
+152.5	Poorly Graded Sand (SP), light gray, loose, dry to slightly moist, fine to medium sand, trace fine subrounded gravel.	7.5		CR	18	6 / 7 / 7		DD = 106.6 pcf MC = 2.6%
		10		SPT	18	1 / 3 / 4		%Pass#200= 10%
+147.5	Sandy Clay (CL), brown, medium stiff, very moist, very fine to fine sand.	12.5		CR	18	3 / 5 / 5		DD = 87.8 pcf MC = 18.7%
+146.5	Silty Sand (SM), light brown and light gray, loose, very moist, fine to medium sand.							
		15		SPT	18	2 / 3 / 5		
	Becomes slightly moist to moist, brown, silt content increases, cohesion increases.	16						
		20						

Project	Project No.
OC Vibe Parking Structure A	700170401
Location	**Elevation and Datum**
1725 South Douglass Road	Approx. 160

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
140.0	Becomes light gray and brown, medium dense, slightly moist, silt content decreases.	20		CR	18	9 / 10 / 20		DD = 103.7 pcf MC = 3.2%
134.5	Sandy Clay (CL), dark brown, medium stiff, very moist, very fine sand.	25		SPT	18	2 / 4 / 3		
134.0	Silty Sand (SM), light gray, slightly moist, very fine sand.	26						
	Becomes medium dense.	30		CR	18	8 / 17 / 26		DD = 105.9 pcf MC = 2.8%
125.5	Poorly Graded Sand (SP), light gray, medium dense, slightly moist, fine sand,	35		SPT	18	7 / 10 / 13		%Pass#200= 8%
123.5	Total Depth = 36.5 Feet Groundwater Not Encountered Caving Not Encountered Boring Backfilled with Cuttings, Tamped, and AC Patched	36.5						

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Project: OC Vibe Parking Structure A		Project No.: 700170401		
Location: 1725 South Douglass Road		Elevation and Datum: Approx. 158		
Drilling Company: 2R Drilling		Date Started: 04/19/2025	Date Finished: 04/19/2025	
Drilling Equipment: CME 75 Truck Mounted		Completion Depth: 36.5 ft	Rock Depth:	
Size and Type of Bit: 8-inch O.D. Hollow-Stem Auger		Number of Samples	Disturbed: 4	Undisturbed: 5 / Core:
Casing Diameter (in):	Casing Depth (ft):	Water Level (ft.)	First: ▽	Completion: ▼ - / 24 HR.: ▼
Casing Hammer: Weight (lbs): Drop (in):		Drilling Foreman: Ish		
Sampler: 2-inch SPT Split Barrel; 2.5-inch Cal Mod		Field Engineer: B. Dilloughery		
Sampler Hammer: Auto, Weight (lbs): 140, Drop (in): 30				

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+158.0								
+157.7	AC = 4 inches thick; No Base.	0						
	Artificial Fill (af) Silty Sand (SM), brown, slightly moist, fine sand.	1						
+155.5	**Alluvium (Qal)** Poorly Graded Sand (SP), light gray, dry to slightly moist, fine sand.	2–3						
	Becomes fine grained sand, loose, trace silt.	5		CR	18	4 5 6		DD = 98.2 pcf MC = 3.9%
	Becomes slightly moist to moist, loose.	7.5		SPT	18	2 4 4		
	Becomes medium dense.	10		CR	18	5 12 17		DD = 108.3 pcf MC = 6.1%
+145.5	Silty Sand (SM), brown and light gray, medium dense, moist to very moist, fine to medium sand.	12.5		SPT	18	4 4 7		
+142.5	Sandy Clay (CL), dark brown, medium stiff, very moist, fine sand, trace clay.	15		CR	18	3 4 8		DD = 95 pcf MC =16.4%
+141.5	Silty Sand (SM), brown and light gray, moist to very moist, fine to medium sand.	16.5						Atterberg Limits: LL= 23 , PL= 22 , PI= 5 %Pass#200= 34%
+138.0		20						

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Log of Boring **B-4** Sheet 2 of 2

Project	Project No.
OC Vibe Parking Structure A	700170401
Location	**Elevation and Datum**
1725 South Douglass Road	Approx. 158

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+138.0	Sandy Silt (ML), dark brown, loose, very moist, very fine sand.	20		SPT	18	2, 2, 3		
+133.0	Silty Sand (SM), dark brown, medium dense, slightly moist to moist, very fine to fine sand.	25		CR	18	7, 11, 16		DD = 109.8 pcf MC = 7.1%
+128.0	Sandy Silt (ML), dark brown, medium stiff, moist, very fine sand.	30		SPT	18	3, 4, 4		
	Becomes very moist to wet, medium stiff, sand content decreases, some clay.	35		CR	18	2, 5, 5		DD = 97.3 pcf MC = 26.2% Atterberg Limits: LL= 28 , PL= 23 , PI= 5 %Pass#200= 72%
+121.5	Total Depth = 36.5 Feet Groundwater Not Encountered Caving Not Encountered Boring Backfilled with Cuttings, Tamped, and AC Patched	36.5						

Depth scale: 20 – 45

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Log of Boring **FP-1** Sheet 1 of 1

Project: OC Vibe Parking Structure A		Project No.: 700170401	
Location: 1725 South Douglass Road		Elevation and Datum: Approx. 160	
Drilling Company: 2R Drilling		Date Started: 05/10/2025	Date Finished: 05/10/2025
Drilling Equipment: CME 75 Truck Mounted		Completion Depth: 12 ft	Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow-Stem Auger		Number of Samples: Disturbed 1; Undisturbed 0; Core	
Casing Diameter (in):	Casing Depth (ft):	Water Level (ft.): First; Completion; 24 HR.	
Casing Hammer: Weight (lbs): Drop (in):		Drilling Foreman: Miguel	
Sampler: 2-inch SPT Split Barrel		Field Engineer: S. Boustany/S. Wilkins	
Sampler Hammer: Auto; Weight (lbs): 140; Drop (in): 30			

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+160.0		0						
+159.6	AC = 5-inches thick, No Base. Hand Augered to 5 feet.							
	Artificial Fill (af) SAND with Silt (SP-SM), graysih brown, moist, fine to medium grained sand.	1–2						
+157.0	**Young Alluvium (Qal)** SAND (SP), gray, moist, fine to medium grained sand, tracel gravel.	3–4						
	Grayish brown, coarse sand.	5–10						
		11	S-1	SPT	18	2 / 2 / 4		
+148.0	Total Depth = 12 feet Groundwater not encountered. Boring converted to percolation well. Borehole backfilled with cuttings and AC surface patched after infiltration test completed.	12						
		13–20						

\\LANGAN.COM\DATA\IRV\DATA4\700170401\PROJECT DATA_DISCIPLINE\GEOTECHNICAL\GINTLOGS\700170401 - OC VIBE PARKING STRUCTURE A LOGS - 04.24.25 - BD.GPJ ... 6/9/2025 2:39:46 PM ... Report: Log - LANGAN

Project: OC Vibe Parking Structure A	Project No.: 700170401
Location: 1725 South Douglass Road	Elevation and Datum: Approx. 160
Drilling Company: 2R Drilling	Date Started: 05/10/2025 / Date Finished: 05/10/2025
Drilling Equipment: CME 75 Truck Mounted	Completion Depth: 16 ft / Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow-Stem Auger	Number of Samples: Disturbed 1 / Undisturbed 0 / Core
Casing Diameter (in): / Casing Depth (ft):	Water Level (ft.): First / Completion / 24 HR.
Casing Hammer: / Weight (lbs): / Drop (in):	Drilling Foreman: Miguel
Sampler: 2-inch SPT Split Barrel	Field Engineer: S. Boustany/S. Wilkins
Sampler Hammer: Auto / Weight (lbs): 140 / Drop (in): 30	

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+160.0		0						
+159.6	AC = 5-inches thick, No Base. Hand Augered to 5 feet.							
	Artificial Fill (af) SAND with Silt (SP-SM), graysih brown, slightly moist, fine to medium grained sand.	1–2						
+157.5	**Young Alluvium (Qal)** SAND (SP), off-white, slightly moist, fine to medium grained sand, tracel fine gravel.	3						
	Light brown, few coarse sand and fine gravel.	5						
+148.0	Silty SAND (SM), light grayish brown, moist, fine to medium sand.	12						
		15	S-1	SPT	18	3 / 3 / 4		
+144.0	Total Depth = 16 feet. Groundwater not encountered. Boring converted to percolation well. Borehole backfilled with cuttings and AC surface patched after infiltration test completed.	16						

MOISTURE DENSITY TESTS

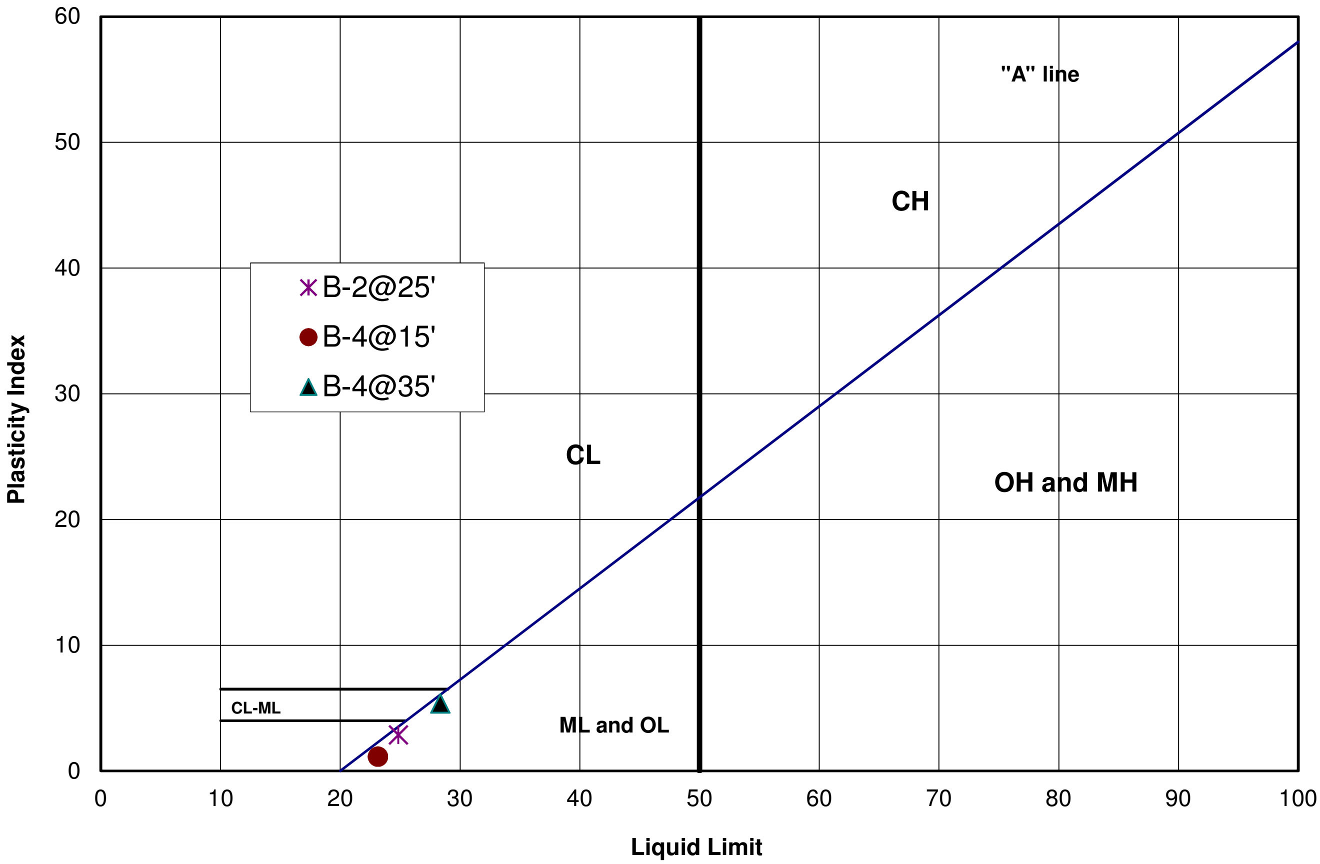
PROJECT Langan # 700170401 **JOB NO.** 2012-0057 **BY** LD **DATE** 05/08/25

Sample No.	B-1	B-2	B-2	B-3	B-3	B-3	B-3	B-4
Depth (ft)	20.0	5.0	15.0	7.5	12.5	20.0	30.0	5.0
Testing								
Soil Type	Brown, Silty Sand	Brown, Silty Sand	Brown, Silty Sand	Brown, Silty Sand	Brown, Sandy Clay	Brown, Silty Sand	Brown, Silty Sand	Brown, Silty Sand
Wet+Tare	898.3	835.9	1075.2	1025.3	659.1	1008.3	1021.1	810.7
Tare	5	5	6	6	4	6	6	5
Wet Weight	131.1	94.2	109.9	114.3	171.8	126.4	126.8	111.8
Dry Weight	123.6	89.7	100.6	111.4	144.7	122.5	123.4	107.6
Wet density	116.7	106.3	116.3	109.4	104.2	107.0	108.8	102.0
% Water	6.1	5.0	9.2	2.6	18.7	3.2	2.8	3.9
Dry Density	110.0	101.2	106.5	106.6	87.8	103.7	105.9	98.2
O.B.Press(psf)								

Sample No.	B-4	B-4	B-4	B-4				
Depth (ft)	10.0	15.0	25.0	35.0				
Testing								
Soil Type	Brown, Silty Sand	Brown, Clayey Sand	Brown, Silty Sand	Brown, Clayey Silt				
Wet+Tare	1065.3	1061.3	1084.5	935.3				
No. Ring	6	6	6	5				
Wet Weight	132.2	274.2	128.9	281.9				
Dry Weight	124.6	235.6	120.3	223.3				
Wet density	114.9	110.6	117.6	122.9				
% Water	6.1	16.4	7.1	26.2				
Dry Density	108.3	95.0	109.8	97.3				
O.B.Press(psf)								

Geo-Logic ASSOCIATES

PLASTICITY INDEX _ ASTM D4318



Sample		LL	PL	PI	USCS	Material Description
B-2@25'		25	22	3	ML	
B-4@15'		23	22	1	ML	
B-4@35'		28	23	5	ML	

Job Name: Langan # 700170301 Date: 1/23/25

Job No.: 2015-0057

Geo-Logic ASSOCIATES

WASH #200 SIEVE - ASTM D 1140-92

Job Name Langan # 700170401 Date 05/08/25

Job No. 2012-0057 By LD

Sample	B-2 @ 7.5'	**Sample**	B-2 @ 10'	**Sample**	B-2 @ 12.5'
Soil Type		Soil Type		Soil Type	
% water	5.9	% water	3.0	% water	3.6
Wet weight	229.8	Wet weight	262.5	Wet weight	275.4
Dry weight	217.0	Dry weight	254.9	Dry weight	265.8
+ 200 sieve	201	+ 200 sieve	232.8	+ 200 sieve	179.3
% Retained	92.6	% Retained	91.3	% Retained	67.4
%Pass. #200	**7**	**%Pass. #200**	**9**	**%Pass. #200**	**33**

Sample	B-2 @ 20'	**Sample**	B-2 @ 25'	**Sample**	B-3 @ 10'
Soil Type		Soil Type		Soil Type	
% water	9.6	% water	14.8	% water	6.9
Wet weight	236.1	Wet weight	150	Wet weight	271.8
Dry weight	215.4	Dry weight	130.7	Dry weight	254.3
+ 200 sieve	155.3	+ 200 sieve	62.4	+ 200 sieve	228.3
% Retained	72.1	% Retained	47.8	% Retained	89.8
%Pass. #200	**28**	**%Pass. #200**	**52**	**%Pass. #200**	**10**

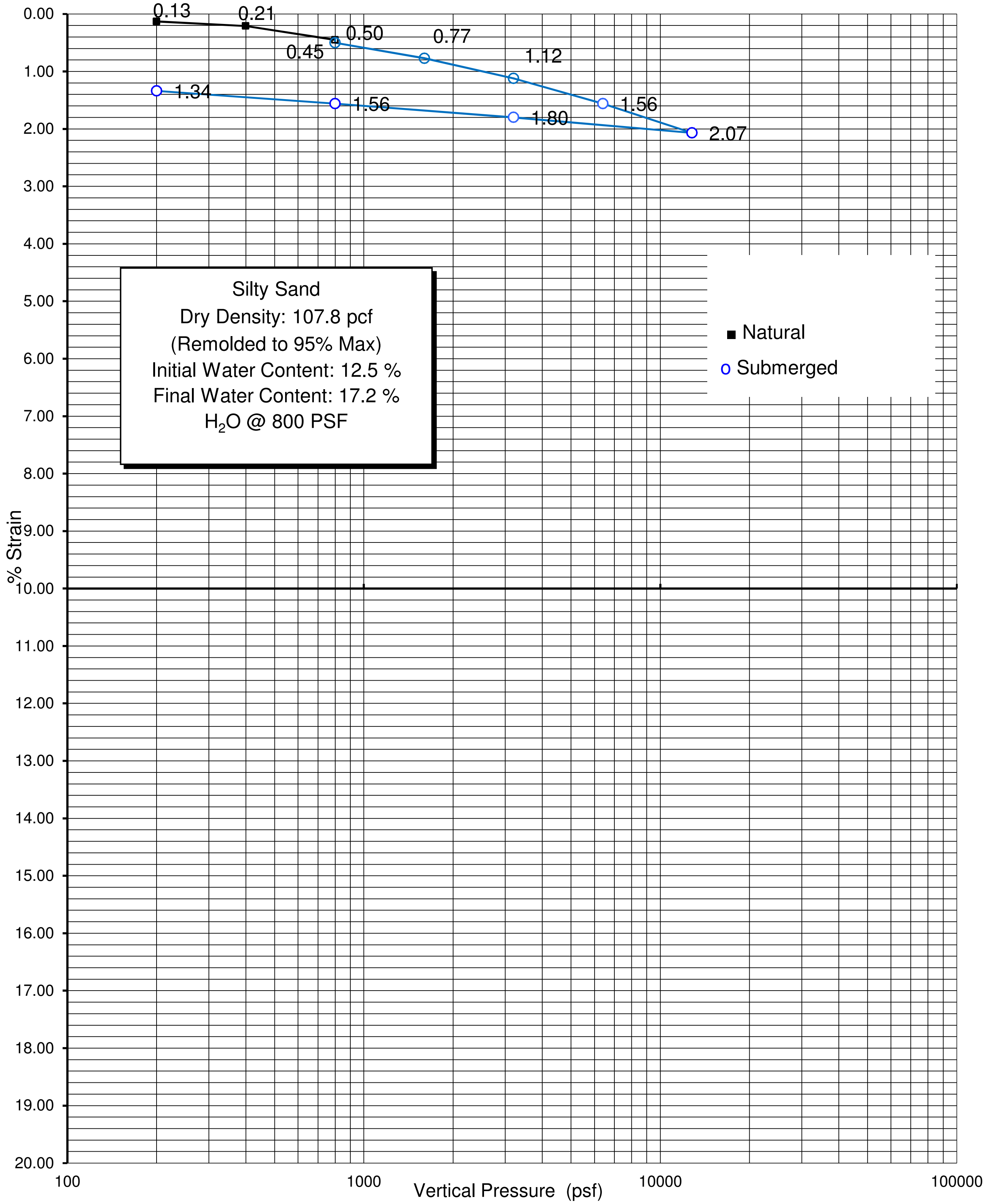
Sample	B-3 @ 35'	**Sample**	B-4 @ 15'	**Sample**	B-4 @ 35'
Soil Type		Soil Type		Soil Type	
% water	3.8	% water	16.4	% water	26.2
Wet weight	274.9	Wet weight	239.7	Wet weight	274.6
Dry weight	264.8	Dry weight	205.9	Dry weight	217.6
+ 200 sieve	243.5	+ 200 sieve	134.9	+ 200 sieve	60.9
% Retained	91.9	% Retained	65.5	% Retained	28.0
%Pass. #200	**8**	**%Pass. #200**	**34**	**%Pass. #200**	**72**

Sample		**Sample**		**Sample**	
Soil Type		Soil Type		Soil Type	
% water		% water		% water	
Wet weight		Wet weight		Wet weight	
Dry weight		Dry weight		Dry weight	
+ 200 sieve		+ 200 sieve		+ 200 sieve	
% Retained		% Retained		% Retained	
%Pass. #200		**%Pass. #200**		**%Pass. #200**	

Geo-Logic ASSOCIATES

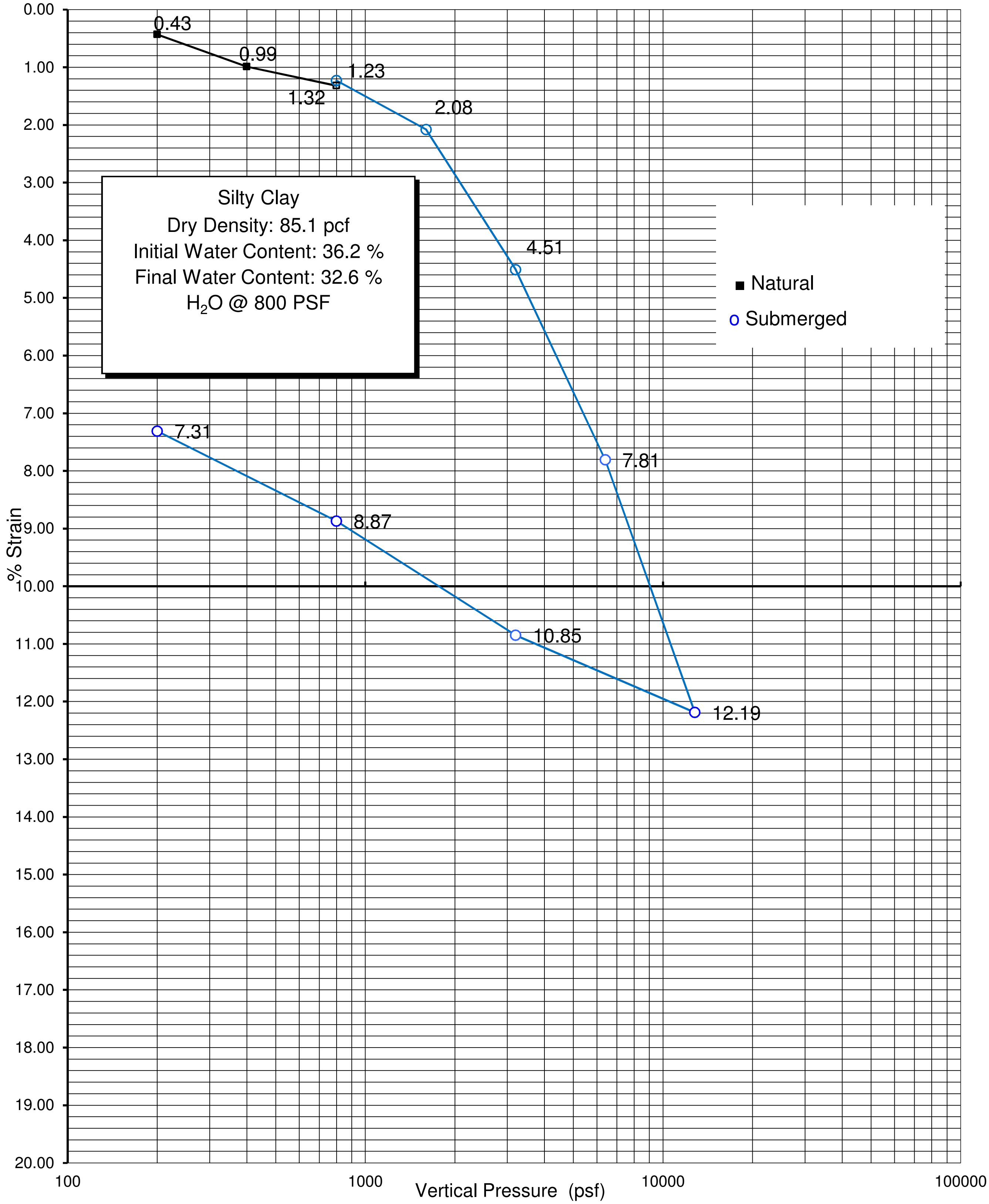
CONSOLIDATION TEST - ASTM D2435

Boring / Sample No. B-1	Depth: 0 - 5'	Date 05-05-25



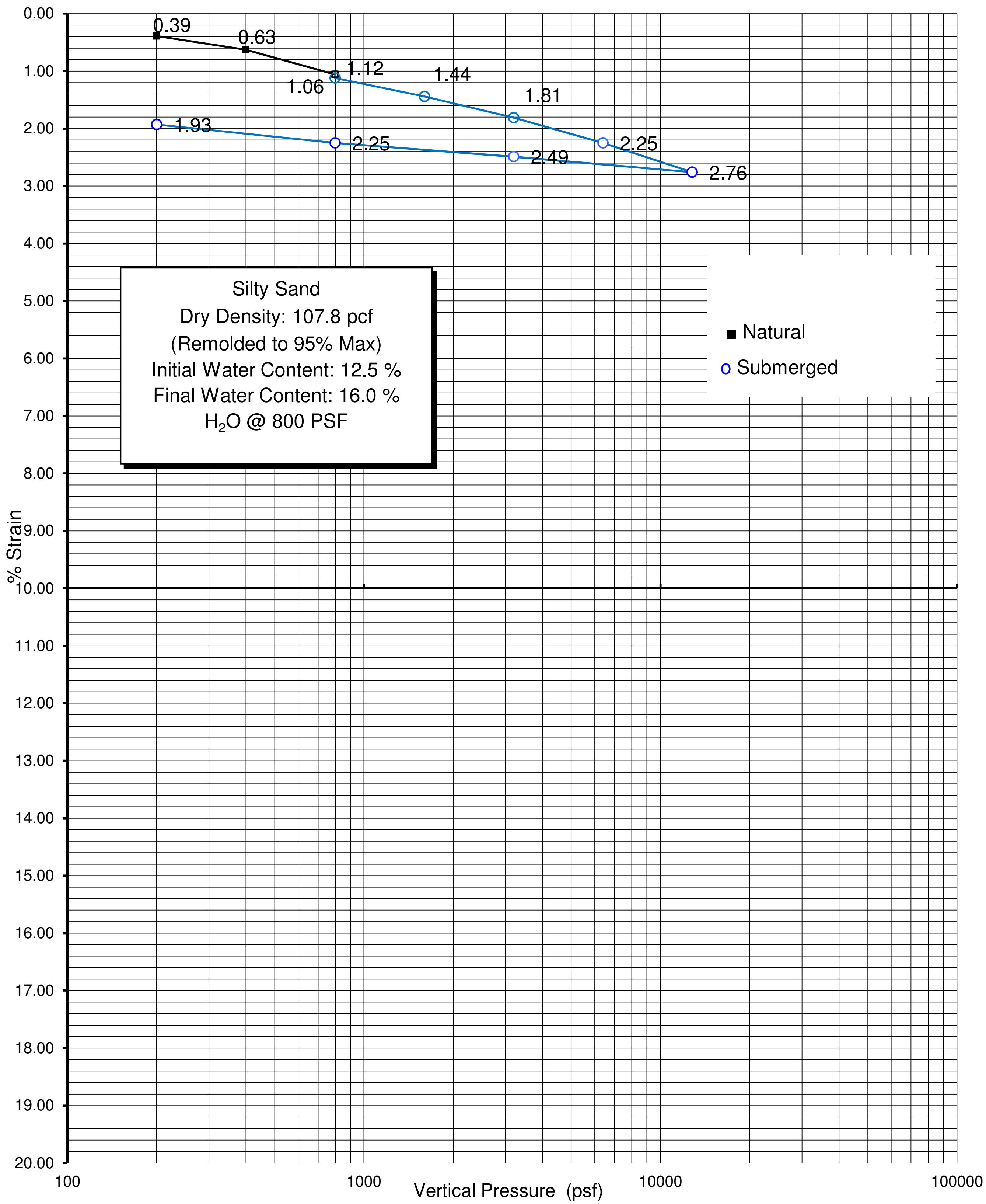
CONSOLIDATION TEST - ASTM D2435

Boring / Sample No. B-1	Depth: 10.0'	Date 05-02-25



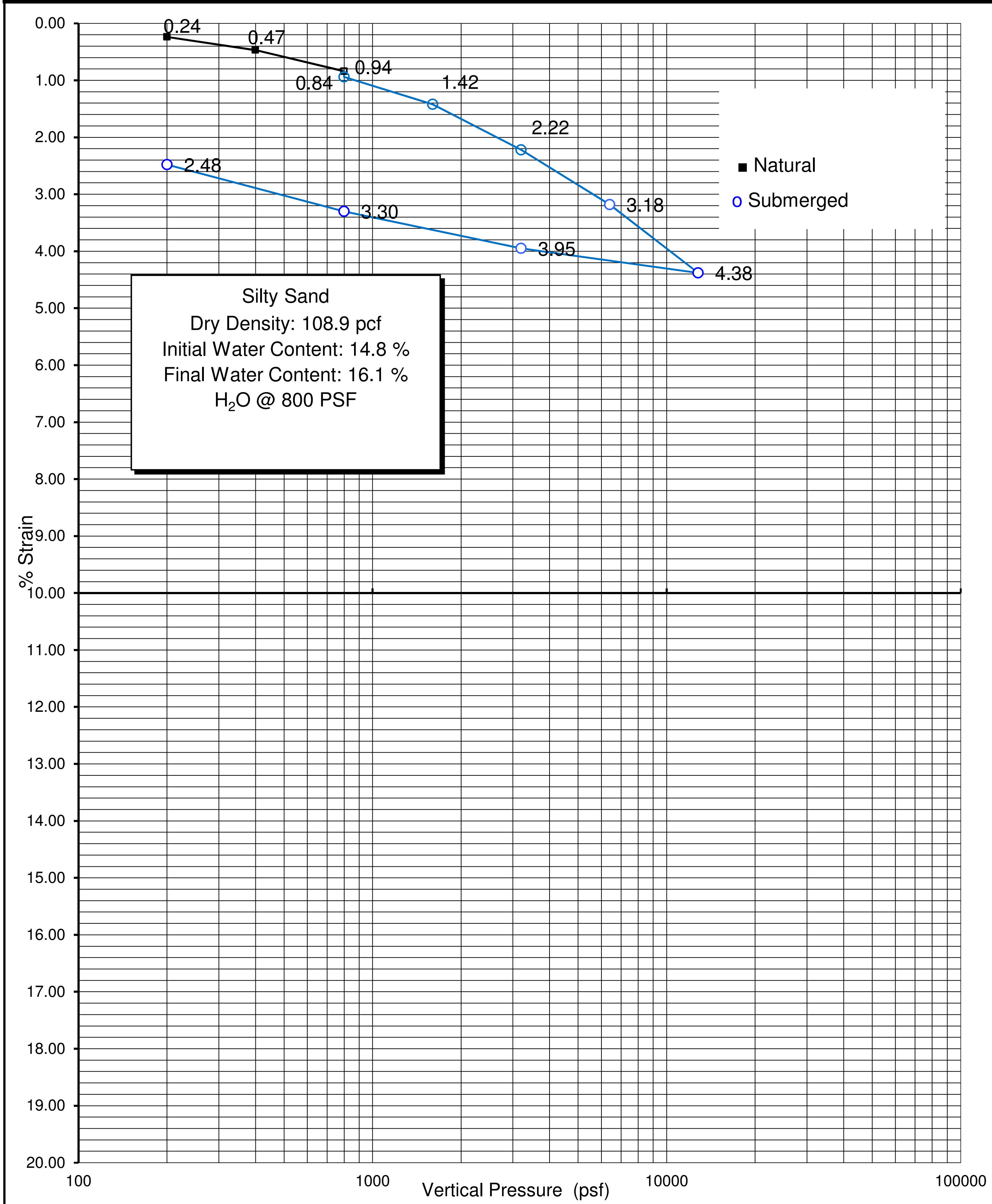
CONSOLIDATION TEST - ASTM D2435

Boring / Sample No. B-2	Depth: 0 - 5'	Date 05-05-25



CONSOLIDATION TEST - ASTM D2435

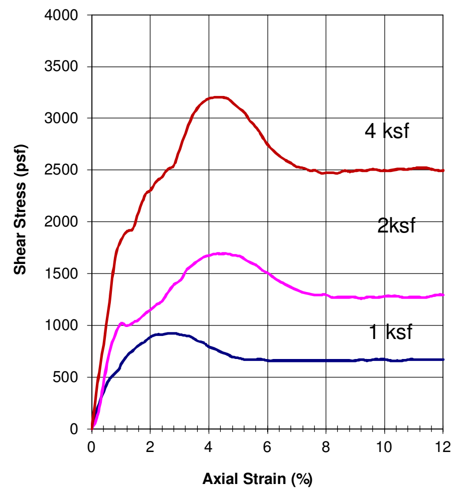
Boring / Sample No. B-2	Depth: 25.0'	Date 05-02-25



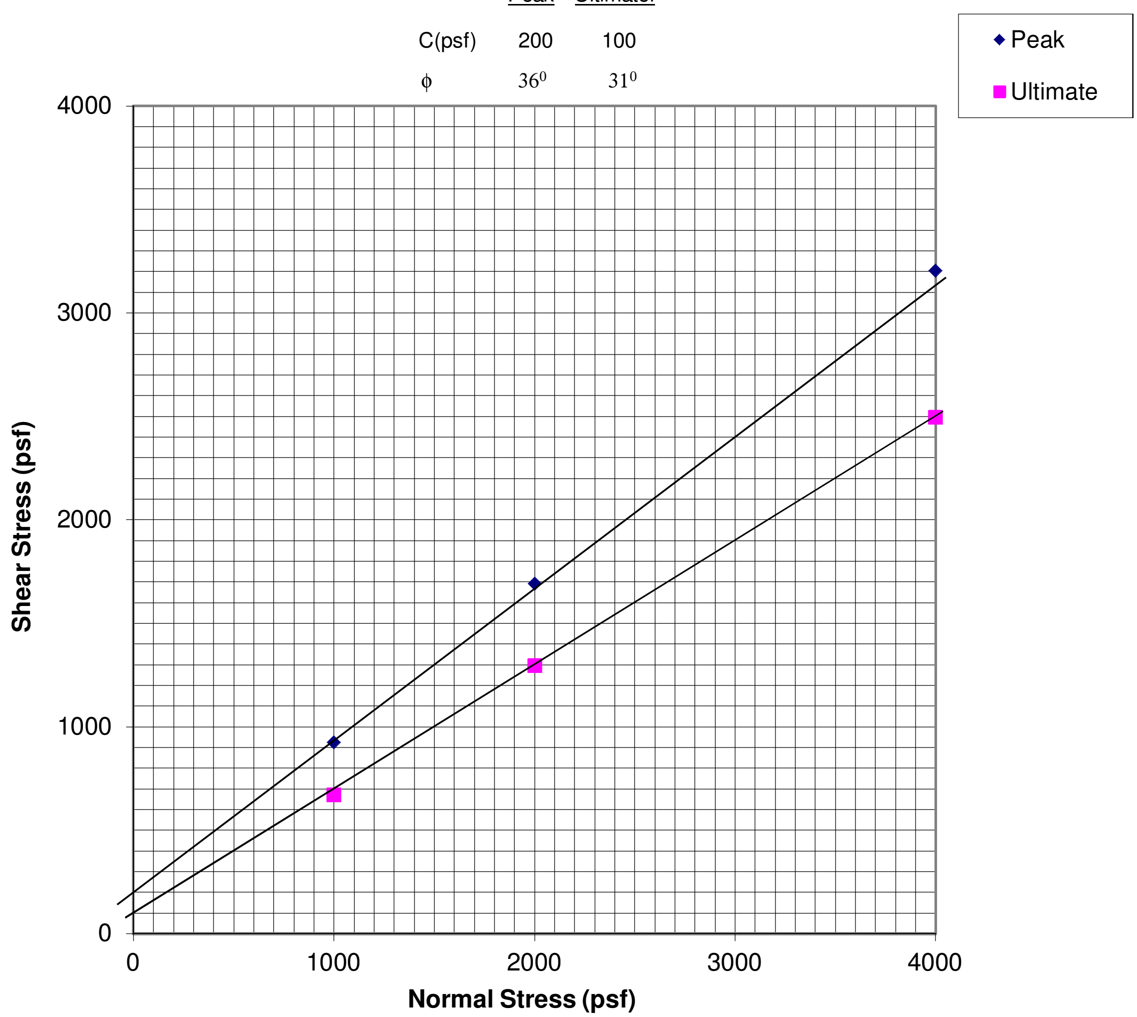
DIRECT SHEAR
ASTM D3080

PROJECT: Langan # 700170401 Date: 5/8/2025
GLA JOB NO.: 2012-0057
SAMPLE : B-1 @ 0 - 5'
SAMPLE TYPE: Remolded @ 95% & Saturated
DESCRIPTION: Silty Sand

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	924	1692	3204
Displacement, % strain	2.6	4.24	4.24
Ultimate Stress, psf	672	1296	2496
Displacement, % strain	12	12	12
Initial Dry Density, pcf	107.8	107.8	107.8
Initial Water Content,%	12.5	12.5	12.5
Final Water Content,%	18.1	18.1	18.1
Strain Rate, in/min.	0.0084	0.0084	0.0084



	Peak	Ultimatel
C(psf)	200	100
ϕ	36^0	31^0

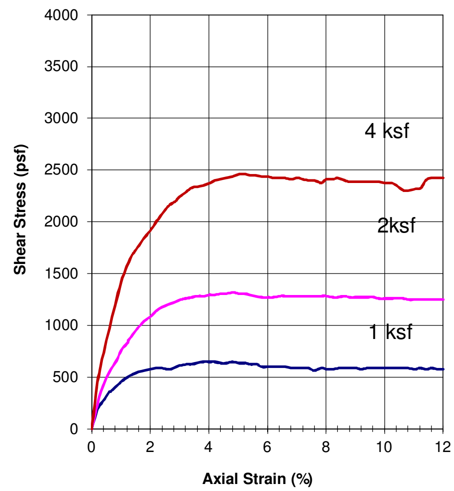


Geo-Logic
ASSOCIATES

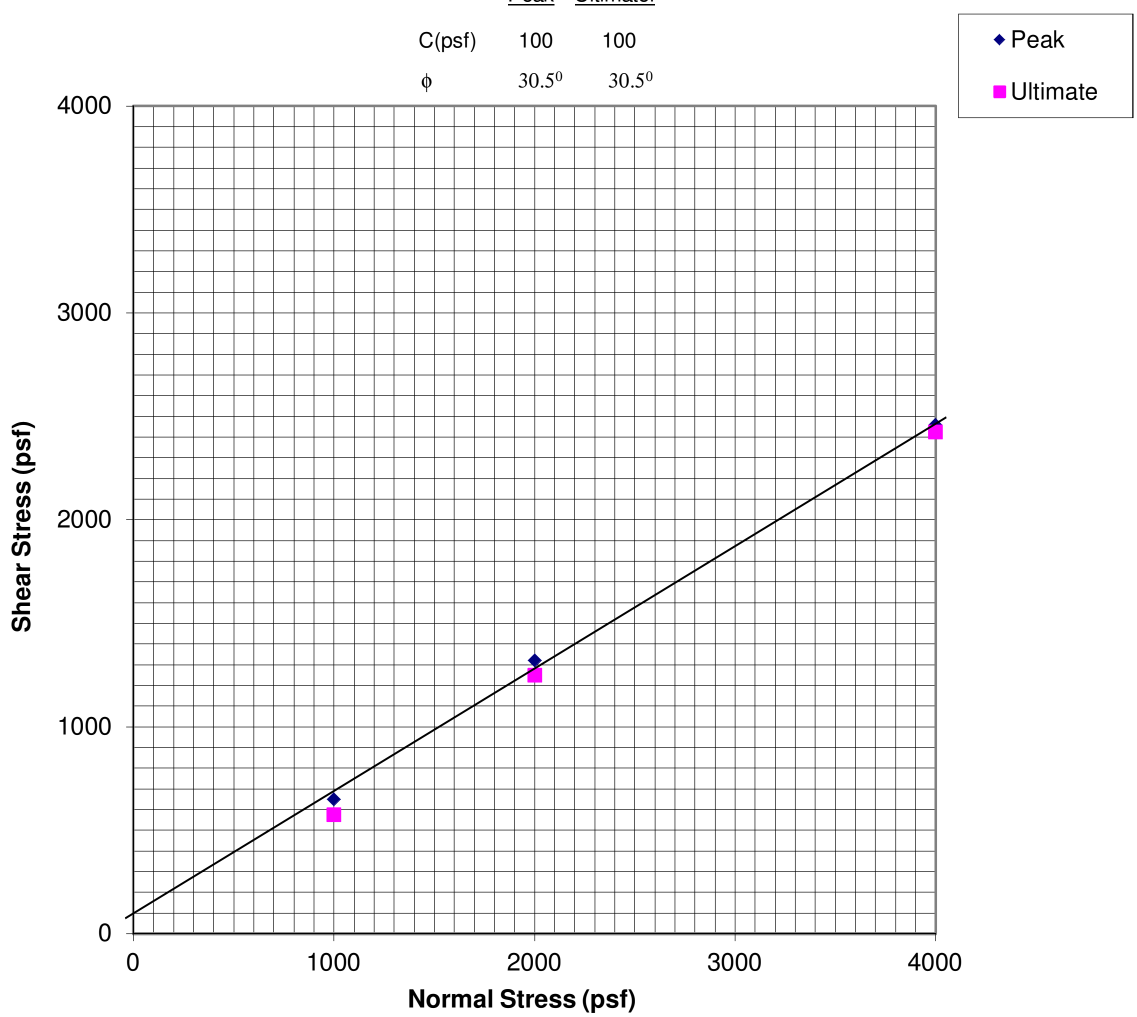
DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700170401	Date:	5/8/2025
GLA JOB NO.:	2012-0057		
SAMPLE :	B-1 @ 30'		
SAMPLE TYPE:	Undisturbed & Saturated		
DESCRIPTION:	Silt with Sand		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	648	1320	2460
Displacement, % strain	3.8	4.84	5.04
Ultimate Stress, psf	576	1248	2424
Displacement, % strain	12	12	12
Initial Dry Density, pcf	87.3	87.3	87.3
Initial Water Content,%	35.3	35.3	35.3
Final Water Content,%	36.7	36.7	36.7
Strain Rate, in/min.	0.0084	0.0084	0.0084



	Peak	Ultimatel
C(psf)	100	100
ϕ	30.5^0	30.5^0

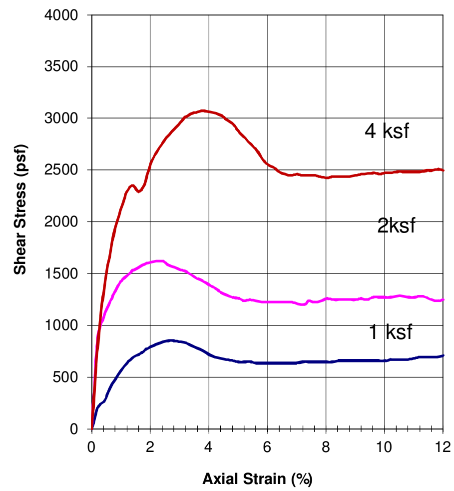


Geo-Logic
ASSOCIATES

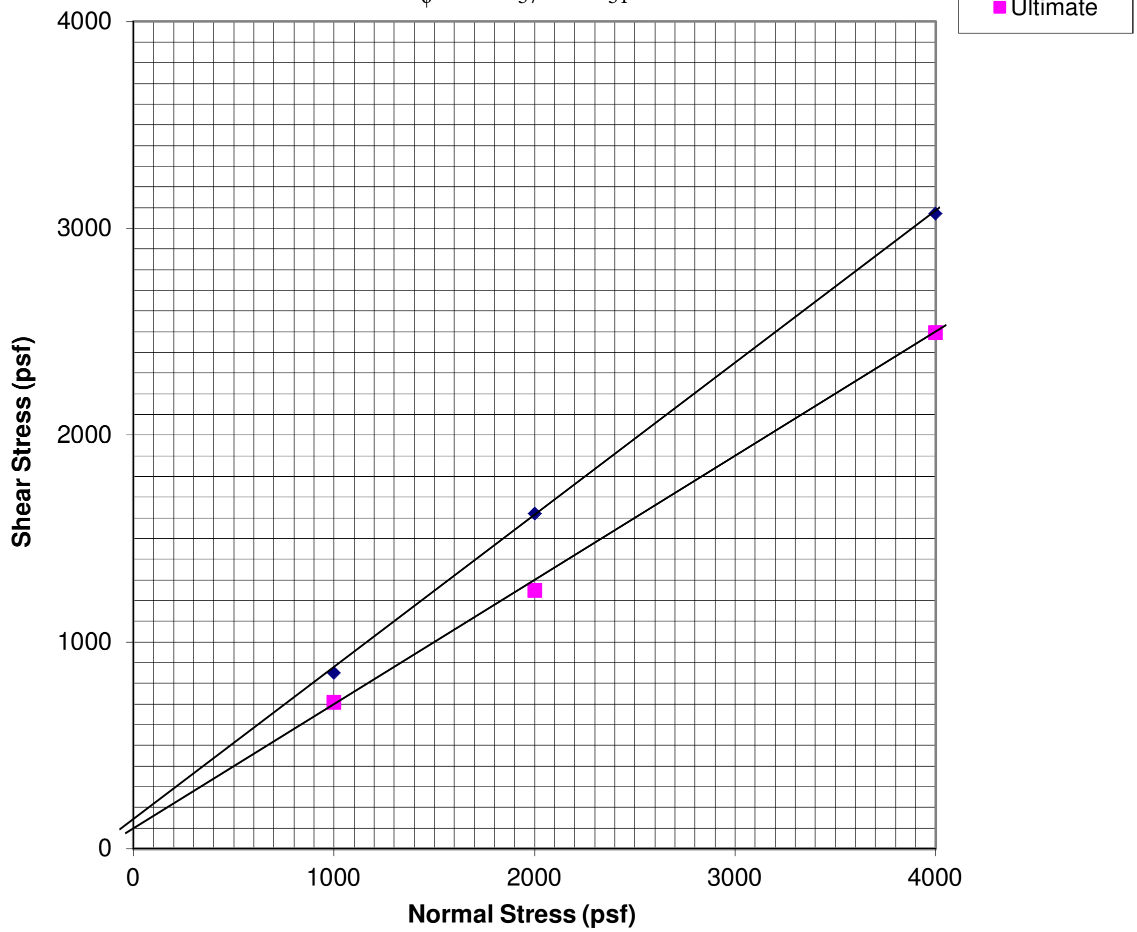
DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700170401	Date:	5/8/2025
GLA JOB NO.:	2012-0057		
SAMPLE :	B-2 @ 0 - 5'		
SAMPLE TYPE:	Remolded @ 95% & Saturated		
DESCRIPTION:	Silty Sand		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	852	1620	3072
Displacement, % strain	2.64	2.2	3.8
Ultimate Stress, psf	708	1248	2496
Displacement, % strain	12	12	12
Initial Dry Density, pcf	107.4	107.4	107.4
Initial Water Content,%	12.5	12.5	12.5
Final Water Content,%	18.8	18.8	18.8
Strain Rate, in/min.	0.0084	0.0084	0.0084



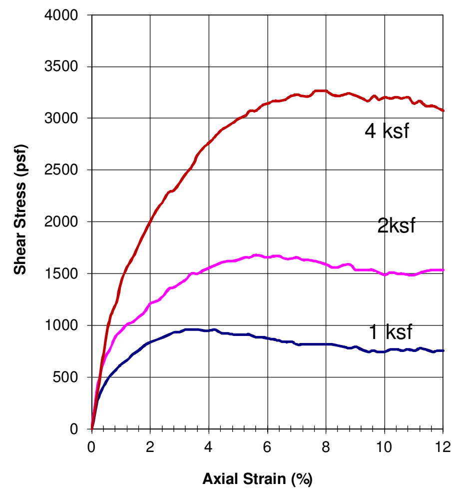
	Peak	Ultimatel
C(psf)	150	100
ϕ	37^0	31^0



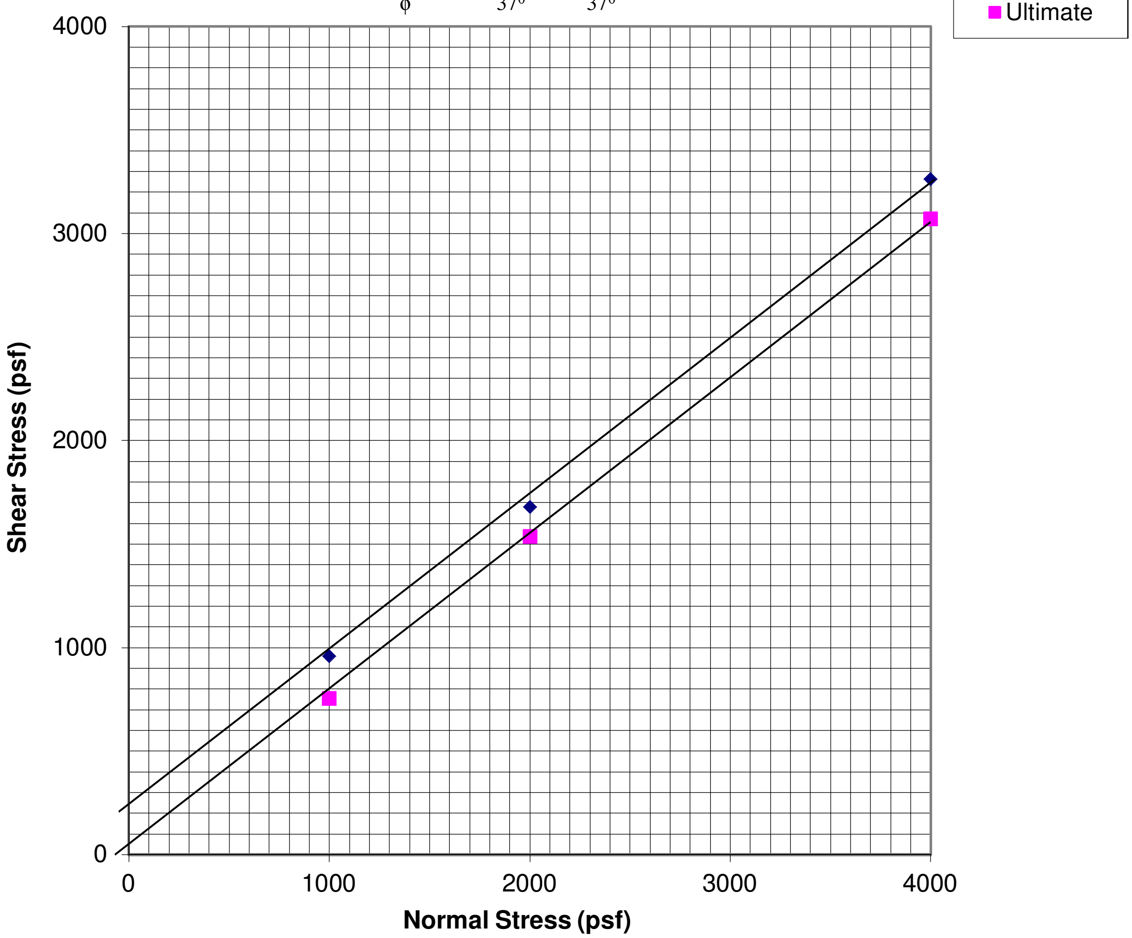
DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700170401	Date:	5/8/2025
GLA JOB NO.:	2012-0057		
SAMPLE :	B-2 @ 10'		
SAMPLE TYPE:	Undisturbed & Saturated		
DESCRIPTION:	Silty Sand		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	960	1680	3264
Displacement, % strain	3.2	5.6	7.64
Ultimate Stress, psf	756	1536	3072
Displacement, % strain	12	12	12
Initial Dry Density, pcf	101.4	101.4	101.4
Initial Water Content,%	3.3	3.3	3.3
Final Water Content,%	18.6	18.6	18.6
Strain Rate, in/min.	0.0084	0.0084	0.0084



	Peak	Ultimatel
C(psf)	250	50
ϕ	37^0	37^0

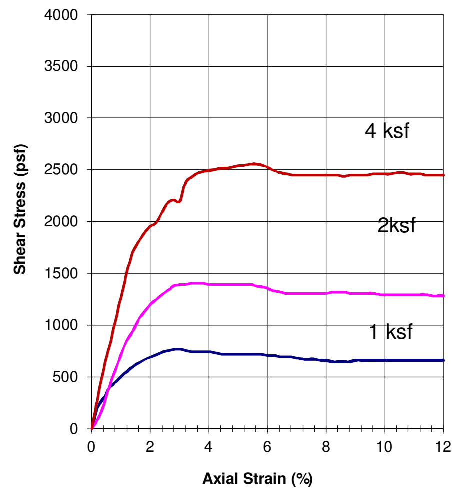


Geo-Logic ASSOCIATES

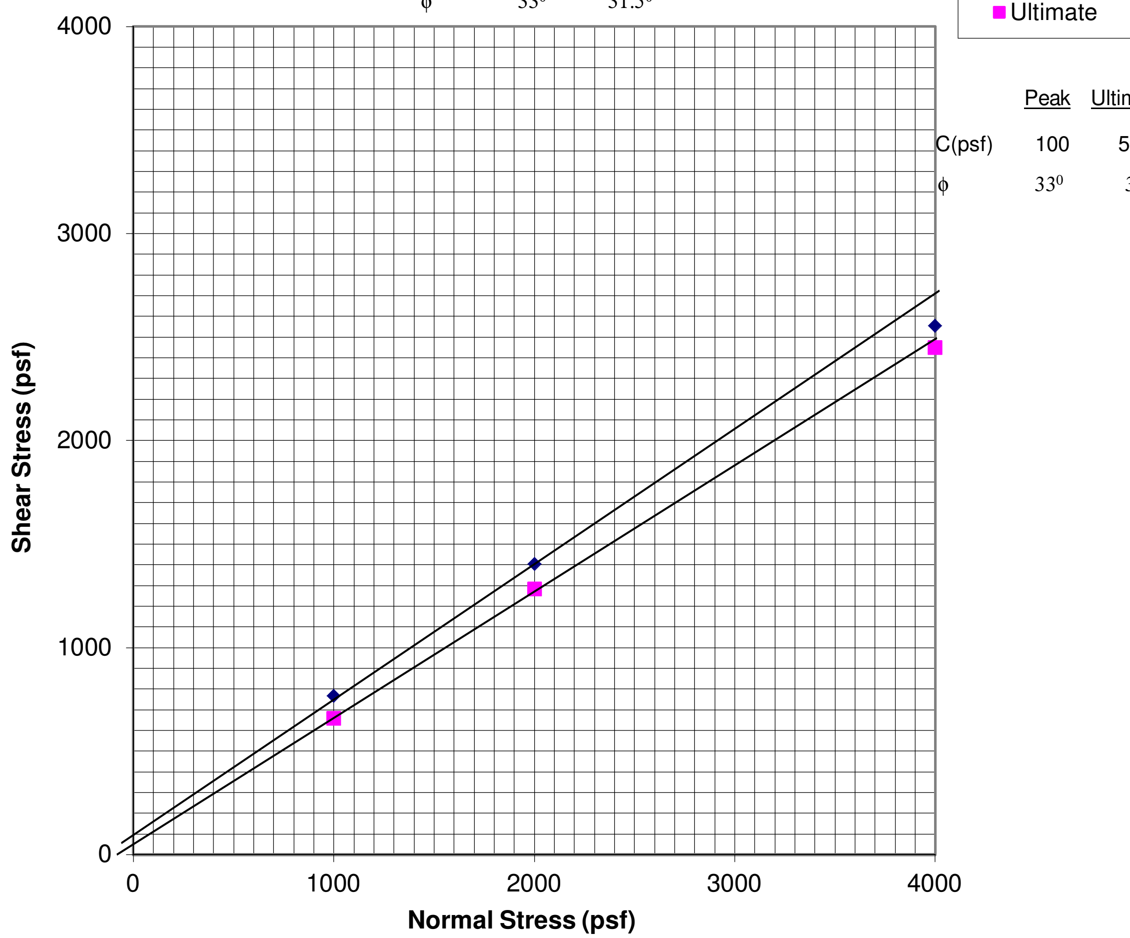
DIRECT SHEAR
ASTM D3080

PROJECT:	Langan # 700170401	Date:	5/8/2025
GLA JOB NO.:	2012-0057		
SAMPLE :	B-2 @ 35'		
SAMPLE TYPE:	Undisturbed & Saturated		
DESCRIPTION:	Sandy Silt		

Specimen No.	1	2	3
Normal Stress, psf	1000	2000	4000
Peak Stress, psf	768	1404	2556
Displacement, % strain	2.84	3.4	5.44
Ultimate Stress, psf	660	1284	2448
Displacement, % strain	12	12	12
Initial Dry Density, pcf	97.0	97.0	97.0
Initial Water Content,%	20.1	20.1	20.1
Final Water Content,%	24.2	24.2	24.2
Strain Rate, in/min.	0.0084	0.0084	0.0084



	Peak	Ultimatel
C(psf)	100	50
ϕ	33^0	31.5^0



	Peak	Ultimatel
C(psf)	100	50
ϕ	33^0	31.5^0

Geo-Logic
ASSOCIATES

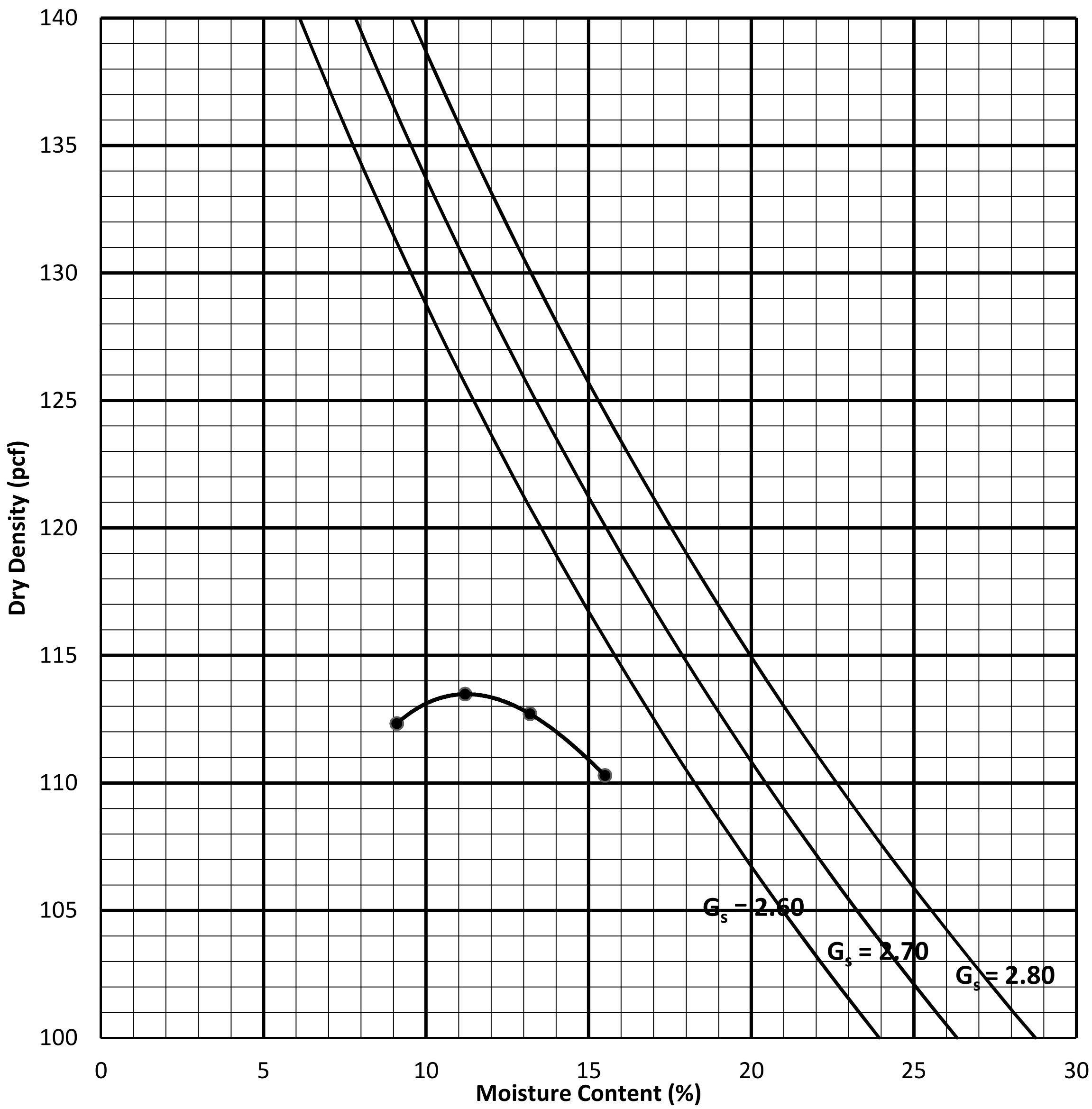
SAMPLE NO.:	B-1 / Bulk				
DESCRIPTION	Silty Sand				
DIRECT SHEAR TEST (type)					
Initial Moisture Content %					
Dry Density (pcf)					
Normal Stress (psf)					
Peak Shear Stress (psf)					
Ultimate Shear Stress (psf)					
Cohesion (psf)					
Internal Friction Angle (degrees)					
EXPANSION TEST UBC STD 18-2					
Initial Dry Density (pcf)					
Initial Moisture Content %					
Final Moisture Content %					
Pressure (psf)					
Expansion Index / Swell %					
CORROSIVITY TEST					
Resistivity (CTM643) (ohm-cm)	8000				
pH (CTM643)	8.0				
CHEMICAL TESTS					
Soluble Sulfate (CTM 417) (ppm)	139				
Chloride Content (CTM 422) (ppm)	22				
Wash #200 Sieve (ASTM-1140) %					
Sand Equivalent (ASTM D2419)					

COMPACTION TEST REPORT

Project: Langan #700170401 **Job No.** 2012-0057
Sample: B-1 / Bulk **Date:** 5/4/2025
Description: Brown, Silty Sand **By:** LD

ASTM D1557	Method A	Volume (cf): 0.03333		# Blows: 25	# Layers: 5
Specimen		A	B	C	D
Wet Weight (grs)		1908	1929	1926	1853
Wet Density (pcf)		126.2	127.6	127.4	122.6
Moisture Content (%)		11.2	13.2	15.5	9.1
Dry Density (pcf)		113.5	112.7	110.3	112.3

Max. Dry Density : 113.5 pcf
Opt. Water Content: 11.5 %

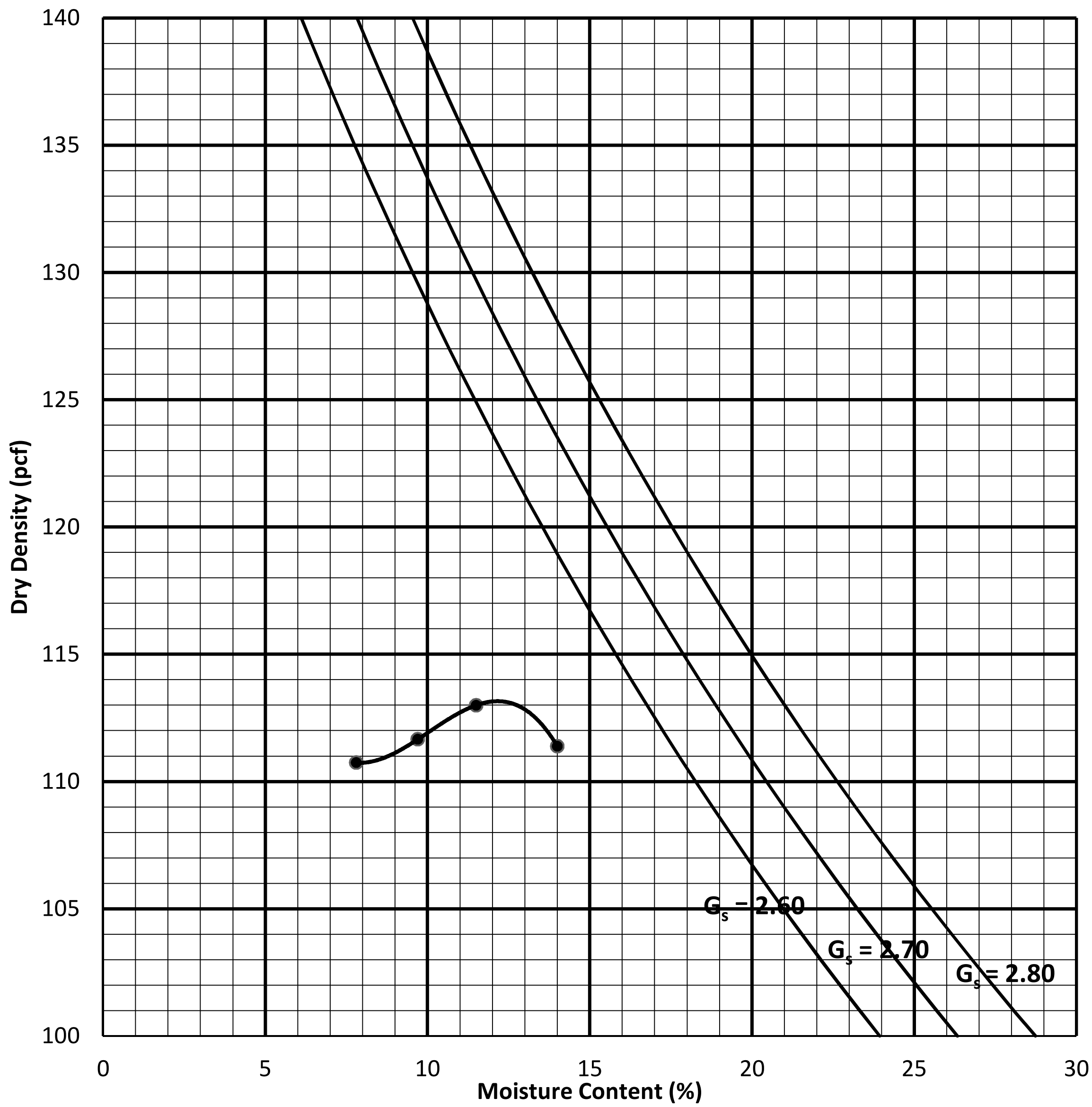


COMPACTION TEST REPORT

Project:	Langan #700170401	**Job No.**	2012-0057
Sample:	B-2 / Bulk	**Date:**	5/4/2025
Description:	Brown, Silty Sand	**By:**	LD

ASTM D1557	Method A	Volume (cf): 0.03333		# Blows: 25	# Layers: 5
Specimen		**A**	**B**	**C**	**D**
Wet Weight (grs)		1905	1920	1852	1805
Wet Density (pcf)		126.0	127.0	122.5	119.4
Moisture Content (%)		11.5	14.0	9.7	7.8
Dry Density (pcf)		113.0	111.4	111.7	110.7

Max. Dry Density : 113.0 pcf
Opt. Water Content: 12.0 %



'R' VALUE CA 301

Client: Langan　　Date: 5/8/25　　By: LD

Client's Job No.: 700170401　　Sample : B-2 @ 0 - 5'

GLA Reference: 2012-0057　　Soil Type: Brown, Silty Sand

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	**350**	**350**	**350**	
Initial Moisture Content	%	**7.3**	**7.3**	**7.3**	
Water Added	ml	**55**	**60**	**63**	
Moisture at Compaction	%	30.1	30.5	30.8	
Sample & Mold Weight	gms	**3148**	**3140**	**3160**	
Mold Weight	gms	**2101**	**2091**	**2103**	
Net Sample Weight	gms	1047	1049	1057	
Sample Height	in.	**2.5**	**2.493**	**2.51**	
Dry Density	pcf	97.5	97.7	97.5	
Pressure	lbs	**7060**	**3050**	**4630**	
Exudation Pressure	psi	562	243	369	
Expansion Dial	x 0.0001	**0**	**0**	**0**	
Expansion Pressure	psf	0	0	0	
Ph at 1000lbs	psi	**14**	**16**	**15**	
Ph at 2000lbs	psi	**24**	**28**	**26**	
Displacement	turns	**3.94**	**4.28**	**4.09**	
R' Value		78	73	76	
Corrected 'R' Value		**78**	**73**	**76**	

FINAL 'R' VALUE	
By Exudation Pressure (@ 300 psi):	**74**
By Epansion Pressure :	**N/A**
TI = 5	

Geo-Logic ASSOCIATES

EXPANSION INDEX - UBC 18-2 & ASTM D 4829-88

PROJECT Langan # 700170401 JOB NO. 2012-0057

Sample	B-1 @ 0 - 5'		By	LD	Sample			By	
Sta. No.					Sta. No.				
Soil Type	Brown, Silty Sand				Soil Type				
Date	Time	Dial Reading	Wet+Tare	590	Date		Dial Reading	Wet+Tare	
5/7/2025	16:20	0.4113	Tare	207.7				Tare	
		H2O	Net Weight	382.3				Net Weight	
5/8/2025	10:00	0.4109	% Water	11.5				% Water	
			Dry Dens.	103.9				Dry Dens.	
			% Max					% Max	
			Wet+Tare	613.3				Wet+Tare	
			Tare	207.7				Tare	
			Net Weight	405.6				Net Weight	
INDEX	0	0.0%	% Water	18.3	**INDEX**			% Water	

Sample			By		Sample			By	
Sta. No.					Sta. No.				
Soil Type					Soil Type				
Date		Dial Reading	Wet+Tare		Date		Dial Reading	Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
			% Water					% Water	
			Dry Dens.					Dry Dens.	
			% Max					% Max	
			Wet+Tare					Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
INDEX			% Water		**INDEX**			% Water	

APPENDIX B

Prior Field Investigation and Geotechnical Laboratory Testing

PRIOR LANGAN
2019 CPTS

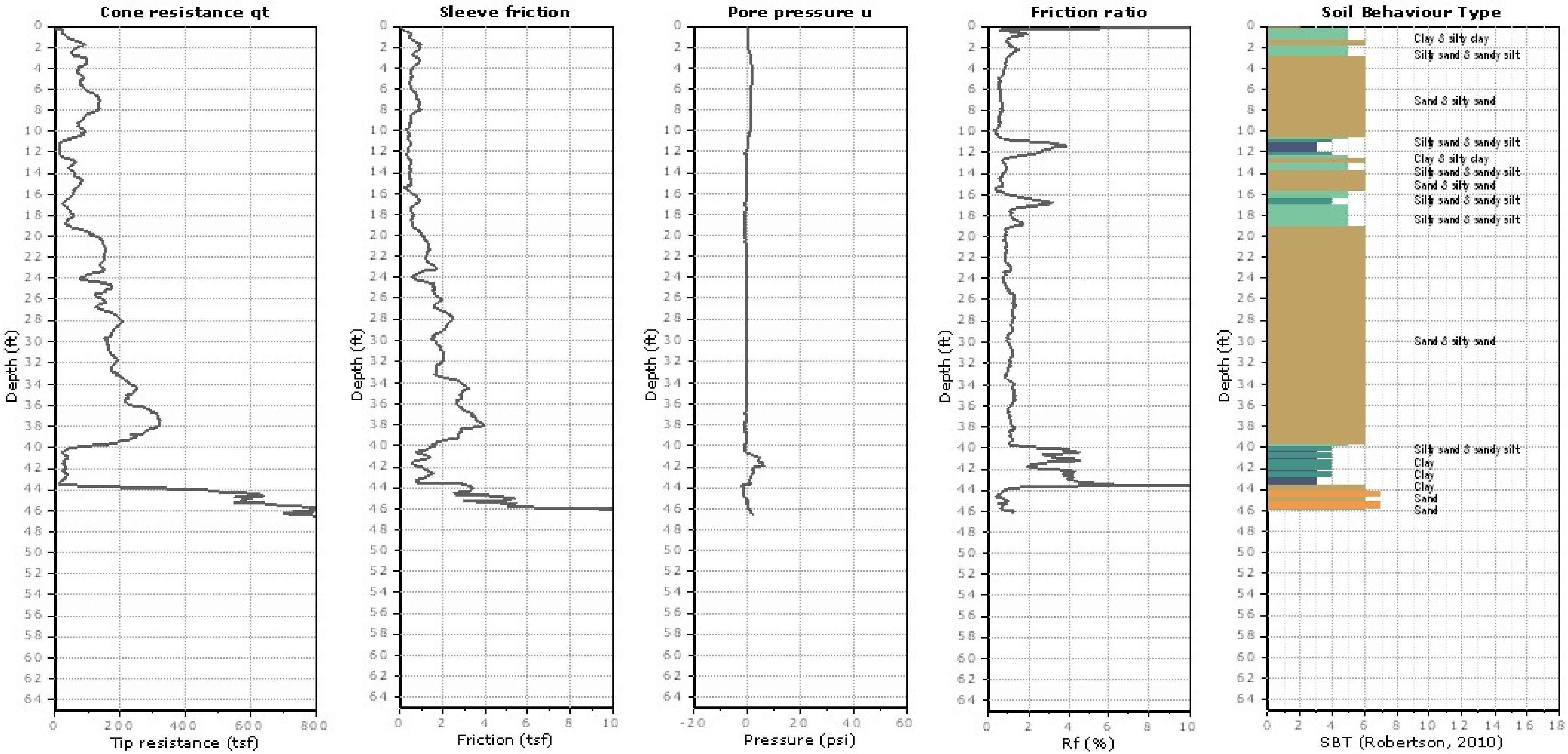
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Langan Engr. & Env. Services

Location: E. Katella Ave & S. Douglass Rd, Anaheim, CA

CPT-A1

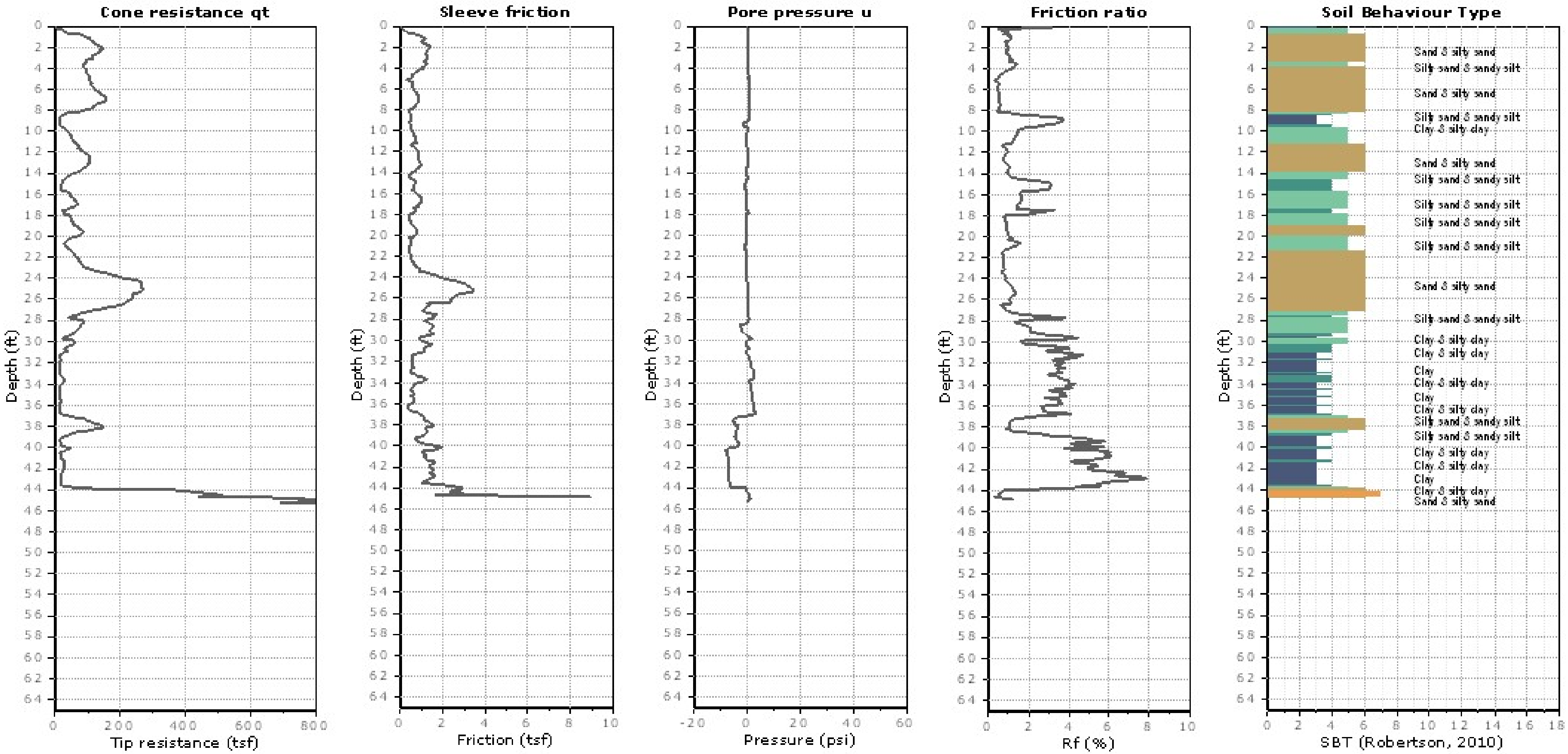
Total depth: 46.53 ft, Date: 8/23/2019



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Langan Engr. & Env. Services
Location: E. Katella Ave & S. Douglass Rd, Anaheim, CA

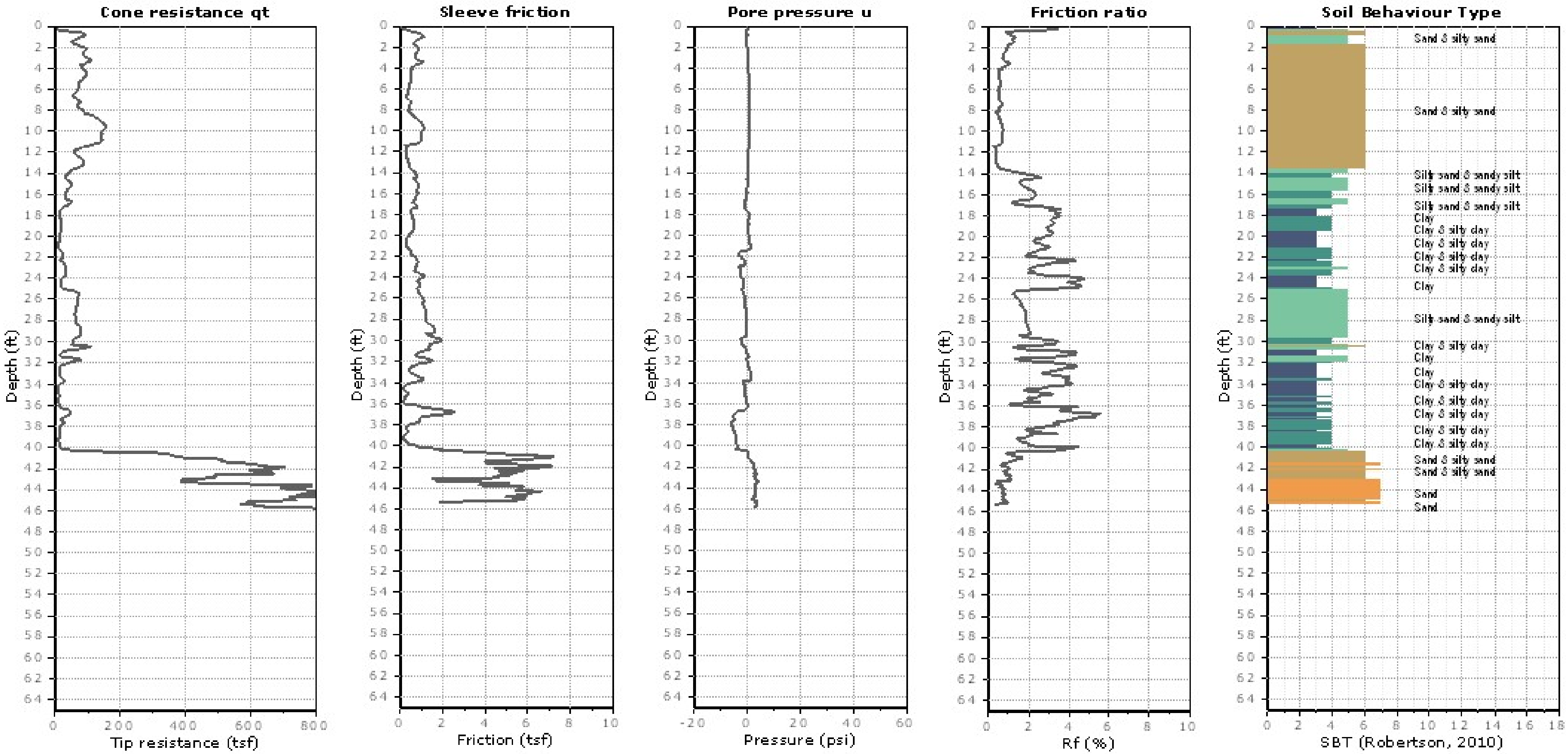
CPT-A2
Total depth: 45.34 ft, Date: 8/23/2019



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Langan Engr. & Env. Services
Location: E. Katella Ave & S. Douglass Rd, Anaheim, CA

CPT-A3
Total depth: 45.80 ft, Date: 8/23/2019



Langan Engr. & Env. Services
E. Katella Ave & S. Douglass Rd
Anaheim, CA

CPT Shear Wave Measurements

Location	Tip Depth (ft)	Geophone Depth (ft)	Travel Distance (ft)	S-Wave Arrival (msec)	S-Wave Velocity from Surface (ft/sec)	Interval S-Wave Velocity (ft/sec)
CPT-A1	10.14	9.14	9.36	13.52	692.03	
	15.55	14.55	14.69	22.31	658.31	606.43
	20.11	19.11	19.21	28.58	672.30	722.10
	25.00	24.00	24.08	35.20	684.18	735.47
	30.05	29.05	29.12	41.00	710.21	868.20
	34.97	33.97	34.03	46.44	732.75	902.58
	40.22	39.22	39.27	52.24	751.74	903.82
	45.05	44.05	44.10	56.58	779.35	1111.62
CPT-B1	10.01	9.01	9.23	11.76	784.80	
	15.03	14.03	14.17	18.28	775.26	758.06
	20.01	19.01	19.11	24.84	769.52	753.52
	25.00	24.00	24.08	30.52	789.10	874.70
	30.02	29.02	29.09	35.86	811.18	937.39
	35.01	34.01	34.07	41.76	815.82	844.05
	40.03	39.03	39.08	47.84	816.91	824.42
	45.05	44.05	44.10	53.08	830.73	956.90
	50.00	49.00	49.04	58.96	831.76	841.06
	55.02	54.02	54.06	64.12	843.06	972.13
	59.97	58.97	59.00	69.04	854.63	1005.47
	62.83	61.83	61.86	71.56	864.48	1134.30

Shear Wave Source Offset - 2 ft

S-Wave Velocity from Surface = Travel Distance/S-Wave Arrival
Interval S-Wave Velocity = (Travel Dist2-Travel Dist1)/(Time2-Time1)

APPENDIX C

Results of Current Geophysical Testing

PRIOR NMG
2020 BORINGS

Date(s) Drilled	7/29/20	Logged By	ZKH
Drilling Company	2R Drilling, Inc.	Drill Bit Size/Type	11"
Drill Rig Type	CME 75 Hollow Stem	Hammer Data	140 lbs. @ 30-inch drop
Sampling Method(s)	Modified California		
Approximate Groundwater Depth:	Groundwater Not Encountered		
Comments			

H- 1

Total Depth Drilled (ft)	56.5
Approximate Ground Surface Elevation (ft)	159.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					ML	Surface: Parking Lot, 5" AC, no AB. **Alluvium (Qal)**			
			D-1	19		SM	@ 2.5' SAMPLE: Upper: Olive brown SILT, moist, stiff, micaceous, rootlet, laminated. Lower: Gray silty fine SAND, damp, medium dense, friable, some clean lenses of sand.	3.5	101.3	
	5		D-2	17		SP	@ 5' SAMPLE: Gray to brownish gray fine to medium SAND, damp, medium dense, highly friable, trace fine gravel.	4.8	101.9	
			D-3	11			@ 7.5' SAMPLE: Gray to brownish gray fine to medium SAND, damp, medium dense, highly friable, trace fine gravel.	2.3	100.6	
150										
	10		D-4	5		SP	@ 10' SAMPLE: Upper: Gray to brownish gray fine to medium SAND with fine gravel, damp, loose, highly friable.	35.7	87.4	CN
						CL	Lower: Olive gray CLAY, very moist, soft, FeO stained.			
	15		D-5	13		SM	@ 15' SAMPLE: Gray to brownish gray silty fine to medium SAND, moist, loose to medium dense, micaceous.	1.5	101.1	
140										
	20		D-6	21			@ 20' SAMPLE: Olive gray silty fine SAND, moist, medium dense, micaceous, pinhole pores, FeO stained.	6.5	108.8	
	25									

LOG OF BORING

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG

Elevation (ft)	Depth (ft)	Samples Type	Samples Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25		D-7	23		SM	@ 25' SAMPLE: Olive brown silty fine SAND, moist, medium dense, micaceous, increase in density.	9.3	108.1	
130										
	30		D-8	23		ML	@ 30' SAMPLE: Olive brown sandy SILT, moist, very stiff, micaceous, laminated.	22.3	94.5	CN
	35		D-9	13			@ 35' SAMPLE: Olive brown sandy SILT, moist, stiff, micaceous, laminated, trace clayey silt.	20.5	101.0	
120										
	40		D-10	10		CL-CH	@ 40': Brown CLAY, very moist to wet, medium stiff, trace fine rounded gravel, highly plastic.	20.4	109.7	
	45		D-11	71		GP	@ 45' SAMPLE: Brown sandy/silty GRAVEL, moist, very dense, angular, FeO stained.	3.8	120.1	
110										
	50		D-12	50/5"			@ 50' SAMPLE: No Recovery.			
							@ 54': Driller notes end of gravel.			
	55									

LOG OF BORING
AREP/OC Vibe
Anaheim, CA

PROJECT NO. 20065-01

NMG

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	55		D-13	43		CL	@ 55' SAMPLE: Strong brown silty CLAY, moist, very stiff, moderately plastic.	16.0	116.6	
							Notes: Total Depth: 56.5 Feet. Groundwater Not Encountered. Backfilled with Bentonite Cement Grout. Patched with Cold Patch AC.			
100										
	60									
	65									
90										
	70									
	75									
80										
	80									
	85									

LOG OF BORING

AREP/OC Vibe
Anaheim, CA

PROJECT NO. 20065-01

NMG

Date(s) Drilled	**7/29/20**	Logged By	**ZKH**
Drilling Company	**2R Drilling, Inc.**	Drill Bit Size/Type	**11"**
Drill Rig Type	**CME 75 Hollow Stem**	Hammer Data	**140 lbs. @ 30-inch drop**
Sampling Method(s)	**Modified California, Bulk**		
Approximate Groundwater Depth:	**Groundwater Not Encountered**		
Comments			

H- 2

Total Depth Drilled (ft)	**51.5**
Approximate Ground Surface Elevation (ft)	**160.0 msl**

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
160	0						Surface: Parking Lot, 6.5" AC, no AB.			
						SM	**Alluvium (Qal)** @ 1'-2.5': Gray silty fine SAND, moist.			B-1 @ 1'-5'
			B-1 D-1	18		SP	@ 2.5' SAMPLE: Gray fine to medium SAND, damp, medium dense, friable, trace gravel.	2.1	100.4	
	5		D-2	13			@ 5' SAMPLE: Gray fine to medium SAND, damp, medium dense, friable, trace gravel.	2.5	107.2	
			D-3	15			@ 7.5' SAMPLE: Light brownish gray fine to coarse SAND, moist, medium dense, friable, travel gravel.	3.9	104.3	
150	10		D-4	19			@ 10' SAMPLE: Light brownish gray fine SAND, moist, medium dense, friable.	6.4	98.7	
	15		D-5	12		ML	@ 15' Upper: Olive brown sandy SILT, moist, medium stiff, trace pinhole pores, micaceous.	26.0	84.9	
						SM	Lower: Light yellowish brown silty fine to medium SAND, moist, medium dense.			
140	20		D-6	9		SM-SC	@ 20' SAMPLE: Olive gray silty/clayey fine SAND, very moist, trace pinhole pores.	24.0	103.0	AL, CN, GS
	25									

LOG OF BORING

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG

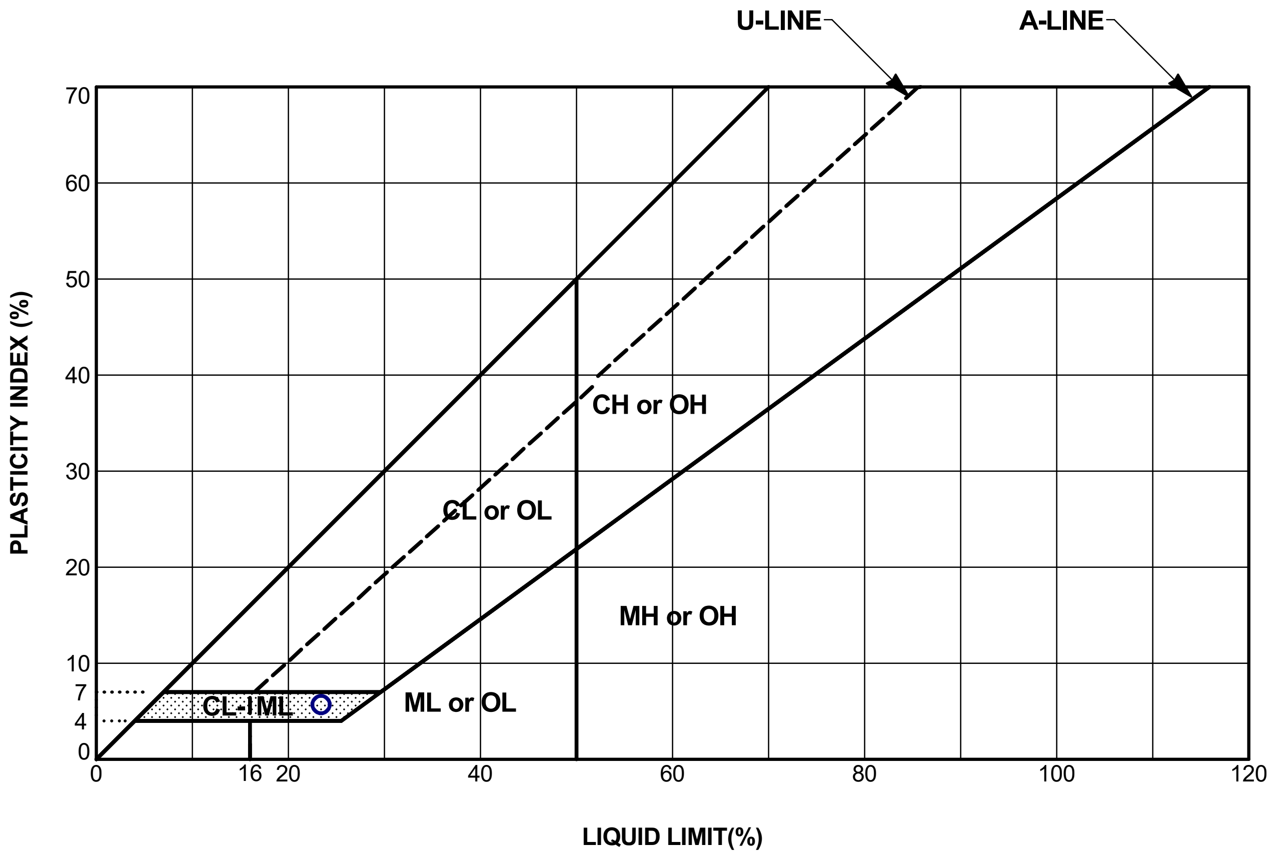
Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25		D-7	18			@ 25' SAMPLE: Light olive brown silty fine SAND, moist, medium dense.	11.8	109.6	
130	30		D-8	18			@ 30' SAMPLE: Light olive brown silty fine SAND, moist, medium dense.	20.0	102.6	
	35		D-9	10		CL-CH	@ 35' SAMPLE: Olive gray to reddish gray (in tip) sandy CLAY, very moist to wet, medium stiff, micaceous, highly plastic.	27.5	100.1	
120	40		D-10	67		CL-GC	@ 40' SAMPLE: Brown gravelly CLAY to clayey GRAVEL, very moist, hard/very dense.	13.3	109.6	
	45		D-11	50/5"		GP	@ 45' SAMPLE: Gray sandy GRAVEL, moist, very dense, friable, micaceous.	3.1		
							@ 47': Driller notes end of gravel.			
110	50		D-12	21		CL	@ 50' SAMPLE: Strong brown CLAY, very moist, stiff, highly plastic.	15.9	112.8	
	55						Notes: Total Depth: 51.5 Feet. Groundwater Not Encountered. Backfilled with Bentonite Cement Grout. Patched with Cold Patch AC.			

LOG OF BORING

AREP/OC Vibe
Anaheim, CA

PROJECT NO. 20065-01

NMG

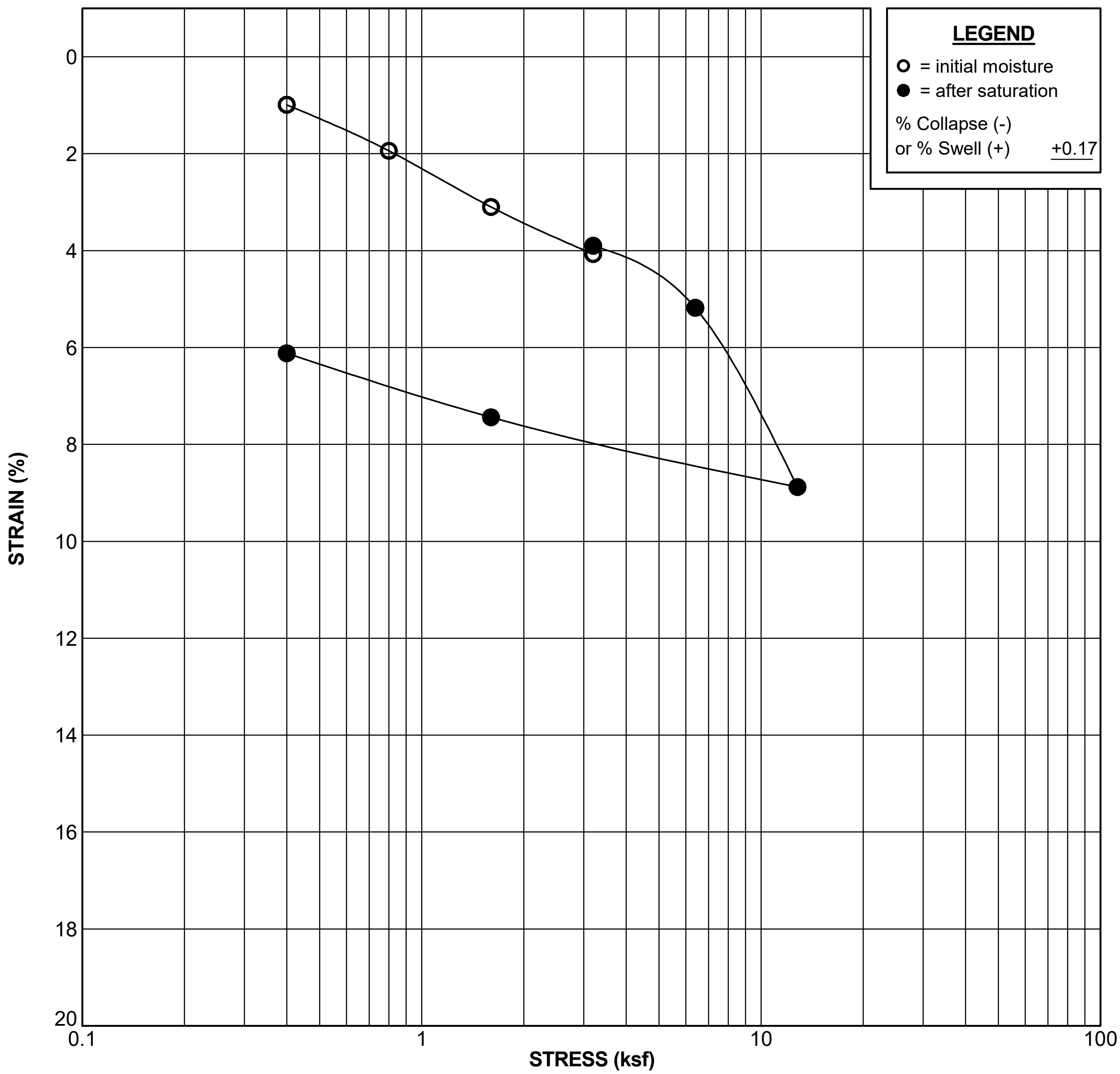


Symbol	Boring Number	Sample Number	Depth (feet)	Passing No. 200 Sieve (%)	LL	PI	USCS	Description
o	H- 2	D-6	20.0	47	23	5	SC - SM	(Qal) Dark olive brown clayey silty SAND

PLASTICITY CHART

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG Geotechnical, Inc.



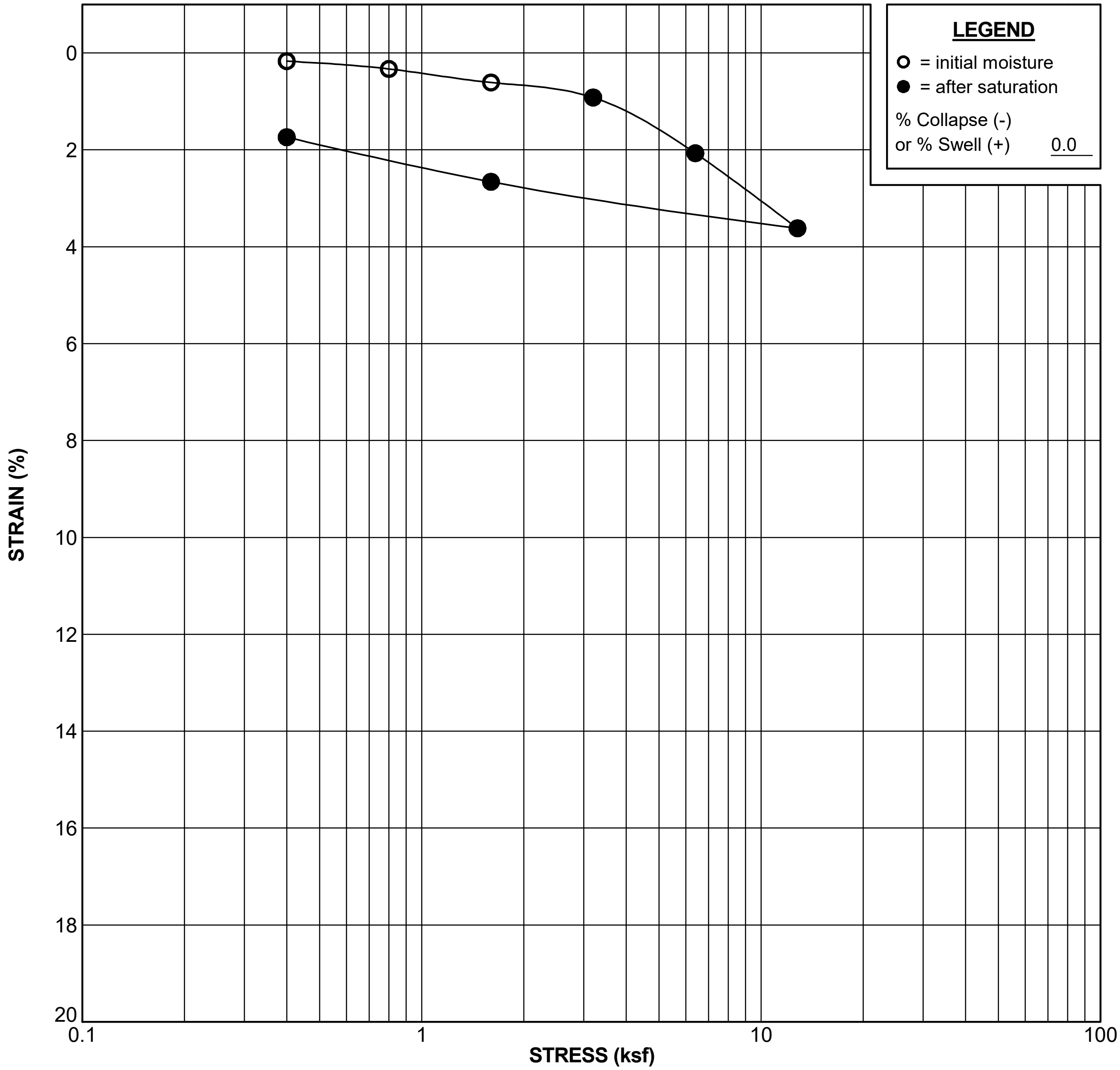
Boring No. H- 1	Sample No. D-4	Depth: 10.0 ft
Sample Description: (Qal) Dark olive brown silty CLAY		USCS: CL
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	27.9	90.3	87.0	0.866
Final	25.0	95.8	89.0	0.759

CONSOLIDATION TEST RESULTS

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG Geotechnical, Inc.



Boring No. H- 1	Sample No. D-8	Depth: 30.0 ft
Sample Description: (Qal) Light olive brown sandy SILT		USCS: ML
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

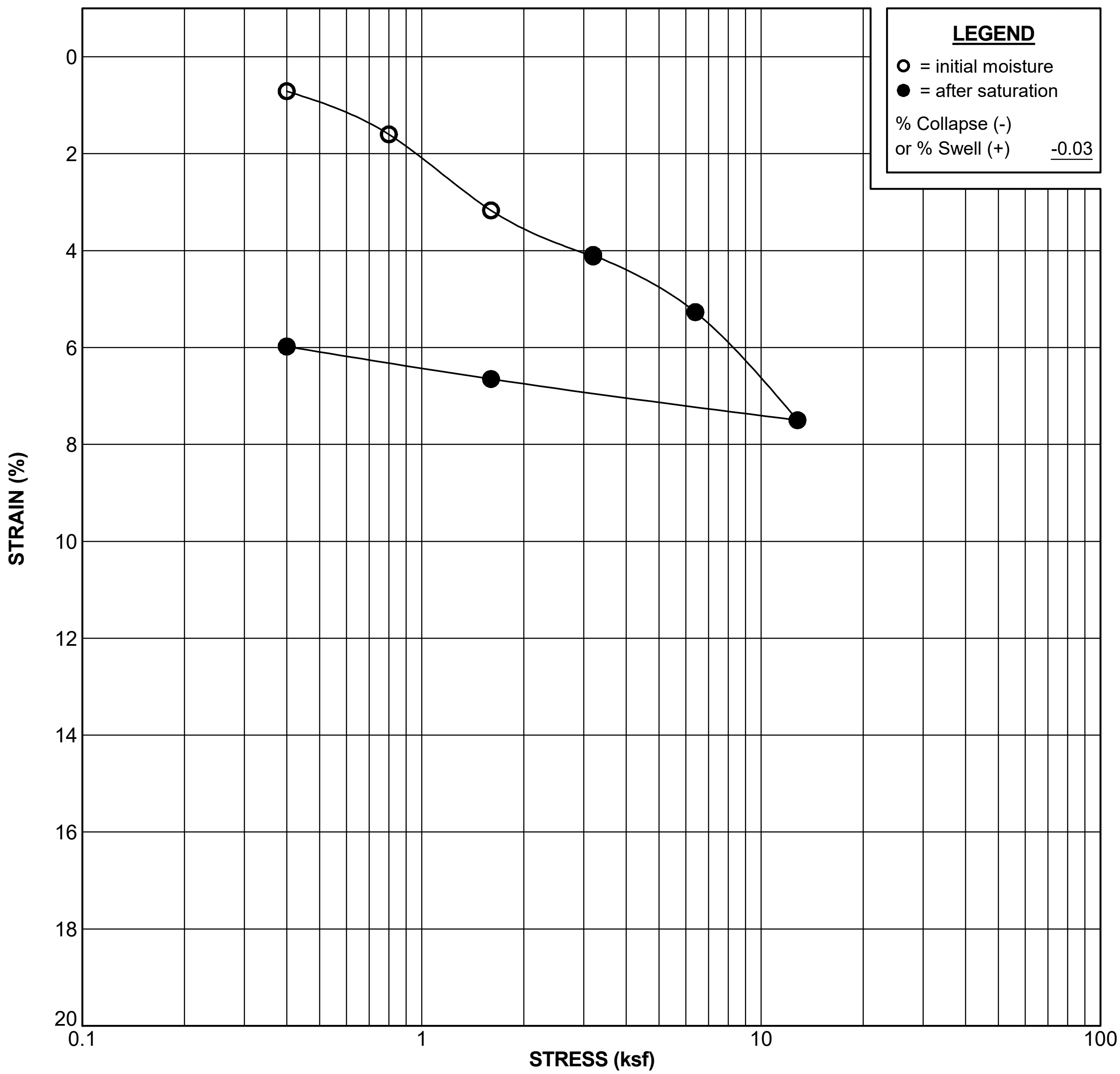
Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	21.8	93.7	73.8	0.798
Final	27.3	95.3	96.0	0.768

CONSOLIDATION TEST RESULTS

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG Geotechnical, Inc.

Template: NMCONS; Prj ID: 20065-01.GPJ; Printed: 9/3/20



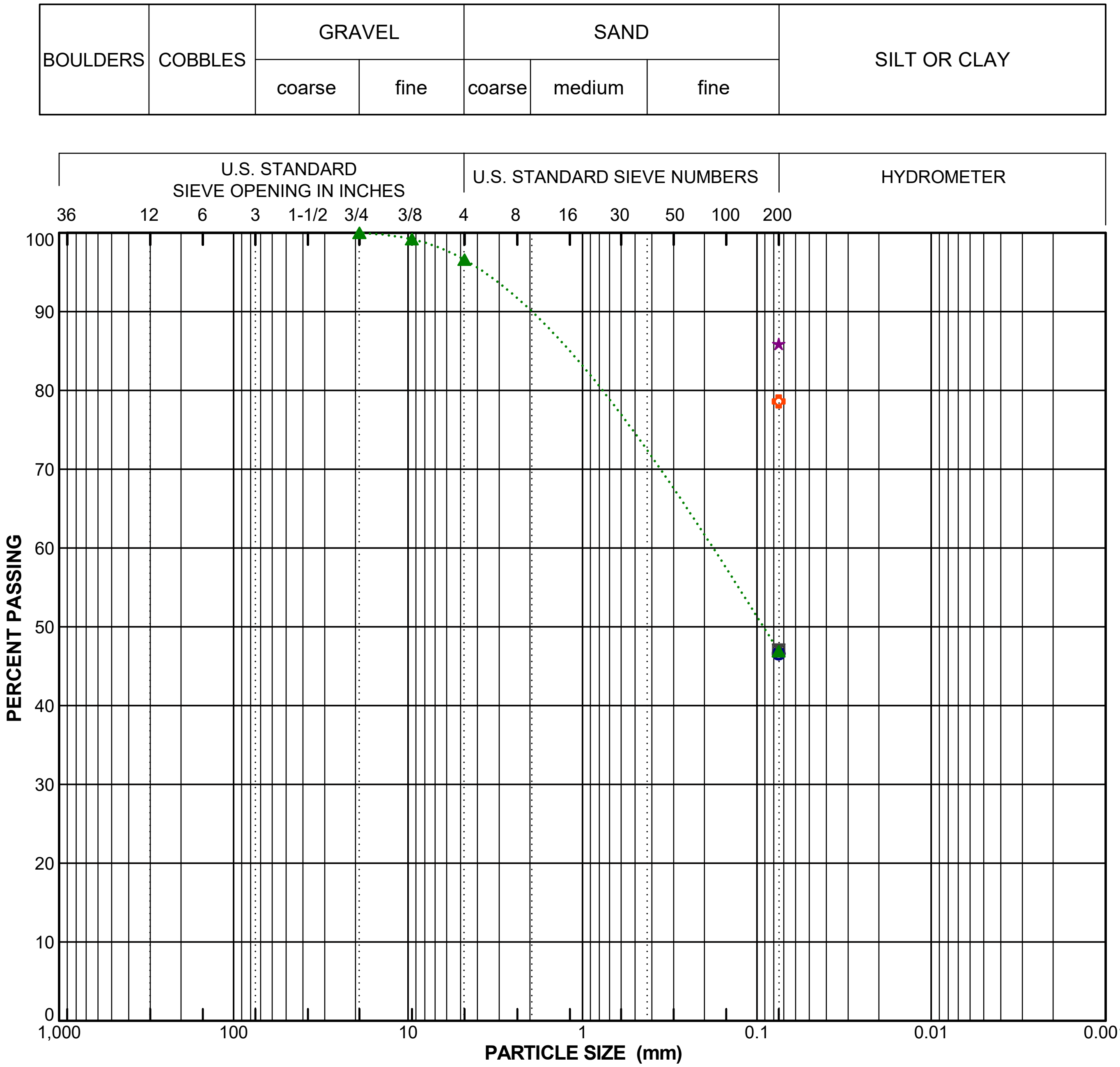
Boring No. H- 2		**Sample No. D-6**	**Depth: 20.0 ft**	
Sample Description: (Qal) Dark olive brown clayey silty SAND			**USCS:** SC - SM	
Liquid Limit: 23	**Plasticity Index:** 5		**Percent Passing No. 200 Sieve:** 47	

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	20.6	105.4	92.9	0.598
Final	18.5	111.7	98.3	0.508

CONSOLIDATION TEST RESULTS

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG Geotechnical, Inc.



Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	H- 2	D-6	20.0	24	23	5				47		SC - SM
⊠	H- 4	D-6	20.0	16						47		SM
▲	H- 6	B-1	10.0	19						47		SM
★	H- 8	D-5	15.0	12						86		ML
✿	H-14	D-4	10.0	20						79		ML

PARTICLE SIZE DISTRIBUTION

AREP/OC Vibe
Anaheim, CA
PROJECT NO. 20065-01

NMG Geotechnical, Inc.

APPENDIX D

Results of Current Field Percolation Testing

REPORT

SURFACE WAVE MEASUREMENTS

1725 S DOUGLAS RD, ANAHEIM, CALIFORNIA

GEO*Vision* Project No. 25133

Prepared for

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Report 25133-01 Rev 0

April 29, 2025

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1 INTRODUCTION

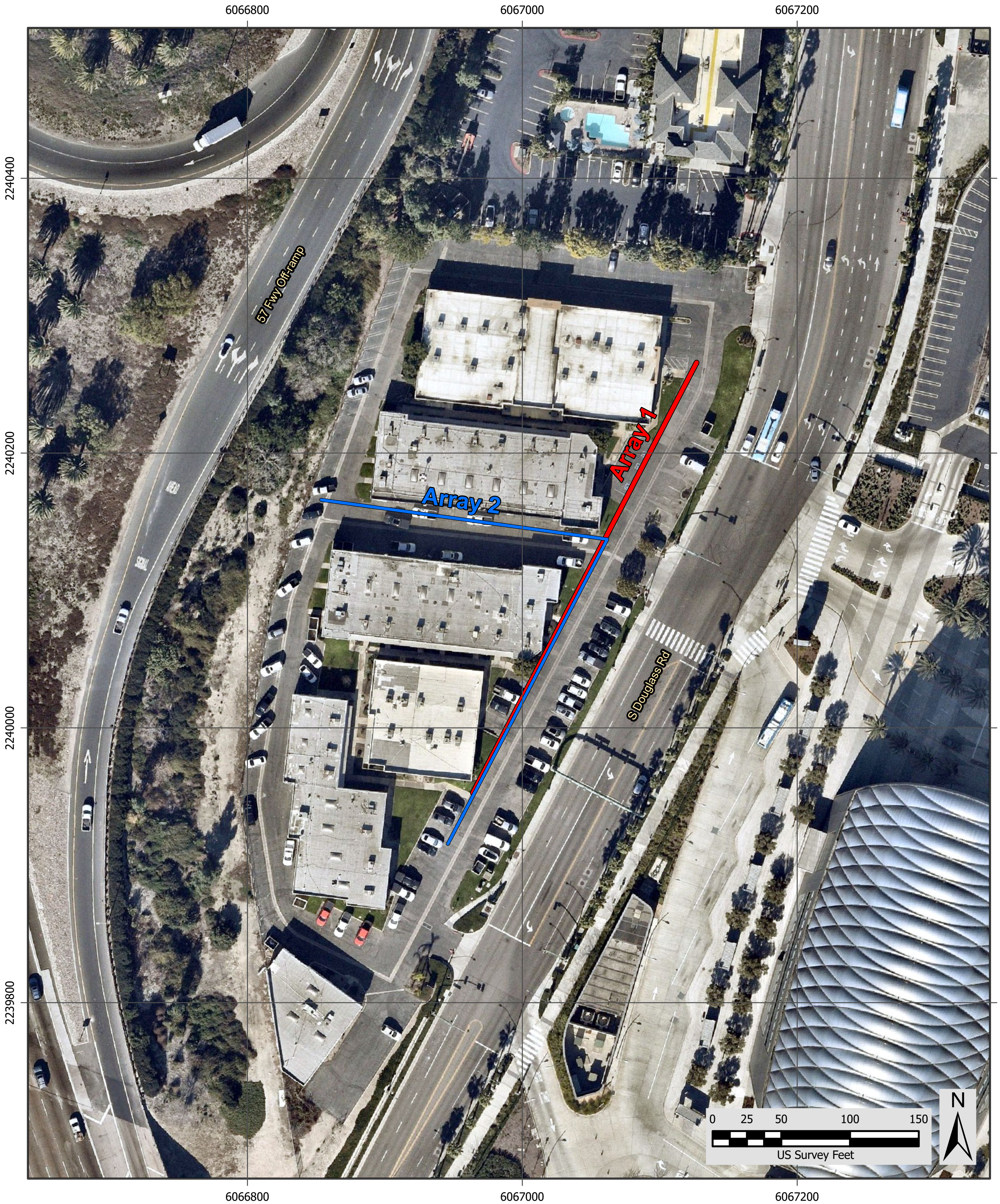
Active- and passive-source surface wave measurements were made at the property located at 1725 S Douglass Road, Anaheim, California on April 19, 2025. The purpose of this investigation was to provide a shear (S) wave velocity profile to a depth of 100 ft, or greater, and estimate the average S-wave velocity of the upper 100 ft (V_{S100ft}). The active-source surface wave technique utilized during this investigation consisted of the multi-channel analysis of surface waves (MASW) method. The passive-source surface wave technique consisted of the array microtremor method. The locations of the active- and passive-source surface wave arrays are shown on Figure 1. MASW measurements were made along a linear array (Array 1) and array microtremor measurements were made using an L-shaped array (Array 2).

For seismic design, the 2022 California Buiilding Code (CBC) and 2018 International Building Code (IBC) reference the provisions in ASCE 7-16, Chapter 20 (Minimum Design Loads and Associated Criteria for Buildings and Other Structures). The Site Classes and associated S-wave velocity ranges outlined in Table 20.3-1 of ASCE 7-16 are as follows:

Site Class A – Hard rock – $V_{S100ft} > 5{,}000$ ft/s
Site Class B – Rock –$2{,}500 < V_{S100ft} \leq 5{,}000$ ft/s
Site Class C – Very dense soil and soft rock –$1{,}200 < V_{S100ft} \leq 2{,}500$ ft/s
Site Class D – Stiff soil – $600 < V_{S100ft} \leq 1{,}200$ ft/s
Site Class E – Soft clay soil – $V_{S100ft} \leq 600$ ft/s
Site Class F – Soils requiring site response analysis

At many sites, active-source surface wave techniques with the utilization of portable energy sources, such as hammers and weight drops, are sufficient to obtain S-wave velocity sounding to 100 ft depth. However, at sites with high ambient noise levels and/or very soft soils, these energy sources may not be sufficient to image to 100 ft depth and a larger energy source, such as a bulldozer, is necessary. Alternatively, passive-source surface wave techniques, such as the array microtremor method, can be used to extend the depth of investigation providing the site has sufficient ambient noise. Two-dimensional passive-source surface wave arrays (e.g., triangular, circular, or L-shaped arrays) are expected to perform significantly better than linear arrays.

This report provides the results of the active and passive surface wave measurements conducted at the site. An overview of the surface wave methods is given in Section 2. Field and data reduction procedures are discussed in Sections 3 and 4, respectively. Data modeling is presented in Section 5 and interpretation, and results are presented in Section 6. References and our professional certification are presented in Sections 7 and 8, respectively.



Active Surface Wave Array (MASW)

Passive Surface Wave L-Array

Notes:
Coordinate System: NAD 1983 StatePlane California VI FIPS 0406 Feet
Base map source: Nearmap (1-2025)

GEOVision geophysical services

Date:	4/29/2025
GV Project:	25133
Developed by:	C Xiong
Drawn by:	T Rodriguez
Approved by:	J Shawver
File Name:	GV_25133

FIGURE 1
SITE MAP

SITE LOCATED AT 1725 S DOUGLASS RD
ANAHEIM, CALIFORNIA

PREPARED FOR
LANGAN CA, INC.

2 Overview of Surface Wave Techniques

2.1 Introduction

Active- and passive-source (ambient vibration) surface wave techniques are routinely utilized for site characterization. Active-source surface wave techniques include the spectral analysis of surface waves (SASW) and multi-channel array surface wave (MASW) methods. Passive-source surface wave techniques include the horizontal over vertical spectral ratio (HVSR) method, and the array and refraction microtremor methods.

The basis of surface wave methods is the dispersive characteristic of Rayleigh and Love waves when propagating in a layered medium. Surface waves of different wavelengths (λ) or frequencies (f) sample different depths. As a result of the variance in the shear stiffness of the distinct layers, waves with different wavelengths propagate at different phase velocities; hence, dispersion. A surface wave dispersion curve is the variation of V_R or V_L with λ or f. The Rayleigh wave phase velocity (V_R) depends primarily on the material properties (V_S, mass density, and Poisson's ratio or compression wave velocity) over a depth of approximately one wavelength. The Love wave phase velocity (V_L) depends primarily on V_S and mass density. Rayleigh and Love wave propagation are also affected by damping or seismic quality factor (Q). Rayleigh wave techniques are utilized to measure vertically polarized S-waves (S_V-waves); whereas Love wave techniques are utilized to measure horizontally polarized S-waves (S_H-waves).

2.2 Surface Wave Techniques

The MASW and array microtremor techniques were utilized during this investigation and are discussed below.

2.2.1 MASW Technique

A description of the MASW method is given by Park, 1999a and 1999b and Foti, 2000. Ground motions are typically recorded by 24, or more, geophones typically spaced 1 to 3 m apart along a linear array and connected to a seismograph. Energy sources for shallow investigations include various sized hammers and vehicle mounted weight drops. When applying the MASW technique to develop a one-dimensional (1-D) V_S model, it is preferable to use multiple-source offsets from both ends of the array. The most routinely applied MASW technique is the Rayleigh-wave based MASW method, which we refer to as MAS_RW to distinguish from Love-wave based MASW (MAS_LW). MAS_RW and MAS_LW acquisition can easily be combined with P- and S-wave seismic refraction acquisition, respectively. MAS_RW data are generally recorded using a vertical source and vertical geophone but may also be recorded using a horizontal geophone with radial (in-line) orientation. MAS_LW data are recorded using transversely orientated horizontal source and transverse horizontal geophone.

A wavefield transform is applied to the time-history data to convert the seismic record from time-offset space to frequency-wavenumber (f-k) space in which the fundamental or higher surface-wave modes can be easily identified as energy maxima and picked. Frequency and/or wavenumber can easily be mapped to phase velocity, slowness, or wavelength using the following properties: $k = 2\pi/\lambda$, $\lambda = v/f$. Common wave-field transforms include: the f-k transform (a 2D fast Fourier transform), slant-stack transform (also referred to as interceptslowness or τ-p transform and equivalent to linear Radon transform), frequency domain beamformer, and phase-shift transform. The minimum wavelength that can be recovered from MASW data set without spatial aliasing is equal to the minimum receiver spacing. Occasionally, SASW analysis procedures are used to extract surface wave dispersion data, from fixed receiver pairs, at smaller wavelengths than can be recovered by wavefield transformation. Construction of a dispersion curve over the wide frequency/wavelength range necessary to develop a robust V_S model while also limiting the maximum wavelength based on an established near-field criterion (e.g., Yoon and Rix, 2009; Li and Rosenblad, 2011), generally requires multiple source offsets.

Although the clear majority of MASW surveys record Rayleigh waves, it has been shown that Love wave techniques can be more effective in some environments, particularly shallow rock sites and sites with a highly attenuative, low velocity surface layer (Xia, et al., 2012; **GEO***Vision*, 2012; Yong, et al., 2013; Martin, et al., 2014). Rayleigh wave techniques, however, are generally more effective at sites where velocity gradually increases with depth because larger energy sources are readily available for the generation of Rayleigh waves. Rayleigh wave techniques are also more applicable to sites with high velocity layers and/or velocity inversions because the presence of such structures is more apparent in the Rayleigh wave dispersion curves than in Love wave dispersion curves. Rayleigh wave techniques are preferable at sites with a high velocity surface layer because Love waves do not theoretically exist in such environments. Occasionally, the horizontal radial component of a Rayleigh wave may yield higher quality dispersion data than the vertical component because different modes of propagation may have more energy in one component than the other. Recording both the vertical and horizontal components of the Rayleigh wave is particularly useful at sites with complex modes of propagation or when attempting to recover multiple Rayleigh wave modes for multi-mode modeling as demonstrated in Dal Moro, et al, 2015. Joint inversion of Rayleigh and Love wave data may yield more accurate V_S models and offer a means to investigate anisotropy, where S_V- and S_H-wave velocity are not equal, as shown in Dal Moro and Ferigo, 2011.

2.2.2 Array Microtremor Technique

A detailed discussion of the array microtremor method can be found in Okada, 2003. Unlike active source techniques which use an active energy source (e.g., hammer), the array microtremor technique (also referred to as passive surface wave or array ambient vibration method) records background noise (ambient vibrations) emanating from ocean wave activity, wind noise, traffic, industrial activity, construction, etc. The technique uses 4, or more, receivers aligned in a 2-dimensional array. Triangle, circle, semi-circle, and "L" shaped arrays are commonly used, although any 2-dimensional arrangement of receivers can be used. For investigations of the upper 100 m, receivers typically consist of 1 to 4.5 Hz geophones. For deeper investigations, 5- to 120-second seismometers are generally utilized. The nested triangle array, which consists of several embedded equilateral triangles, is popular as it provides accurate dispersion curves with a relatively small number of geophones. The "L" array is useful at sites located at the corner of intersecting streets. The maximum receiver separation in an array should be at a minimum equal to the desired depth of investigation. Typically, 15 to 60 minutes of ambient vibration data is recorded depending on the size of the array, desired depth of investigation, and noise conditions. Investigations to depths on the order of 1 km may require that ambient vibrations are recorded for a much longer duration. The surface wave dispersion curve is typically estimated from array microtremor data using various f-k methods such as beamforming (Lacoss, et al., 1969), and maximum-likelihood (Capon, 1969), and the spatial-autocorrelation (SPAC) method. The beam-forming and maximum-likelihood methods are generally referred to as the frequency wavenumber (FK) and high-resolution frequency wavenumber (HRFK or HFK) methods. The SPAC method was originally based on work by Aki, 1957 and has since been extended and modified (Ling and Okada, 1993 and Ohori *et al*., 2002) to permit the use of noncircular arrays, and is now collectively referred to as extended spatial autocorrelation (ESPAC or ESAC). Further modifications to the SPAC method permit the use of irregular or random arrays (Bettig *et al*., 2001). Although it is common to apply SPAC methods to obtain a surface wave dispersion curve for modeling, other approaches involve direct modeling of the coherency data, also referred to as SPAC coefficients (Asten, 2006 and Asten, *et al*., 2015). The beam-forming and maximum-likelihood methods are generally referred to as the frequency wavenumber (FK) and high-resolution frequency wavenumber (HRFK or HFK) methods, respectively. More recently, a Rayleigh wave three-component beamforming method (RTBF) has been developed (Wathelet, et al., 2018) and appears to offer significant resolution enhancements over other methods.

FK, HRFK and RTBF methods are generally expected to perform better when ambient vibration sources are not azimuthally well-distributed (e.g., rural area where the primary noise source is a large industrial facility). SPAC methods are expected to perform better when noise sources are azimuthally well-distributed (e.g., in a large, urbanized area).

The minimum wavelength surface wave that can be extracted from an array microtremor dataset acquired utilizing a symmetric array is typically set equal to the minimum receiver spacing. The maximum wavelength is often set equal to twice the maximum receiver separation for SPAC analysis and the maximum receiver spacing for FK analysis.

2.3 Surface Wave Dispersion Curve Modeling

The dispersion curves generated from the active and passive surface wave soundings are generally combined and modeled using iterative forward and inverse modeling routines. The final model profile is assumed to represent actual site conditions. The theoretical model used to interpret the dispersion curve assumes horizontally layered, laterally invariant, homogeneous-isotropic material. Although these conditions are seldom strictly met at a site, the results of active and/or passive surface wave testing provide a good “global” estimate of the material properties along the array. The results may be more representative of the site than a borehole “point” estimate.

The surface wave forward problem is typically solved using the Thomson-Haskell transfer-matrix (Thomson, 1950; Haskell, 1953) later modified by Dunkin (1965) and Knopoff (1964), dynamic stiffness matrix (Kausel and Roësset, 1981), or reflection and transmission coefficient (Kennett, 1974) methods. Each of these methods can determine fundamental- and higher-mode phase velocities, which correspond to plane waves in 2-D space. The transfer-matrix method is often used in MASW and passive surface-wave software packages, whereas the dynamic stiffness matrix is utilized in many SASW software packages. MAS_RW and/or passive surface-wave modeling may involve modeling of the fundamental mode, some form of effective mode, or multiple individual modes (multi-mode). As outlined in Roësset et al. (1991), several options exist for forward modeling of Rayleigh wave SASW data. One formulation considers only fundamental mode, plane Rayleigh-wave motion (called the 2-D solution), whereas another includes all stress waves (e.g., body, fundamental, and higher mode surface waves) and incorporates a generalized receiver geometry (3-D global solution) or actual receiver geometry (3-D array solution).

The fundamental mode assumption is generally applicable to modeling Rayleigh-wave dispersion data collected at normally dispersive sites, providing there are not abrupt increases in velocity or steep velocity gradients. Effective-mode or multi-mode approaches are often required for irregularly dispersive sites and sites with steep velocity gradients at shallow depth. If active and passive surface wave data are combined or MAS_RW data are combined from multiple seismic records with different source offsets and receiver gathers, then effective-mode computations are limited to algorithms that assume far-field plane Rayleigh wave propagation. Local search (e.g., linearized matrix inversion methods) or global search methods (e.g., Monte Carlo approaches such as simulated annealing, generic algorithm, and neighborhood algorithm) are typically used to solve the inverse problem.

The maximum wavelength (λ_{max}) recovered from a surface wave data set is typically used to estimate the depth of investigation although a sensitivity analysis of the V_S models would be a more robust means to estimate the depth of investigation. For normally dispersive velocity profiles with a gradual increase in V_S with depth, the maximum depth of investigation is on the order of $\lambda_{max}/2$ for both Rayleigh and Love wave dispersion data. For velocity profiles with an abrupt increase in V_S at depth, the maximum depth of investigation is on the order of $\lambda_{max}/3$ for Rayleigh wave dispersion data but less than $\lambda_{max}/3$ for Love wave dispersion data. The depth of investigation can be highly variable for sites with complex velocity structure (e.g., high velocity layers).

As with all other surface geophysical methods, the inversion of surface wave dispersion data does not yield a unique V_S model, and multiple possible solutions may equally fit the experimental data. Based on experience at other sites, the shear wave velocity models (V_S and layer thicknesses) determined by surface wave testing are within 20% of the velocities and layer thicknesses that would be determined by other seismic methods (Brown, 1998). The average velocity of the upper 30 m, however, is much more accurate, often to better than 5%, because it is not sensitive to the layering in the model. V_{S30} does not appear to suffer from the non-uniqueness inherent in V_S models derived from surface wave dispersion curves (Martin et al., 2006, Comina et al., 2011). Therefore, V_{S30} is more accurately estimated from the inversion of surface wave dispersion data than the resulting V_S models.

It may not always be possible to develop a coherent, fundamental mode dispersion curve over sufficient frequency range for modeling due to dominant higher modes with the higher modes not clearly identifiable for multi-mode modeling. It may, however, be possible to identify the Rayleigh wave phase velocity of the fundamental mode at 40 m wavelength (V_{R40}) in which case V_{S30} can at least be estimated using the Brown et al., 2000 relationship:

$$V_{S30} = 1.045V_{R40}$$

This relationship was established based on a statistical analysis of many surface wave data sets from sites with borehole velocity control and has been further evaluated by Martin and Diehl, 2004, and Albarello and Gargani, 2010. Further investigation of this approach has revealed that

V_{S30} is generally between V_{R40} and V_{R45} with V_{R40} often being most appropriate for shallow groundwater sites and V_{R45} for deep groundwater sites.

3 FIELD PROCEDURES

Two types of surface wave data were acquired at the site: an active-source surface wave array to characterize near-surface velocity structure and a passive-source surface wave array to characterize deeper velocity structure. The active- and passive-source surface wave sounding locations at the site are shown in Figure 1. Active-source surface wave data were acquired along Array 2 using the MASW technique. Passive-source surface wave data were acquired along Array 1 using the array microtremor method. The surface wave arrays were surveyed using a Trimble R10 GPS system with the RTX differential correction service.

MASW equipment used during this investigation consisted of Geometrics Geode signal enhancement seismographs, 4.5 Hz vertical geophones, seismic cables, an Accelerated Weight Drop (AWD), 20lb sledgehammer, and 4lb hammer. MASW data were acquired along a linear array of 48 geophones spaced 7.5 ft apart for a length of 352.5 ft (Array 1). Source locations were located at 45 ft intervals in the interior of the array and up to 90 ft from each end geophone. The AWD was used on the off-end shots, and the 20 and 4lb hammers were used on the interior shots. Data from the transient impacts (hammers) were generally averaged 5 to 12 times to improve the signal-to-noise ratio. All field data were saved to hard disk and documented on field data acquisition forms.

The array microtremor equipment consisted of Geometrics Geode signal enhancement seismographs, 4.5 Hz vertical geophones. Array 1 consisted of a 47-station L-shaped array with a geophone spacing of 10ft. Ambient noise measurements were made along the array for about 75 minutes at a 2-millisecond sample rate. The field geometry and associated files names were documented in field notes.

4 DATA REDUCTION

The MASW data were reduced using the software Seismic Pro Surface V10 developed by Geogiga and multiple in-house scripts for various data extraction and formatting tasks, with all data reduction documented in a Microsoft Excel spreadsheet.

The following steps were used for data reduction:

- Input seismic records to be used for analysis into software package.
- Check and correct source and receiver geometry as necessary.
- Select offset range used for analysis (multiple offset ranges utilized for each seismic record as discussed below) and document in spreadsheet.
- Apply phase shift transform to seismic record to convert the data from time – offset to frequency – phase velocity space.
- Identify, pick, save, and document dispersion curve.
- Change the receiver offset range and repeat process.
- Repeat process for all seismic records.
- Use in-house script to apply near-field criteria with maximum wavelength set equal to 1.0 times the source to midpoint of receiver array distance.
- Use in-house script to merge multiple dispersion curves extracted from the MASW data collected along each seismic line for a specific source type (different source locations, different receiver offset ranges, etc.).
- Edit dispersion data, as necessary (e.g., delete poor quality curves and outliers).
- Calculate a representative dispersion curve at equal log-frequency or log-wavelength spacing for the MASW dispersion data using a moving average, polynomial curve fitting routine.

This unique data reduction strategy, which can involve combination of over 50 dispersion curves for a 1-D sounding, is designed for characterizing sites with complex velocity structure that do not yield surface wave dispersion data over a wide frequency range from a single source type or source location. The data reduction strategy ensures that the dispersion curve selected for modeling is representative of average conditions beneath the array and spans as broad a frequency/wavelength range as possible while considering near field effects.

The array microtremor data were reduced using the SeisImager software package developed by Oyo Corporation/Geometrics, Inc., and the following steps:

The processing sequence for implementation of the ESAC method in the SeisImager software package is as follows:

- Input seismic record(s) for a dataset into software.
- Optionally, extract subarrays with different apertures from the array.
- Load receiver geometry (x and y positions) for each channel in seismic record.
- Apply time-segmentation routine to break the data file(s) into multiple 30 to 60 second seismic records, as necessary.
- Calculate the SPAC coefficients for each seismic record and average.
- Optionally, select a subset of receiver offset ranges for analysis (e.g., only select receiver pairs with multiple azimuths).

- For each frequency calculate the RMS error between the SPAC coefficients and a Bessel function of the first kind and order zero over a user defined phase velocity range and velocity step.
- Plot an image of RMS error as a function for frequency (f) and phase velocity (v).
- Identify and pick the dispersion curve as the continuous trend on the f-v image with the lowest RMS error.
- Repeat the process for all arrays and time blocks.
- Use an in-house script to convert dispersion curves to appropriate format for editing.
- Edit dispersion data, as necessary, and use in-house script to combine all dispersion data after setting maximum wavelength to about 2 times the maximum receiver spacing.
- Calculate a representative dispersion curve for the passive dispersion data from each array using a moving average polynomial curve fitting routine.

The representative dispersion curves from the active and passive surface wave data were combined and the moving average polynomial curve fitting routine in WinSASW V3 was used to generate a composite representative dispersion curve for modeling. During this process, the active and passive surface wave dispersion data were given equal weights. An equal logarithm wavelength sample rate was used for the representative dispersion curve to reflect the gradual loss in model resolution with depth.

5 DATA MODELING

Surface wave data were modeled using the fundamental mode Rayleigh wave routine in the WinSASW V3 software package. During this process, an initial velocity model was generated based on general characteristics of the dispersion curve and the inverse modeling routine utilized to adjust the layer V_S until an acceptable agreement with the observed data was obtained. Layer thicknesses were adjusted, as necessary, and the inversion process repeated until a V_S model was developed with low RMS error between the observed and calculated dispersion curves. Data inputs into the modeling software include layer thickness, S-wave velocity, P-wave velocity or Poisson's ratio, and mass density. P-wave velocity and mass density only have a very small influence (i.e., less than 10%) on the S-wave velocity model generated from a surface wave dispersion curve. However, realistic assumptions for P-wave velocity, which is significantly impacted by the location of the saturated zone, and mass density will slightly improve the accuracy of the S-wave velocity model.

Constant mass density values of 111 to 124 lb./ft^3 were used in the velocity profiles for subsurface soils/rock depending on P- and S-wave velocity. Within the normal range encountered in geotechnical engineering, variation in mass density has a negligible (±2%) effect on the estimated V_S from surface wave dispersion data. During modeling of Rayleigh wave dispersion data, the compression wave velocity, V_P, for unsaturated sediments was estimated using a Poisson's ratio, v, of 0.3 and the relationship:

$$V_P = V_S \, [(2(1-v))/(1-2v)]^{0.5}$$

Poisson's ratio has a larger effect than density on the estimated V_S from Rayleigh wave dispersion data. Achenbach (1973) provides approximate relationship between Rayleigh wave velocity (V_R), V_S and v:

$$V_R = V_S \, [(0.862 + 1.14\, v)/(1+ v)]$$

Using this relationship, it can be shown that V_S derived from V_R only varies by about 10% over possible 0 to 0.5 range for Poisson's ratio where:

$$V_S = 1.16V_R \text{ for } v = 0$$
$$V_S = 1.05V_R \text{ for } v = 0.5$$

The common range of Poisson's ratio for unsaturated sediments is about 0.25 to 0.35. Over this range, V_S derived from modeling of Rayleigh wave dispersion data will vary by about 5%. The depth to the high Poisson's ratio, saturated zone was fixed to the layer closest to a depth of 60 ft per drilling observation.

6 INTERPRETATION AND RESULTS

A V_S model was developed from the Rayleigh wave dispersion data derived from MASW and array microtremor data acquired along Arrays 1 and 2. The fit of the calculated fundamental mode dispersion curve to the experimental data collected along Arrays 1 and 2 and the modeled V_S profile for the surface wave sounding are presented as Figure 2. The resolution decreases gradually with depth due to the loss of sensitivity of the dispersion curve to changes in V_S at greater depth. The V_S profile used to match the field data is provided in tabular form as Table 1.

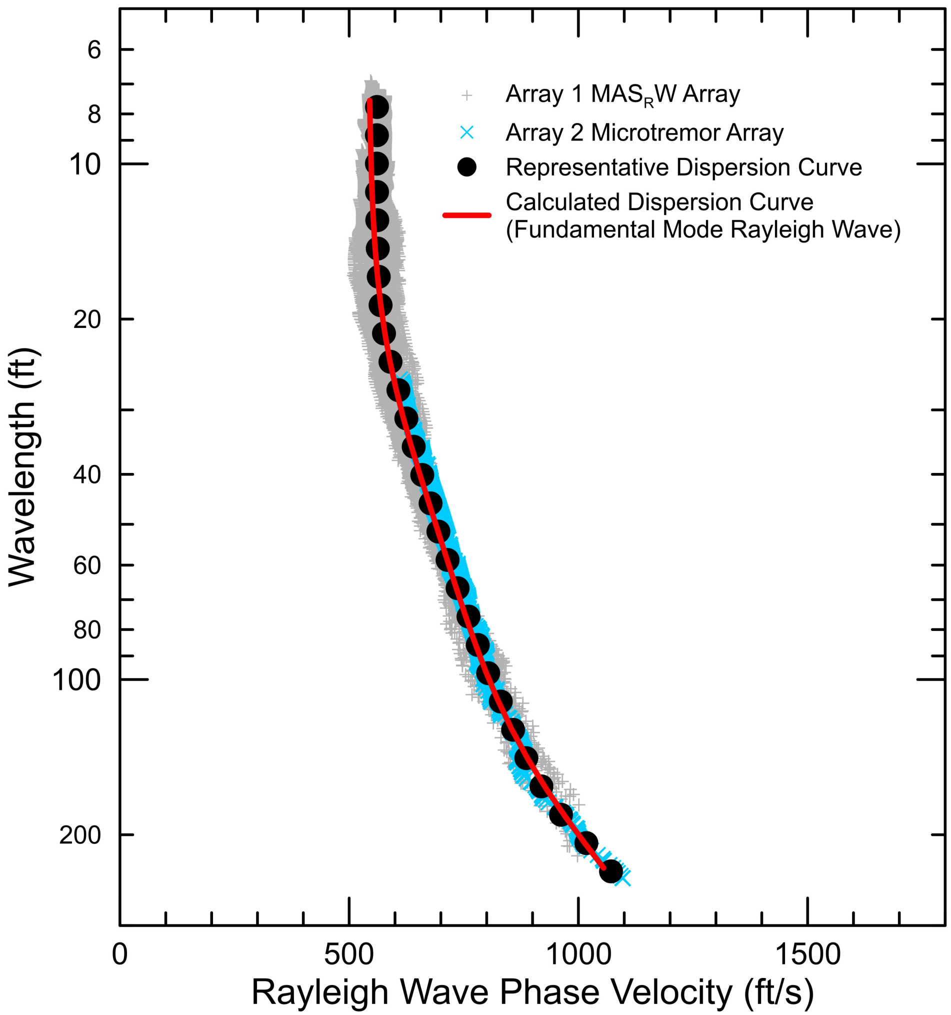
The Rayleigh wave phase velocities from the microtremor array are in good agreement with those from the MASW data in the overlapping wavelength region. Scatter in dispersion data from the two methods are expected to be primarily associated with lateral velocity variability beneath the arrays. Monochromatic noise sources were observed on the coherency data around 20, 29 and 38 Hz.

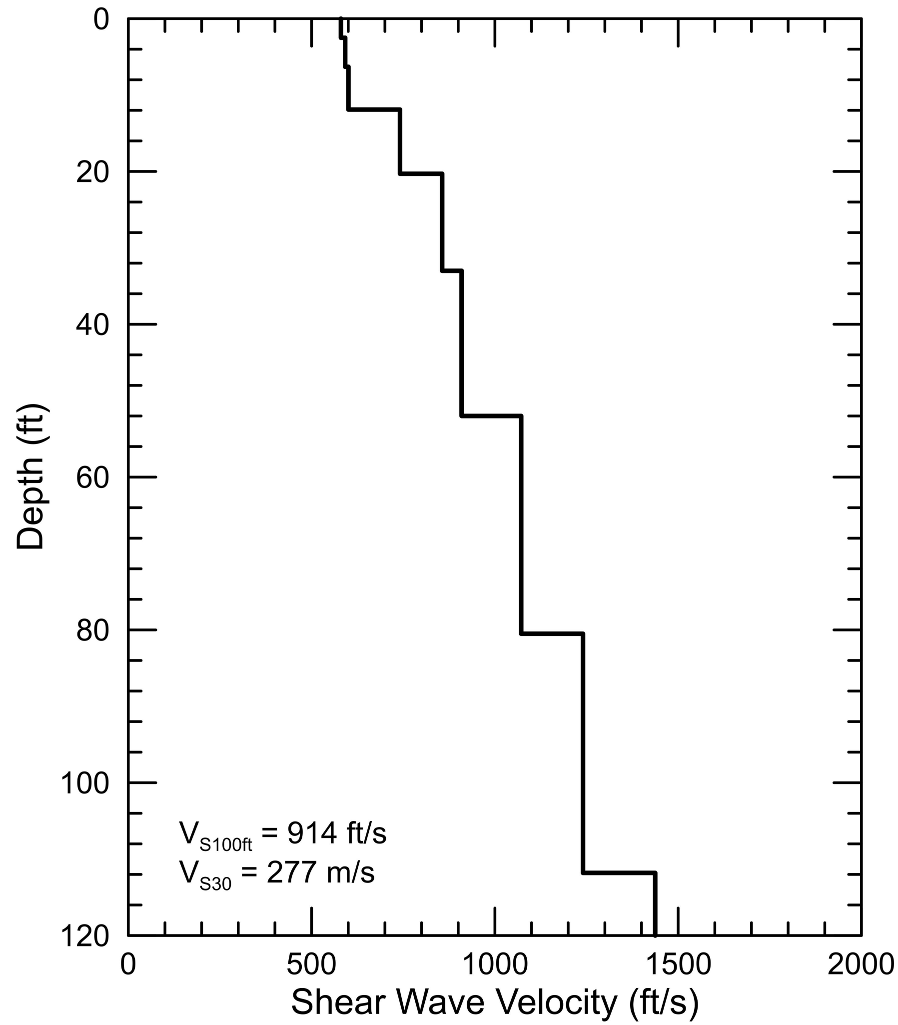
The estimated depth of investigation for the combined active- and passive-source surface wave sounding is about 120 ft. Shear wave velocity gradually increases with depth from about 580 ft/s near the surface to 1437 ft/s at a model depth of 112 ft.

The average shear wave velocity to a depth of 100 ft (V_{S100ft}) is 914 ft/s for the V_S model. Therefore, per the criteria in the 2022 CBC and ASCE 7-16, the site is classified as Site Class D, stiff soil.

Table 1 Arrays 1 and 2 V_S Model

Depth to Top of Layer (ft)	Layer Thickness (ft)	S-Wave Velocity (ft/s)	Inferred P-Wave Velocity (ft/s)	Inferred Poisson's Ratio	Inferred Unit Weight (lb/ft^3)
0	2.5	580	1085.1	0.3	111.1
2.5	3.8	591.7	1107	0.3	111.6
6.3	5.6	600.5	1123.5	0.3	111.9
11.9	8.4	741.2	1386.7	0.3	116.3
20.3	12.7	856.2	1601.8	0.3	118.6
33	19	909.3	1701.2	0.3	119.4
52	28.5	1071.8	5421.9	0.48	121.1
80.5	31.3	1240.4	5609.1	0.474	122.7
111.8	**Half space**	1437.4	5827.8	0.468	124.4





GEOVision geophysical services

Project No: 25133
Date: April 25, 2025
Drawn By: C Garcia
Approved By: JB Shawver
R:\GVProjects\2025\25133 - Langan\Report\Figure 2.cdr

FIGURE 2
SURFACE WAVE MODEL - ARRAYS 1 AND 2

1725 S DOUGLASS RD
ANAHEIM, CALIFORNIA

PREPARED FOR
LANGAN

7 REFERENCES

Achenbach J, 1973, Wave Propagation in Elastic Solids, Elsevier, Amsterdam, Netherlands.

Aki K, 1957, Space and time spectra of stationary stochastic waves, with special reference to microtremors. *Bull. Earthq. Inst. Univ. Tokyo*, Vol. 35, p 415–457.

Albarello D and Gargani G, 2010, "Providing NEHRP soil classification from the direct interpretation of effective Rayleigh-wave dispersion curves", *Bulletin of the Seismological Society of America*, Vol. 100, No. 6, p 3284-3294.

Asten M, 2006, Site shear velocity profile interpretation from microtremor array data by direct fitting of SPAC curves, in *Proceedings of the Third Int. Symp. Effects of Surface Geol. Seismic Motion*, Vol. 2, LCPC Edition, Grenoble, France, August 30–September 01, Paper No. 99, p 1069-1080.

Asten M, Stephenson WJ and Hartzell, S, 2015, The use of wavenumber normalization in computing spatially averaged coherencies (krSPAC) of microtremor data from asymmetric arrays, *Proceedings 6th International Conference on Earthquake Geotechnical Engineering*, Christchurch, New Zealand, 9 p.

Bettig B, Bard PY, Scherbaum F, Riepl J, Cotton F, Cornou C and Hatzfeld D, 2001, Analysis of dense array noise measurements using the modified spatial auto-correlation method (SPAC): application to the Grenoble area, *Bollettino di Geofisica Teoricaed Applicata*, Vol 42, p 281–304.

Brown L, 1998, Comparison of V_S profiles from SASW and borehole measurements at strong motion sites in Southern California, Master's thesis, University of Texas, Austin.

Brown L, Diehl J and Nigbor R, 2000, A simplified method to measure average shear-wave velocity in the top 30 m (V_s30), *Proc. 6th International Conference on Seismic Zonation*, p 1–6.

Capon J, 1969, High-resolution frequency-wavenumber spectrum analysis, *Proc. Institute of Electrical and Electronics Engineers (IEEE)*, Vol. 57, no. 8, p 1408–1418.

Comina C, Foti S, Boiero D, and Socco LV, 2011, Reliability of $V_{S,30}$ evaluation from surface-wave tests, *J. Geotech. Geoenviron. Eng.*, p 579–586.

Dal Moro G, Moura R, Moustafa A, 2015, Multi-component joint analysis of surface waves, *Journal of Applied Geophysics*, Vol. 119, p 128-138.

Dal Moro G and Ferigo F, 2011, Joint Analysis of Rayleigh- and Love-wave dispersion curves: Issues, criteria and improvements, *Journal of Applied Geophysics*, Vol. 75, p 573-589.

Dunkin J W, 1965, Computation of modal solutions in layered, elastic media at high frequencies, *Bulletin of the Seismological Society of America*, Vol. 55, pp. 335–358.

Foti S, 2000, Multistation Methods for Geotechnical Characterization using Surface Waves, Ph.D. Dissertation, Politecnico di Torino, Italy.

GEOVision, Inc (2012): EPRI (2004, 2006) ground-motion model (GMM) review project: Shear wave velocity measurements at seismic recording stations, http://www.epri.com/abstracts/Pages/ProductAbstract. aspx?ProductId=000000003002000719.

Haskell N A, 1953, The dispersion of surface waves on multilayered media, *Bull. Seismol. Soc. Am.*, v. 43, pp. 17–34.

Kausel, E. and J. M. Röesset (1981). Stiffness matrices for layered soils, *Bulletin of the Seismological Society of America*, v. 71, no. 6, pp. 1743–1761.

Kennett, B.L.N (1974). Reflections, rays and reverberations, *Bulletin of the Seismological Society of America*, v. 64, no. 6, pp. 1685–1696.

Knopoff L. (1964). "A matrix method for elastic wave problems." *Bulletin of the Seismological Society of America*, Vol. 54, pp. 431–438.

Lacoss R, Kelly E and Toksöz M, 1969, Estimation of seismic noise structure using arrays, *Geophysics*, v. 34, pp. 21-38.

Li J and Rosenblad B, 2011, Experimental study of near-field effects in multichannel array-based surface wave velocity measurements, *Near Surface Geophysics*, Vol. 9, 357-366.

Ling S and Okada H, 1993, An extended use of the spatial correlation technique for the estimation of geological structure using microtremors, *Proc. the 89th Conference Society of Exploration Geophysicists Japan (SEGJ)*, pp. 44–48 (in Japanese).

Martin A and Diehl J, 2004, Practical experience using a simplified procedure to measure average shear-wave velocity to a depth of 30 meters (V_S30), *Proceedings of the 13th World Conference on Earthquake Engineering*, Vancouver, B.C., Canada, August 1-6, 2004, Paper No. 952.

Martin A, Shawver J and Diehl J, 2006, Combined use of Active and Passive Surface Wave Techniques for Cost Effective UBC/IBC Site Classification, *Proceedings of the 8th National Conference on Earthquake Engineering*, San Francisco, California, Paper No. 1013.

Martin A, Yong A and Salomone L, 2014, Advantages of active Love wave techniques in geophysical characterization of seismographic station sites – case studies in California and the Central and Eastern United States, Proceedings of the Tenth U.S. National Conference on Earthquake Engineering, Frontiers of Earthquake Engineering, July 21-25, Anchorage, Alaska.

Ohori M, Nobata A, and Wakamatsu K, 2002, A comparison of ESAC and FK methods of estimating phase velocity using arbitrarily shaped microtremor arrays, *Bull. Seismol. Soc. Am.*, v. 92, no. 6, p. 2323–2332.

Okada H, 2003, The Microtremor Survey Method, *Society of Exploration Geophysics Geophysical Monograph Series*, Number 12, 135p.

Park C, Miller R and Xia J, 1999a, Multimodal analysis of high frequency surface waves, *Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems '99*, 115-121.

Park C, Miller R and Xia, J, 1999b, Multichannel analysis of surface waves, *Geophysics*, Vol 64, No. 3, 800-808.

Thomson W T, 1950, Transmission of elastic waves through a stratified solid medium, *J. Applied Physics*, v. 21, no. 2, pp. 89–93.

Wathelet M, Guillier B, Roux P, Cornou C and Ohrnberger M, 2018, Rayleigh wave three-component beamforming: signed ellipticity assessment from high-resolution frequency-wavenumber processing of ambient vibration arrays, *Geophysical Journal International*, Vol 215, p 507-523.

Xia J, Xu Y, Luo Y, Miller R, Cakir R and Zeng C, 2012, Advantages of using Multichannel analysis of Love waves (MALW) to estimate near-surface shear-wave velocity, *Surveys in Geophysics*, 841–860.

Yong A, Martin A, Stokoe K and Diehl J, 2013, ARRA-funded V_{S30} measurements using multi-technique method approach at strong-motion stations in California and Central-Eastern United States, Open-File Report 2013-1102, United States Geological Survey, http://pubs.usgs.gov/of/2013/1102/.

Yoon S and Rix G, 2009, Near-field effects on Array-based surface wave methods with active sources, *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 135, no. 3, 399-406.

8 CERTIFICATION

All geophysical data, analysis, interpretations, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by a **GEO***Vision* California Professional Geophysicist.

Prepared by

April 29, 2025

Carlos Garcia | Date

Senior Staff Geophysicist
GEO*Vision* Geophysical Services

Approved by

April 29, 2025

JB Shawver | Date

California Professional Geophysicist, P.Gp. 1058
GEO*Vision* Geophysical Services

* This geophysical investigation was conducted under the supervision of a California Professional Geophysicist using industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing, interpretation, and reporting. All original field data files, field notes, observations, and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

A professional geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, or ordinances

APPENDIX E
Results of Liquefaction Analysis

PERCOLATION TEST DATA SHEET

LANGAN

Project:	Proposed OCVIBE Parking Structure A			Project No.:	700170401		Date of Test:	5/10/2025	
Test Hole No.:		FP-1		Tested By:	SB/SHW				
Depth of Test Hole (ft):		12	Filter Pack Porosity (n)		0.39		USCS Soil Classification:		SAND (SP)
Casing Length (ft):		12	Casing Diameter (p, in)		4		Test Hole Diameter (b, in):		10
Trial No.	Date	Time of Measurement	Initial Depth to Water (Feet)	Time of Measurement	Final Depth to Water (Feet)	Time Interval (min)	Change in Water Level (Feet)	Percolation Rate (in/min)	Infiltration Rate (in/hr)
Sandy Soil #1	5/10/2025	8:00 AM	6.50	8:00 AM	7.00	0.13	0.50	46.15	
Sandy Soil #2	5/10/2025	8:10 AM	7.00	8:10 AM	7.50	0.15	0.50	40.00	
1	5/10/2025	8:30 AM	6.50	8:40 AM	10.27	10	3.77	4.52	
2	5/10/2025	8:40 AM	6.50	8:50 AM	10.15	10	3.65	4.38	
3	5/10/2025	8:50 AM	6.50	9:00 AM	10.07	10	3.57	4.28	
4	5/10/2025	9:00 AM	6.50	9:10 AM	10.00	10	3.50	4.20	
5	5/10/2025	9:10 AM	6.50	9:20 AM	10.03	10	3.53	4.24	
6	5/10/2025	9:20 AM	6.50	9:30 AM	10.10	10	3.60	4.32	
							Uncorrected Infiltration Rate		13.8
							Correction Factor (C)		0.49
							Corrected Infiltration Rate		**6.7**

Comments:

1. Percolation test was performed in accordance with the Orange County - Technical Guidance Document dated 20 December 2013.
2. Infiltration Rate was calculated using Porchet Method.
3. Correction factor formula: $C=(1-n)\ dp^2/db^2+n$; where n=porosity of filter pack; dp=diameter of pipe (casing); db=diameter of boring
4. Weather: Sunny, 80s
5. Measurements were collected from the top of the PVC pipe.

PERCOLATION TEST DATA SHEET

LANGAN

Project:	Proposed OCVIBE Parking Structure A				Project No.:	700170401	Date of Test:	5/10/2025	
Test Hole No.:		FP-2			Tested By:	SB/SW			
Depth of Test Hole (ft):		16	Filter Pack Porosity (n)		0.39		USCS Soil Classification:		SAND (SP)
Casing Length (ft):		16	Casing Diameter (p, in)		4		Test Hole Diameter (b, in):		10
Trial No.	Date	Time of Measurement	Initial Depth to Water (Feet)	Time of Measurement	Final Depth to Water (Feet)	Time Interval (min)	Change in Water Level (Feet)	Percolation Rate (in/min)	Infiltration Rate (in/hr)
Sandy Soil #1	5/10/2025	10:00 AM	9.50	10:00 AM	10.00	0.33	0.50	18.18	
Sandy Soil #2	5/10/2025	10:10 AM	10.00	10:10 AM	10.50	0.42	0.50	14.29	
1	5/10/2025	10:10 AM	10.00	10:20 AM	13.82	10	3.82	4.58	
2	5/10/2025	10:20 AM	10.00	10:30 AM	13.91	10	3.91	4.69	
3	5/10/2025	10:30 AM	10.00	10:40 AM	14.04	10	4.04	4.85	
4	5/10/2025	10:40 AM	10.00	10:50 AM	13.98	10	3.98	4.78	
5	5/10/2025	10:50 AM	10.00	11:00 AM	14.03	10	4.03	4.84	
6	5/10/2025	11:00 AM	10.00	11:10 AM	14.00	10	4.00	4.80	
							Uncorrected Infiltration Rate		14.3
							Correction Factor (C)		0.49
							Corrected Infiltration Rate		**7.0**

Comments:
1. Percolation test was performed in accordance with the Orange County - Technical Guidance Document dated 20 December 2013.
2. Infiltration Rate was calculated using Porchet Method.
3. Correction factor formula: $C=(1-n)\ dp^2/db^2+n$; where n=porosity of filter pack; dp=diameter of pipe (casing); db=diameter of boring
4. Weather: Sunny, 80s
5. Measurements were collected from the top of the PVC pipe.

Attachment D

2-Year Storm Event Hydrology Calculations

```
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1535

                           Analysis prepared by:

                                  Stantec




 ************************* DESCRIPTION OF STUDY *************************
* OCVIBE - DECK A                                                          *
* 2-YR Storm Analysis - Proposed Condition                                 *
* 2042682200\design\npdes\preliminary wqmp\deck_a\3rd_submittal\pda2p.dat  *
 **************************************************************************

  FILE NAME: PDA2P.DAT
  TIME/DATE OF STUDY: 09:35 07/29/2025
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======   ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   400.00
  ELEVATION DATA: UPSTREAM(FEET) =    161.00  DOWNSTREAM(FEET) =    158.05

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.915
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.624
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.14      0.30     0.100    36    8.92
  APARTMENTS                 B        0.31      0.30     0.200    36    9.50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
  SUBAREA RUNOFF(CFS) =      0.64
  TOTAL AREA(ACRES) =      0.45   PEAK FLOW RATE(CFS) =      0.64

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   150.60  DOWNSTREAM(FEET) =   149.86
  FLOW LENGTH(FEET) =    62.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.35
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.64
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    9.22
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     462.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.22
  RAINFALL INTENSITY(INCH/HR) =   1.59
  AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.17
  EFFECTIVE STREAM AREA(ACRES) =       0.45
  TOTAL STREAM AREA(ACRES) =       0.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.64

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   175.00
  ELEVATION DATA: UPSTREAM(FEET) =    159.27  DOWNSTREAM(FEET) =    158.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.931
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.877
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.09      0.30     0.100    36    6.93
  APARTMENTS                 B        0.20      0.30     0.200    36    7.39
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
  SUBAREA RUNOFF(CFS) =      0.48
  TOTAL AREA(ACRES) =      0.29   PEAK FLOW RATE(CFS) =      0.48

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.93
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.877
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.05      0.30     0.100    36
  APARTMENTS                 B        0.13      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
  SUBAREA AREA(ACRES) =    0.18      SUBAREA RUNOFF(CFS) =    0.30
  EFFECTIVE AREA(ACRES) =      0.47   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.17
  TOTAL AREA(ACRES) =        0.5       PEAK FLOW RATE(CFS) =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   155.40  DOWNSTREAM(FEET) =   153.00
  FLOW LENGTH(FEET) =   227.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.41
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       0.77
  PIPE TRAVEL TIME(MIN.) =   1.11    Tc(MIN.) =    8.04
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    105.00 =     402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.04
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.724
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK               B        0.16      0.30     0.850    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    0.16      SUBAREA RUNOFF(CFS) =    0.21
  EFFECTIVE AREA(ACRES) =      0.63   AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =        0.6       PEAK FLOW RATE(CFS) =       0.92

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   153.00  DOWNSTREAM(FEET) =   151.00
  FLOW LENGTH(FEET) =   207.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.48
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.92
  PIPE TRAVEL TIME(MIN.) =   0.99    Tc(MIN.) =    9.03
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    106.00 =     609.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.03
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.612
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                B        0.64      0.30     0.100    36
  APARTMENTS                B        1.50      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.170
```

```
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    3.02
  EFFECTIVE AREA(ACRES) =      2.78   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =        2.8       PEAK FLOW RATE(CFS) =       3.88

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    102.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   151.00  DOWNSTREAM(FEET) =   149.86
  FLOW LENGTH(FEET) =   119.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.20
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.88
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    9.41
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    102.00 =     728.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.41
  RAINFALL INTENSITY(INCH/HR) =   1.57
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.21
  EFFECTIVE STREAM AREA(ACRES) =       2.78
  TOTAL STREAM AREA(ACRES) =       2.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.88

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.64    9.22    1.593  0.30( 0.05) 0.17       0.4     100.00
      2        3.88    9.41    1.574  0.30( 0.06) 0.21       2.8     103.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.48    9.22    1.593  0.30( 0.06) 0.20       3.2     100.00
      2        4.51    9.41    1.574  0.30( 0.06) 0.20       3.2     103.00
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.51    Tc(MIN.) =     9.41
  EFFECTIVE AREA(ACRES) =       3.23   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        3.2
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    102.00 =     728.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    107.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   154.01  DOWNSTREAM(FEET) =   152.12
  FLOW LENGTH(FEET) =   413.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.08
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.51
  PIPE TRAVEL TIME(MIN.) =   1.69    Tc(MIN.) =   11.10
  LONGEST FLOWPATH FROM NODE    103.00 TO NODE    107.00 =    1141.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =     11.10
  EFFECTIVE AREA(ACRES) =      3.23  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.204
  PEAK FLOW RATE(CFS)   =       4.51

  ** PEAK FLOW RATE TABLE **
   STREAM      Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       4.48   10.91    1.446  0.30( 0.06) 0.20       3.2     100.00
      2       4.51   11.10    1.432  0.30( 0.06) 0.20       3.2     103.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Attachment E

Class V Injection Well Proof of Registration, if Applicable

Attachment F

Approved <u>Credit Application</u>, if Applicable

Attachment G

Recorded WQMP Covenant

(Verified Final WQMP only)

Attachment H

Completed WQMP Verification Inspection Form

(Verified Final WQMP only)