Appendix E

Preliminary Low Impact Development (LID) Plan

Preliminary Low Impact Development (LID) Plan

Prepared for:
G3 Urban
15235 S. Western Avenue
Gardena, CA 90249
Contact: Mitchell Gardner
(925) 876-9985

Property:
VTTM no. 83834
APN: 7035-016-064
11709 Artesia Boulevard
Artesia, CA 90701

Prepared by:
C&V Consulting, Inc.
9830 Irvine Center Drive
Irvine, CA 92618
(949) 916-3800
Contact: Ryan Bittner, P.E.

June 2022

Receipt of WDID

REPLACE THIS SHEET

To be provided prior to final approval

Notice of Intent

REPLACE THIS SHEET

To be provided prior to final approval

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Project Owner's Certification of the Preliminary Low Impact Development (LID) Plan

Project Name: ***11709 Artesia Boulevard, Artesia***

Project Number: **Vesting Tentative Tract Map No. 83834**
APN 7035-016-064

Project Address: **11709 Artesia Boulevard**
Artesia CA 90701

This Preliminary Low Impact Development (LID) Plan for the ***VTTM 83834*** project has been prepared for G3 Urban by C&V Consulting, Inc. It is intended to comply with the requirements of the City of Artesia's Conditions of Approval.

The undersigned is authorized to approve implementation of provisions of this plan as appropriate and will strive to have the plan carried out by successors consistent with the County of Los Angeles LID Manual and the intent of the NPDES storm water requirements.

"I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Owner's Name:	Mitchell Gardner		
Owner's Title:	Architect – President of Development		
Company:	G3 Urban		
Address:	15235 S. Western Avenue, Gardena, CA 90249		
Email:			
Telephone No.:	(925) 876-9985		
Signature:		Date:	

Engineer Certification

Engineer's Name:	Ryan Bittner		
Engineer's Title:	CEO		
Company:	C&V Consulting, Inc.		
Address:	9830 Irvine Center Drive, Irvine, CA 92618		
Email:	rbittner@cvc-inc.net		
Telephone No.	(949) 916-3800		
I hereby certify that this Low Impact Development Plan is in compliance with, and meets the requirements set forth in, Order No. R4-2012-0175, of the Los Angeles Regional Water Quality Control Board.			
Engineer's Signature		Date	6/10/2022
Place Stamp Here			

Section 200

A. Contact Information/List of Responsible Parties

The property contact information is:

Mitchell Gardner
G3 Urban
15235 S. Western Avenue
Gardena, CA 90249
(925) 876-9985

The property owner shall have primary responsibility and significant authority for the implementation, maintenance, and inspection of the property BMPs. Duties of the Owner include but are not limited to:

- Implementing all elements of the LID, including but not limited to:
  - Implementation of prompt and effective erosion and sediment control measures
  - Implementing all non-storm water management, and materials and waste management activities, such as: monitoring, discharges, general site clean-up; vehicle and equipment cleaning, spill control; good construction housekeeping to ensure that no materials other than storm water are discharged which may have an adverse effect on receiving waters or storm drain systems, etc.
- Pre-storm inspections
- Storm event inspections
- Post-storm inspections
- Routine inspections as described in the LID
- Ensuring elimination of all unauthorized discharges
- The Owner shall be assigned authority to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate all of the necessary corrections/repairs are made immediately, and that the project complies with the LID at all times.
- Managing and report any Illicit Connections or Illegal Discharges.

Section 300

A. References

The following documents are made a part of this LID by reference:

- Project plans and specifications for the City of Artesia to support the ***VTTM 83834*** project, prepared by C&V Consulting, Inc., 9830 Irvine Center Drive, Irvine, California 92618.

- County of Los Angeles Department of Public Works, Low Impact Development Standards Manual dated February 2014

- State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ, NPDES No. CAS000002 dated July 1, 2010

- California Stormwater BMP Handbook – Construction, January 2009.

- California Stormwater BMP Handbook – New Development and Redevelopment, January 2003.

- Los Angeles County Municipal Stormwater/ NPDES Permit Order R4-2012-0175

Section 400 – Body of LID

A. Objectives

This Low Impact Development (LID) Plan has four main objectives:

1) Identify all pollutant sources, including sources of sediment that may affect the quality of storm water discharges associated with daily use / activity (storm water discharges) from the property site.
2) Identify non-storm water discharges.
3) Identify, construct, implement and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized non-storm water discharges from the property site.
4) Develop a maintenance schedule for BMPs designed to reduce or eliminate pollutants.

B. Project Background and Description

The proposed project site consists of several existing lots that forms a rectangular shape area with a gross area of 4.99 acre and the proposed improvement of the project comprises of an area of 3.30 acre. It is located at 11709 Artesia Boulevard, in the City of Artesia (APN:7035-016-064). The site is bounded by Flallon Avenue to the west, Alburtis Avenue to the east, Artesia Boulevard to the south, and an industrial building to the north.

The existing conditions of the project site consists of a vacant lot. The entire site is completely paved with no landscaping on site per geospatial images which is assumed to be 100% impervious as the site have a negligible pervious area coverage.

The project proposes the construction of 16 residential buildings with 80 attached condominiums with private garages, private drive aisles, sidewalks, and common landscaped areas. The project site will be accessible with entrances/ exits along Flallon Avenue and Alburtis Avenue. The public streets, which will not be a part of this hydrological analysis are to be remain in-kind to preserve the perviousness of land usage and drainage pattern per existing conditions. Drive aisles and parking areas will be composed of asphalt concrete pavement. Proposed imperviousness is delineated and analyzed per preliminary LID exhibit to be 90% impervious. Actual imperviousness is to be verified with Final Landscape Plan during final engineering.

C. Vicinity Map

The site comprises several existing lots that forms a rectangular shape area and it is located near the northeast corner of Artesia Boulevard and Flallon Avenue, County of Los Angeles (APN: 7035-016-064). There is an existing improvement to remain across the Alburtis Avenue that is not a part of the proposed development area analysis.

Refer to Figure 1 for the Vicinity Map.

D. Existing Site Drainage Condition

The existing site is generally sloped in the southerly direction with elevations ranging between approximately 60.0 and 57.3 feet above mean sea level. Drainage from the existing site is conveyed as sheet flow overland mainly in the westerly direction towards Flallon Avenue and partially in the easterly direction towards Alburtis Avenue. The Overall drainage of the project site generally surface flows southwesterly to confluence with the street flows to the existing catch basins at the public right of way adjacent to site near the corner of Artesia Boulevard and Flallon Avenue. There is an existing drainage inlet near the center of the site that collects a portion of the center of the site. As the portion of the site that collects flow are generally flat and the low point ponds to slope towards the Fallon Avenue, the site is analyzed as a single drainage area that is tributary to the downstream system. All flow ultimately discharges to the San Gabriel River which drains to the Pacific Ocean at San Pedro Bay. Water bodies downstream of the project site are listed on the most current 303(d) list as follows:

- San Gabriel River Rach 1 (Estuary to Firestone)
    - Coliform Bacteria
- San Gabriel River Estuary
    - Copper
    - Dioxin
    - Nickel
    - Oxygen, Dissolved
- San Pedro Bay
    - Chlordane
    - DDT (tissue & sediment)
    - PCBs (Polychlorinated biphenyls)
    - Sediment Toxicity

All facilities downstream of the project site are engineered, therefore the project is exempt from Hydromodification Control requirements.

E. Proposed Site Drainage Conditions

The proposed development site drainage comprises of a single on-site drainage management area for water quality as stormwater are collected with the proposed inlets located at each entrance to the site and routed to a single treatment system prior to be released offsite. The proposed catch basin inlets and grated inlets collect the proposed

site's generated runoff to be routed to an underground detention system that feeds into a bio-filtration system via pump station for water quality treatment. The treated flow will be pumped to a parkway culvert and be routed to the downstream system following existing drainage pattern. When the underground detention is at full capacity, the confluence of the flows will be mitigated to the proposed overflow parkway culvert through the interconnected storm drain system. The public streets, which will not be a part of this hydrological analysis are to be remain in-kind to preserve the historical drainage pattern.

In cases of higher storm event, the site is graded to outlet overflow at the entrances of the site towards Flallon Avenue and Alburtis Avenue after the detention fills up and storm runoff bubbles out from the inlets of the site. The runoff will then continue along the street flow downstream following existing conditions.

Per Geotechnical Investigation, prepared by Albus & Associates, Inc. dated December 7, 2021, based on state-provided information, the historic-high groundwater is approximately 10 feet below the ground surface. From the geotechnical perspective, the findings indicate the site is not feasible for infiltration, therefore, bio-filtration BMPs are considered for the proposed site.

Refer to Figure 2, BMP Exhibit for additional information.

F. LID Project Types, Characteristics, & Activities

Per the Los Angeles Department of Public Works (LACDPW), *Low Impact Development Standards Manual*, dated February 2014, the proposed project is classified as a "Designated Project." A "Designated Project" is defined by the LACDPW as follows:

> "Redevelopment projects, which are developments that result in creation or addition or replacement of either: (1) 5,000 square feet or more of impervious surface on a site that was previously developed as described in the above bullets; or (2) 10,000 square feet or more of impervious surface area on a site that was previous developed as a single family home."

G. Pollutant Source Identification and BMP Selection

The following is a list of materials to be used in the daily construction activities at the project site, which will potentially contribute to pollutants, other than sediment, to storm water runoff. Control Practices for each activity are identified below:

- Vehicle fluids, including oil, grease, petroleum, and coolants from personal vehicles.
- Landscaping materials and wastes (topsoil, plant materials, herbicides, fertilizers, mulch, pesticides)
- General trash debris and litter
- Pet waste (bacteria/ fecal coliforms)

The Best Management Practices (BMPs) that have been selected for implementation on this project are detailed in the following sections.

H. Source Control BMPs

Project proponents shall implement Site Design concepts that achieve each of the following:

- Minimize Urban Runoff
- Minimize Impervious Footprint
- Conserve Natural Areas
- Minimize Directly Connected Impervious Areas (DCIAs)

Table-1 identifies the source control and treatment BMPs and how each is implemented to achieve each Site Design concept. BMP fact sheets are provided by the LACDPW *Low Impact Development Standards Manual* and the California Stormwater Quality Association.

Table-1: Source Control BMPs

BMP	BMP DESCRIPTION	CHECK ONE		IF NOT APPLICABLE, STATE BRIEF REASON
		INCLUDED?	NOT APPLICABLE	
	Non-Structural Source Control BMPs:			
	Education for Leasers', Operators, Occupants, or Employees	X		
	Activity Restrictions (CC&Rs)	X		
SD-12	Landscape Irrigation Practices	X		
SD-32	Common Area Litter Control	X		
SE-7	Street Sweeping Private Streets and Parking Lots	X		
	Drainage Facility Inspection and Maintenance	X		
	Structural Source Control BMPs:			
SD-13	Storm Drain Message and Signage	X		
SD-10	Landscape Irrigation Practices	X		
SD-11	Roof Runoff Controls	X		

BMP	BMP DESCRIPTION	CHECK ONE		IF NOT APPLICABLE, STATE BRIEF REASON
		INCLUDED?	NOT APPLICABLE	
	Protect Slopes and Channels		X	No proposed slopes and channels
SD-30	Outdoor Vehicle/Equipment/ Accessory Washing Area		X	No proposed car wash racks
	Proper Site Design:			
SD-30	Fuel and Maintenance Area		X	No proposed fueling areas
SD-33	Air/Water Supply Area Drainage		X	No proposed air/water supply
SD-32	Outdoor Trash Storage and Waste Handling Area		X	No proposed outdoor trash storage
SD-31	Outdoor Loading/ Unloading Dock Area		X	No proposed loading/unloading dock areas
SD-35	Outdoor Vehicle/Equipment Repair/Maintenance Area		X	No proposed maintenance bays
SD-36	Outdoor Vehicle/Equipment/ Accessory Washing Area		X	No proposed wash areas
S-2	Outdoor Material Storage Area		X	No proposed material storage areas
SD-36	Outdoor Work Areas or Processing Areas		X	No proposed outdoor work areas
	Provide Wash Water Controls for Food Preparation Areas		X	No proposed food preparation areas

Non-Structural Measures

Non-structural BMPs are generally managerial, educational, inspection and/ or maintenance oriented. These items consist of educating employees and occupants, developing and implementing HOA guidelines, implementing BMPs and enforcing Code requirements. Non-structural BMPs used for this project are summarized below:

Education for Employees and Occupants

Practical informational materials will be provided to homeowners, HOA and employees on general good housekeeping practices that contribute to protection of storm water quality. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Initially, the Owner will provide these materials. Thereafter, such materials will be available through the HOA education program.

This program must be maintained, enforced, and updated periodically by the HOA. Educational materials including, but not limited to, the materials included in the Appendix F of this plan will be made available to the employees and contractors of the HOA.

Activity Restrictions

Activities on this site will be limited to activities related to residential living. The project's Conditions, Covenants, and Restrictions (CC&Rs) will outline the activities that are restricted on the property. Such activities related to the LID include car washing, car maintenance and disposal of used motor fluids, pet waste cleanup, and trash container areas.

Efficient Landscape System & Landscape Maintenance

Management programs will be designed and established by the HOA, who will maintain the common areas within the project site. These programs will include how to mitigate the potential dangers of fertilizer and pesticide usage (refer to the Maintenance and Frequency Table). Ongoing maintenance will be consistent with the State of California Model- Water Efficient Landscape Ordinance. Fertilizer and pesticide usage shall be consistent with County Management Guidelines for use of Fertilizers and Pesticides.

Street Sweeping in Private Streets and Parking Lots

The HOA shall have all streets and parking lots swept on a weekly basis. This procedure will be intensified around October 15th of each year prior to and throughout rain storm period.

Drainage Facility Inspection & Maintenance

The HOA will be responsible for implementing each of the BMPs detailed in this plan. The HOA will also be responsible for cleaning and maintaining the BMPs on a regular basis. Refer to Appendix G for the Operation and Maintenance Plan. Refer to Appendix C for site specific drainage BMP information.

Storm Drain Stenciling/ Signage
Phrase "No Dumping – Drains to Ocean" or equally effective phrase to be stenciled on catch basins to alert the public to the destination of pollutants discharged into storm water. This stenciling will be inspected and re-stenciled on a periodic basis by the HOA. Refer to Table 4 for maintenance frequency.

Landscape & Irrigation System Design
As part of the design of all common area landscape irrigation shall employ water conservation principals, including, but not limited to, such provisions as water sensors, programmable irrigation times (for short cycles), etc. will be used. Such common areas will be maintained by the HOA.

Common Area Litter Control
The HOA must implement trash management and litter control procedures in common areas aimed at reducing pollution of drainage water. The HOA may contract a landscape maintenance company to provide this service during regularly scheduled maintenance which will consist of litter patrol and noting trash disposal violations and reporting the violations to the HOA for investigation.

Title 22 CC&R Compliance
The HOA will comply with this Regulation as part of the development's CC&Rs. CC&Rs will be prepared as a separate document and reviewed by the City's Attorney.

Uniform Fire Code Implementation
The HOA will comply with this Code as part of the development's CC&Rs. CC&Rs will be prepared as a separate document and reviewed by the City's Attorney.

Employee Training
A training program will be established as it would apply to future employees, contractors, and homeowners of the HOA to inform and train in maintenance activities regarding the impact of dumping oil, paints, solvents, or other potentially harmful chemicals into storm drains; the proper use of fertilizers and pesticides in landscaping maintenance practices; and the impacts of littering and improper water disposal.

The HOA (or a hired firm) will conduct the training program which will include targeted training sessions with specific construction disciplines (landscaping, concrete finishers, painters, etc.). See Appendix F for examples of educational materials that will be provided to the Employees.

The project's CC&Rs will include provisions for future employee training programs conducted on a yearly based prior to the rainy season.

I. Structural BMPs

Structural BMPs shall be installed by the developer, through the construction and development of the project, for instance; landscaping and irrigation systems shall be designed by licensed landscape architects and installed by qualified contractors to specifications and standards of the City of Artesia. The structural BMPs used for this project are summarized below:

Expected pollutants associated with this development include vehicle discharge fluids, landscaping materials and waste, litter, and pet waste. To mitigate these pollutants, the structural best management practices summarized below.

Table-2: Design BMPs

BMP	TECHNIQUE	INCLUDED? YES	INCLUDED? NO	BRIEF DESCRIPTION OF METHOD
SD-10	Minimize Impervious Area/Maximize Permeability (C-Factor Reduction)	X		We have incorporated landscape areas wherever possible within the project site. See Appendix B for details.
	Minimize Directly Connected Impervious Areas (DCIAs) (C-Factor Reduction)	X		We minimize DCIAs by limiting sidewalks and parking areas to the minimum necessary for proper use and proposed planter areas where path of walk will not be obstructed.
	Create Reduced or "Zero Discharge" Areas (Runoff Volume Reduction)		X	The site runoff will be bio-filtrated prior to discharge from the site.

Table-3: Treatment BMPs

BMP	NAME	INCLUDED?		IF NOT APPLICABLE, STATE BRIEF REASON
		YES	NO	
VEG-5	Vegetated Filter Strip		X	Alternative BMP selected
VEG-4	Vegetated Swale		X	Space not available for BMP
MP-40	Media Filter		X	Alternative BMP selected
MP-52	Drain Inserts		X	Alternative BMP selected
T-3	Extended Detention Basin		X	Alternative BMP selected
T-4	Wet Pond		X	Alternative BMP selected
T-2	Constructed Wetland		X	Alternative BMP selected
T-1	Sand Filter		X	Alternative BMP selected
RET-5	Permeable Pavement without an Underdrain		X	Alternative BMP selected
RET-2	Infiltration Basin		X	Alternative BMP selected
RET-3	Infiltration Trench		X	Alternative BMP selected
TC-40	Media Filter		X	Alternative BMP selected
BIO-1	Biofiltration	X		Proposed WetlandMOD will be utilized in the proposed development and provide treatment of 1.5 times the SWQDV.

Biofiltration: WetlandMOD Biofiltration Treatment System

The unique treatment capabilities of the 'WetlandMod' System - 'BioClean' System) incorporates capture, screening, hydrodynamic separation, advanced media filtration, biofiltration to reduce and control water volume in a more efficient way compared to traditional downward flow bioretention system.

The 'BioClean' System removes a range of pollutants associated with urban run-off. Suspended Solids, Heavy metals, Pathogens, Phosphorus, oil and grease pollutants are removed from storm water runoff at a high level of efficiency. The public Agency has found that this system is an acceptable solution to biological treatment of first flush storm water during the project Entitlement Phase of the project when infiltration is not an option for a site due to Geotechnical issues with underlying soils. The 'BioClean' System treats runoff by first intercepting flow through a pre-treatment chamber and pipe inlet from the area drain storm drains and storage pipe where it's screened through a filter where trash, litter, gross solids and sediment are captured. The second stage of treatment provides treatment through biofiltration media. The perimeter filter utilizing bio-media provides physical treatment by physically and chemically capturing fine total suspended solids, metals, nutrients, and bacteria. The final stage of treatment provides treatment in the wetland chamber through sub-surface flow by biological remediation through a combination of physical, chemical, and biological processes.

The 'BioClean' System is a horizontal flow-based BMP for this project and is designed based on the Manufacturer's design calculations for the device at the Treatment Design Volume provided in Appendix 'A'. Since the site is not providing infiltration, the design volume is 1.5 times the LID volume. Storage chambers are provided upstream of the biofiltration system to ensure this volume is captured and fed to the biofiltration system. See Appendix 'A' for design treatment volume calculations.

The WetlandMod Detail provided by the Manufacturer within Appendix C verifies that the proposed WetlandMod Biofiltration System will treat the required volume within target drawdown duration of 96 hours. The calculation is copies below for reference:

Drainage Management Area (DMA)	Size (ac)	SWQDV (cf)*	SWQDV x 1.5 (cf)	MWS Model	MWS HGL Height (ft)	Treatment Capacity (cf)
A	3.30	8,475.2	12,712.8	WM-L-6-24-5-V	5	12,712.8

*Los Angeles County Department of Public Works (LACDPW) HydroCalc Software was utilized to calculate stormwater quality design volume (SWQDV). The governing flowrate between the 0.75-inch storm event and the 85th Percentile storm event was utilized for design. Refer to Appendix A for HydroCalc outputs.

The proposed site will generate a runoff volume of approximately 8,475.2 cf for the 85th Percentile storm event. After multiplying this value by a factor of 1.5, the required treatment volume equals 12,712.8 cf. The WetlandMOD Biofiltration Systems provide a total treatment capacity of approximately 12,712.8 cf and therefore provide more than enough treatment for the proposed development. The WetlandMOD systems will address the pollutants of concern associated with the development type. Refer to Appendix C for more information on WetlandMOD Biofiltration System. Treatment

Volumes are to be verified with proposed perviousness per final site plan during Final Engineering.

Pipe Detention Systems
The WetlandMOD Bio-filtration system requires the design volume to be stored upstream to ensure the entire treatment volume is captured and fed to the biofiltration system. Detention and/or Retention Systems shall be installed in accordance with the latest edition of ASTM D2321. Refer to Appendix C for more information on Detention Storage System.

Proposed Condition Drainage Area	Area (ac)	Water Quality Treatment Volume (cu-ft)	Proposed Detention Volume (cu-ft)
DMA-A	3.30	12,712.8	12,817

Catch Basin Inspection
The HOA will maintain the drainage systems, including catch basins and culverts. The HOA is required to have catch basins inspected and, if necessary, cleaned prior to the storm season, no later than October 15th each year or prior to the first 24-hour storm event, whichever occurs first. These duties may be contracted out to the landscape maintenance firm hired by the HOA. Please see Appendix E for maintenance program. Refer to Appendix G for the Operation and Maintenance Plan.

Runoff-Minimizing Landscape Design
As part of the design of all common area landscape areas, similar planting material with similar water requirements will be used in order to reduce excess irrigation runoff and promote surface filtration. Such common areas will be maintained by the HOA.

Community Car Wash Racks
No community car wash rack or area will be provided, therefore, vehicle washing by residents on the property will not be allowed per the CC&Rs.

Self-Contained Washing
Self-contained washing of vehicles by residents or owners on the property will not be allowed per the CC&Rs.

Outdoor Material Storage Areas
Outdoor material storage areas refer to storage areas or storage facilities solely for the storage of materials. Improper storage of materials outdoors may provide an opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the storm water conveyance system. Outdoor Storage by residents or owners on the property will not be allowed per the CC&Rs.

J. BMP Maintenance, Inspection, and Repair

Inspections will be conducted as follows:

- Annually and prior to the start of the rainy season
- Every (1) month during rainy season
- At any other time(s) or intervals of time specified in the contract documents

Repairs and/ or maintenance procedures shall be carried out at the soonest possible time.

K. Inspection, Maintenance, and Responsibility for BMPs

Table-4 and Table-5 show the lists of the post-construction BMPs (routine non-structural and structural), the required ongoing maintenance, the inspection and maintenance frequency, the inspection criteria, and the entity or party responsible for implementation, maintenance, and/or inspection.

Table-4: Non-Structural BMP Maintenance Responsibility/Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Homeowner/ Business owner Education, Activity Restrictions	HOA will provide educational materials. Those materials and responsibilities must be passed onto subsequent property owners.	Continuous. CC&Rs to be provided to homeowners at the time they purchase the property and updates provided by the HOA as they occur.
Common Area Landscape Management	HOA will appoint a landscape maintenance contractor	Monthly during regular maintenance and use with management guidelines for use of fertilizers and pesticides.
Parking Areas and Drive Aisle Management	HOA	The Drives Aisles are to be swept on a routine scheduled basis to facilitate the pickup of trash and debris (plant or otherwise) and to remove excessive oil, grease and build-up. During sweeping, debris is to be removed from the parking areas and drives and then scrubbed and rinsed. This sweeping schedule will be at a minimum occurrence of once a week and as necessary to rid / reduce active pollutants from the pavement areas. This maintenance requirement will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the final Title report of these properties.
Litter Control by Sweeping	HOA	Weekly inspection of trash receptacles to ensure that lids are closed and pick up any excess trash on the ground, noting trash disposal violations to the HOA for remediation.
Employee Training	HOA	Monthly for maintenance personnel and employees to include the educational materials contained in the approved LID.

BMP	RESPONSIBILITY	FREQUENCY
Common Area Catch Basin Inspection & Cleaning	HOA will appoint a landscape maintenance contractor for common areas and storm drain facilities.	Inspect basins once a month. Clean debris and silt in bottom of catch basins as needed. Intensified on or about October 15th each year or prior to the first 24-hour storm event, whichever occurs first. Refer to Appendix E.

Table-5: Structural BMP Maintenance Responsibility/ Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Common Area Efficient Irrigation	HOA will appoint a landscape contractor after construction	Once a week, in conjunction with maintenance activities. 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 night time temperatures.
Common Area Runoff Efficient Landscape Design	HOA will appoint a landscaping contractor	Once a week in conjunction with maintenance activities and prior to finalizing any replanting schemes. Verify that plants continue to be grouped according to similar water requirements in order to reduce excess irrigation runoff.
WetlandMOD Biofiltration Vaults	HOA	WetlandMOD Biofiltration Vaults maintenance will conform to manufacturer's specifications. Please see additional information in Appendix C
Pipe Detention System	HOA	Pipe Detention System maintenance will conform to manufacturer's specifications. Please see additional information in Appendix C

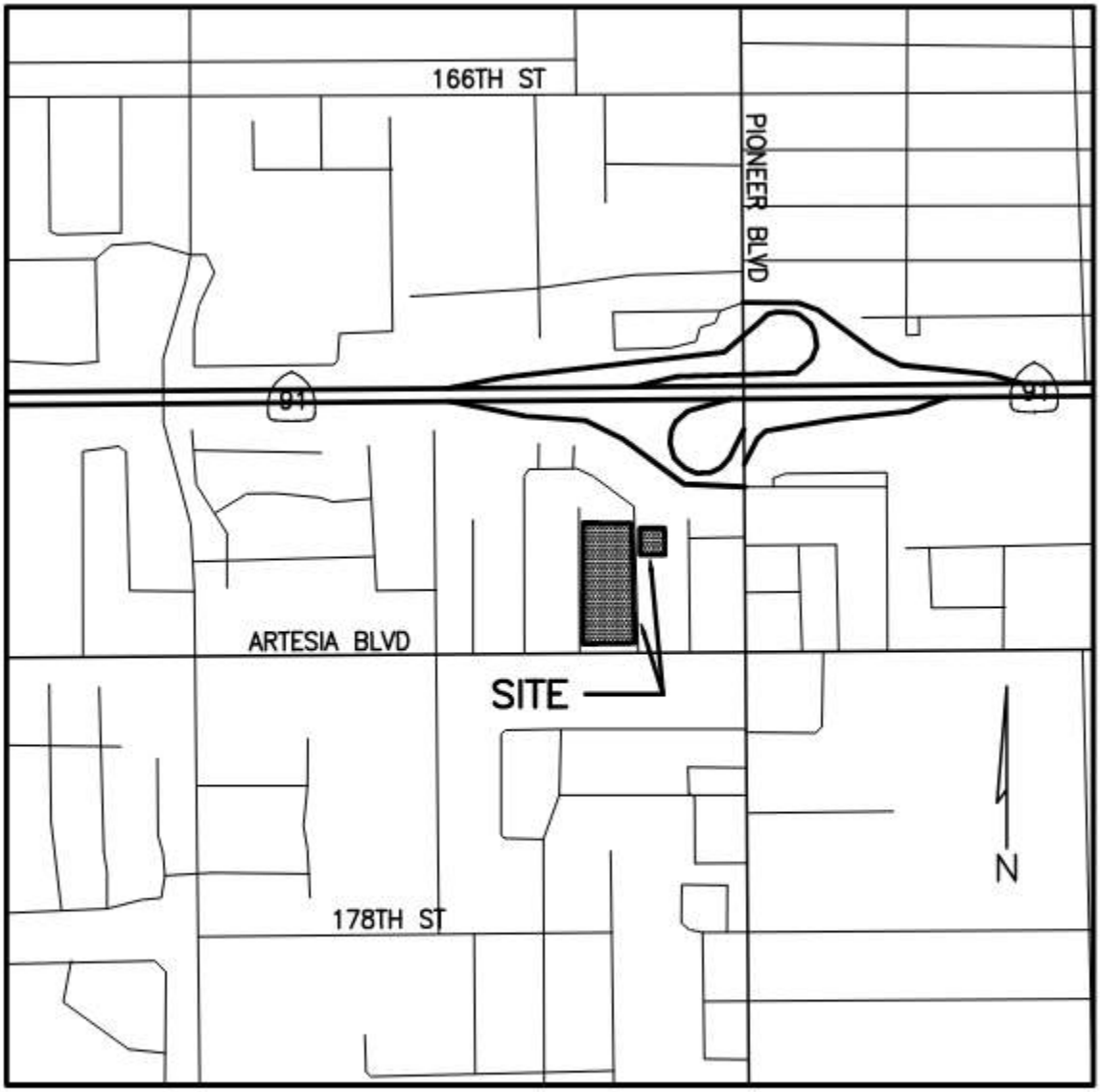
L. Operation/Maintenance Funding after Project Completion

The post-construction BMPs as described above will be funded and maintained by:

Mitchell Gardner
G3 Urban
15235 S. Western Avenue
Gardena, CA 90249
(925) 876-9985

Maintenance and requirements of the maintenance for the properties will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project and will be the responsibility of the property owner at all times. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the Title report of these properties.

Figure 1:
Project Vicinity Map



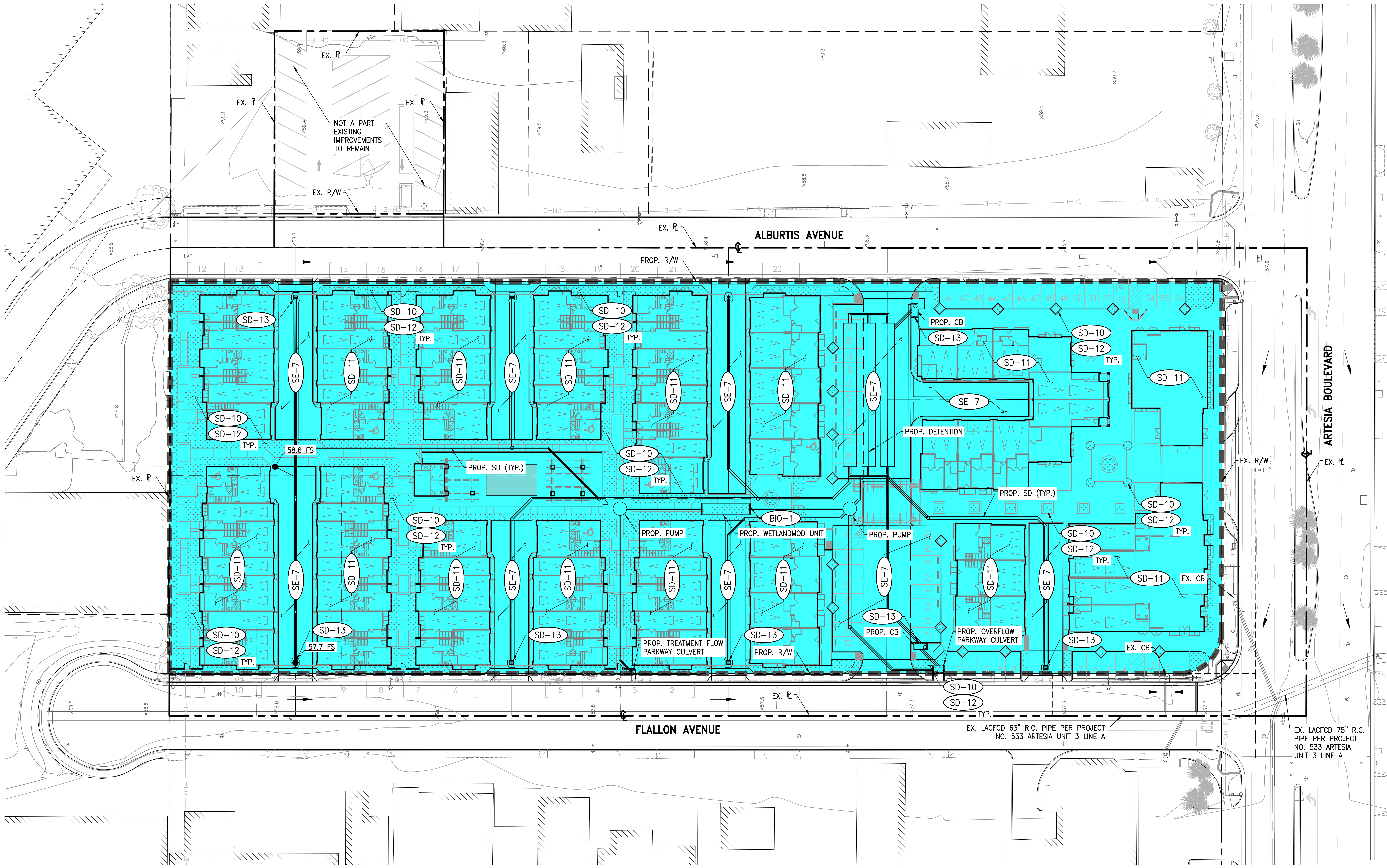
VICINITY MAP
N.T.S.

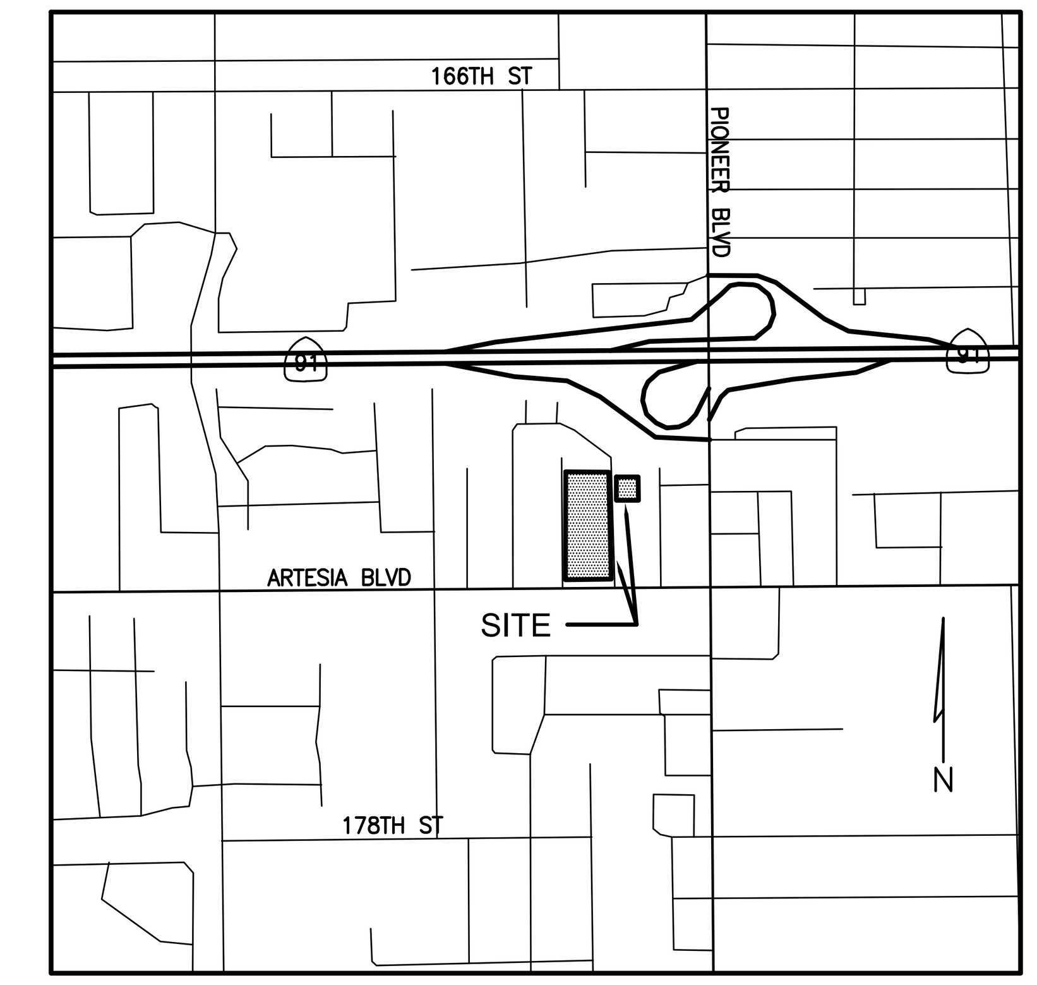
11709 ARTESIA BOULEVARD

ARTESIA, CALIFORNIA

Figure 2:
BMP Exhibit

PRELIMINARY LID EXHIBIT





VICINITY MAP

N.T.S.

LEGEND:

- DRAINAGE MANAGEMENT AREA (DMA) BOUNDARY
- SITE BOUNDARY
- EXISTING RIGHT OF WAY
- EXISTING LOT LINE
- FLOW DIRECTION
- FLOW LINE
- PERVIOUS AREA

BEST MANAGEMENT PRACTICES:

- SE-7 PRIVATE STREET SWEEPING
- SD-10 SITE DESIGN & LANDSCAPE PLANNING
- SD-11 ROOF RUNOFF CONTROLS
- SD-12 EFFICIENT IRRIGATION
- SD-13 STORM DRAIN SIGNAGE
- BIO-1 MODULAR WETLAND SYSTEM

DMA	COLOR	LANDUSE	AREA (AC)	IMPERVIOUS %	1.5x SWQDV (CF)	TREATMENT CAPACITY
A		RESIDENTIAL	3.30	90%	12,712.8	12,712.8

NOTE: PROPOSED DEVELOPMENT IMPERVIOUS COVERS ARE DELINEATED PER LANDSCAPE PLAN PER THIS EXHIBIT.

SCALE: 1" = 30'

0 15 30 60

REVISIONS

NO.	DATE	DESCRIPTION	BY

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
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VTTM NO. 83834
11709 ARTESIA BOULEVARD
CITY OF ARTESIA
COUNTY OF LOS ANGELES, CALIFORNIA
SHEET 1 OF 1 SHEETS

Figure 3:
Impaired Waters

COUNTY OF LOS ANGELES

SAN GABRIEL RIVER WATERSHED

San Gabriel River Watershed

Proposed Project Site

LEGEND

- SAN GABRIEL RIVER WATERSHED
- UNINCORPORATED AREA
- DAM / LAKE / RESERVOIR
- MAJOR RIVER
- MAJOR CHANNEL

MILES
0 0.875 1.75 3.5

Data contained in this map is produced in whole or part from the Los Angeles County Department of Public Works' digital database.

REF: \\pwgisd02\mpmgis\MPMGIS\projects\mpm\gismaps\wk_2627\SanGabrielRiver_wtrshed.mxd DATE: 08/21/07

Mapping & Property Management Division, Mapping & GIS Services Section

Appendix A:
Volume and Flowrate Calculations & Hydrologic Report

The proposed development was analyzed for the 0.75-in storm event and the 85th Percentile storm event using the LACDPW HydroCalc software. The governing stormwater runoff volume between the two storm events was utilized for design. In accordance with the LA County BMP Design Manual, a factor of 1.5 was applied to obtain the design volume. Below is a summary of the HydroCalc outputs:

DMA	85th Percentile Storm ✓		0.75-in Storm		Governing Volume (cfs)	SWQDV x 1.5 (cfs)
	Volume (cf)	Flowrate (cfs)	Volume (cf)	Flowrate (cfs)		
A	8,475.2	0.931	7,306.2	0.743	8,475.2	12,712.8

Refer to LACDPW HydroCalc Output Data within this Appendix for Volume and Flowrate Calculations.

Peak Flow Hydrologic Analysis

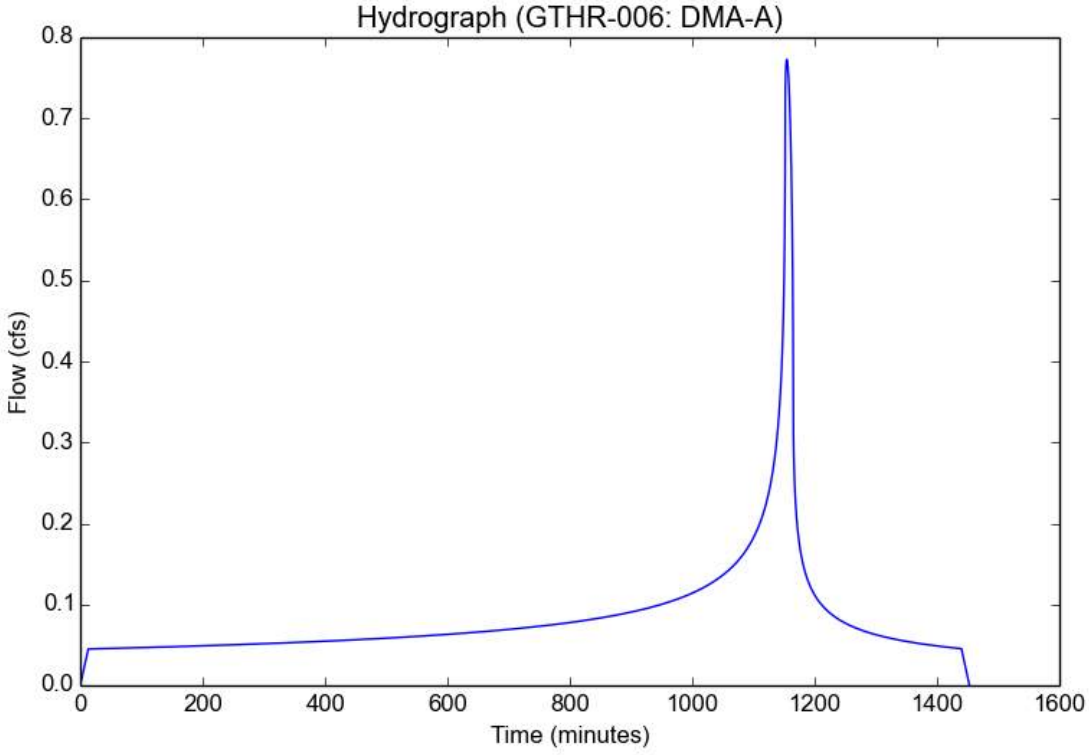
File location: P:/G/GTHR-006/Admin/Reports/LID/Appendix A - HydroCalc/GTHR-006 - DMA-A_0.75in.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	GTHR-006
Subarea ID	DMA-A
Area (ac)	3.3
Flow Path Length (ft)	123.0
Flow Path Slope (vft/hft)	0.0073
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.9
Soil Type	6
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.2856
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	0.7728
Burned Peak Flow Rate (cfs)	0.7728
24-Hr Clear Runoff Volume (ac-ft)	0.1677
24-Hr Clear Runoff Volume (cu-ft)	7306.2156



Peak Flow Hydrologic Analysis

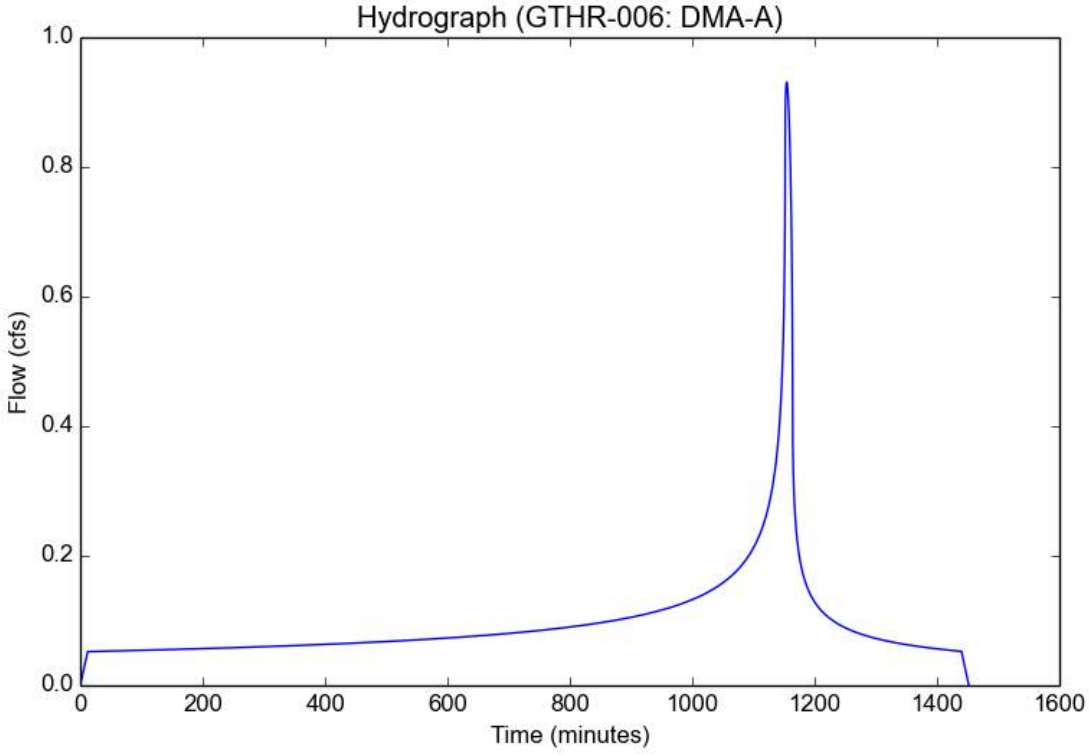
File location: P:/G/GTHR-006/Admin/Reports/LID/Appendix A - HydroCalc/GTHR-006 - DMA-A_85%.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	GTHR-006
Subarea ID	DMA-A
Area (ac)	3.3
Flow Path Length (ft)	123.0
Flow Path Slope (vft/hft)	0.0073
85th Percentile Rainfall Depth (in)	0.87
Percent Impervious	0.9
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

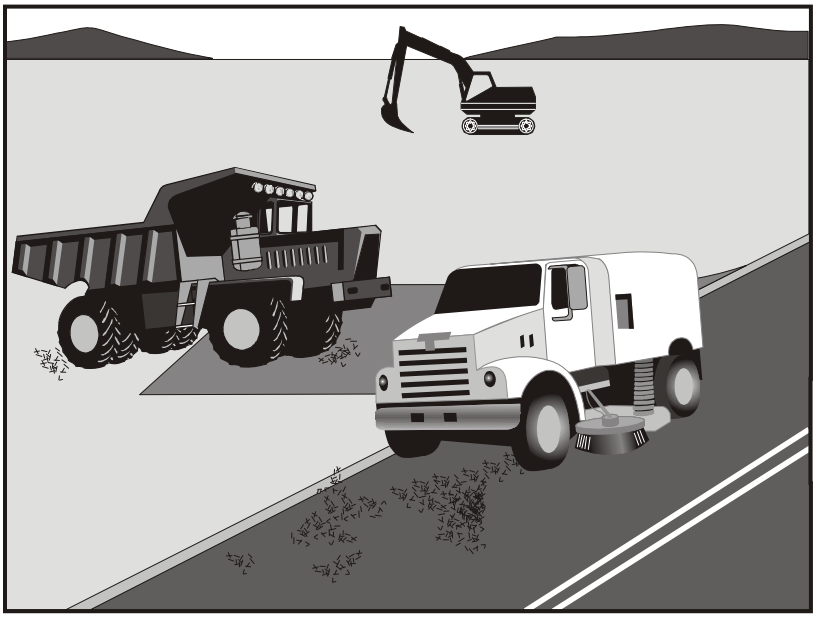
Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.87
Peak Intensity (in/hr)	0.344
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	0.9308
Burned Peak Flow Rate (cfs)	0.9308
24-Hr Clear Runoff Volume (ac-ft)	0.1946
24-Hr Clear Runoff Volume (cu-ft)	8475.2074



Appendix B:
Site BMPs

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

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

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Site Design & Landscape Planning SD-10

Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

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

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

BIO-1: Biofiltration

Definition

A biofiltration area is a vegetated shallow depression that is designed to receive and treat stormwater runoff from downspouts, piped inlets, or sheet flow from adjoining paved areas. A shallow ponding zone is provided above the vegetated surface for temporary storage of stormwater runoff. During storm events, stormwater runoff accumulates in the ponding zone and gradually infiltrates the surface and filters through the biofiltration soil media before being collected by an underdrain system.

Stormwater runoff treatment occurs through a variety of natural mechanisms as stormwater runoff filters through the vegetation root zone. In biofiltration areas, microbes and organic material in the biofiltration soil media help promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture and promote the drying of the soil through transpiration. Biofiltration areas are typically planted with native, drought-tolerant plant species that do not require fertilization and can withstand wet soils for at least 96 hours.

A schematic of a typical biofiltration area is presented in Figure E-7.

LID Ordinance Requirements

Biofiltration can be used as an alternative compliance measure.

Pollutant of Concern	Treated by Biofiltration?
Suspended solids	No
Total phosphorus	No
Total nitrogen	Yes
Total Kjeldahl nitrogen	Yes
Cadmium, total	No
Chromium, total	Yes
Copper, total	No
Lead, total	Yes
Zinc, total	No

Source: Treatment Best Management Practices Performance, Los Angeles Regional Water Quality Control Board, December 9, 2013.

Advantages

- Has a low cost for installation
- Enhances site aesthetics
- Requires little maintenance

Disadvantages

- May require individual owner/tenants to perform maintenance

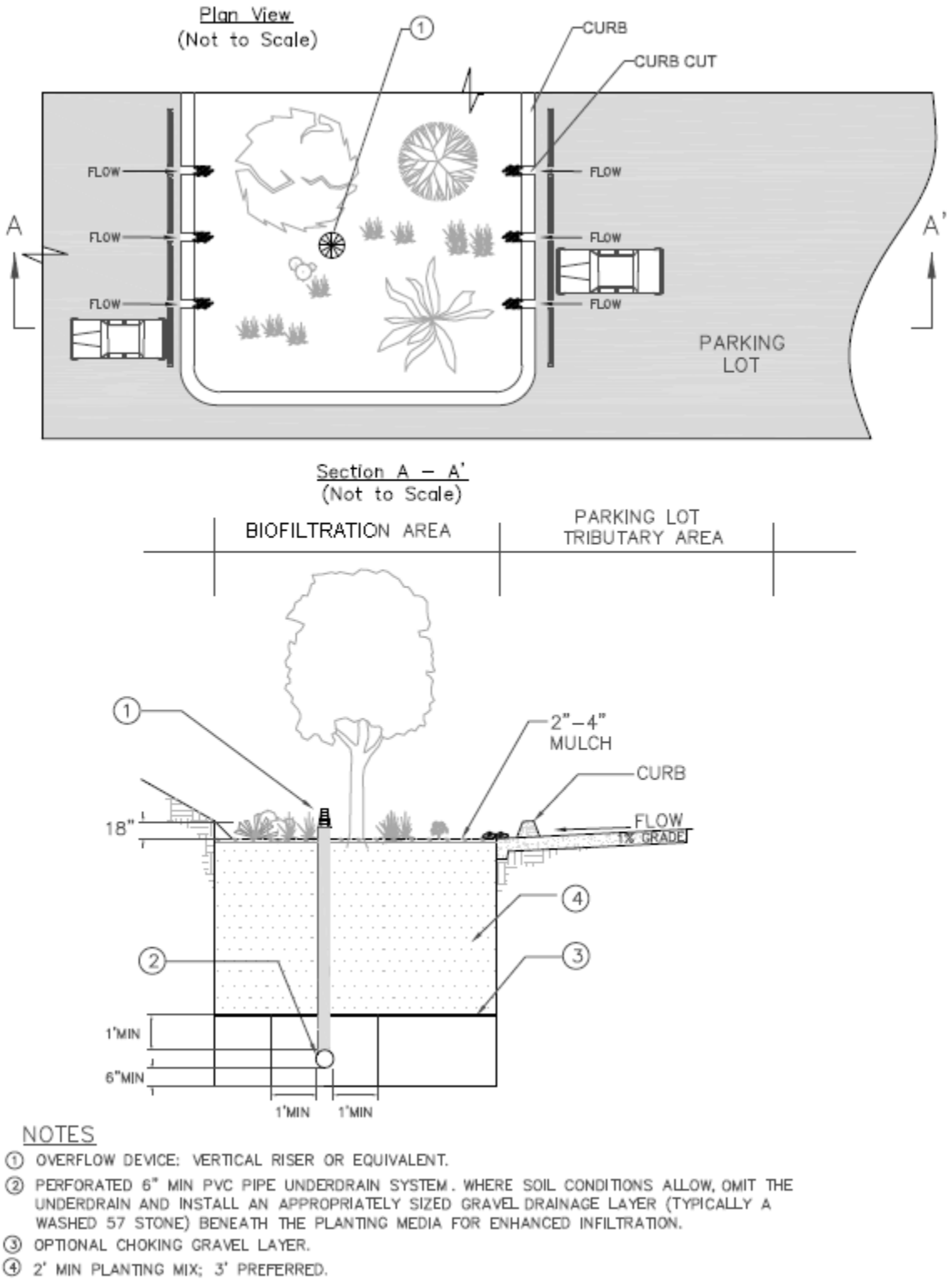


Figure E-7. Biofiltration Area Schematic

General Constraints and Implementation Considerations

- Biofiltration areas can be applied in various settings including, but not limited to:
  - Individual lots for rooftop, driveway, and other on-site impervious surface
  - Shared facilities located in common areas for individual lots
  - Areas within loop roads or cul-de-sacs
  - Landscaped parking lot islands
  - Within right-of-ways along roads
  - Common landscaped areas in apartment complexes or other multi-family housing designs
  - Parks and along open space perimeter
- If tire curbs are provided and parking stalls are shortened, cars are allowed to overhang the biofiltration area.
- Biofiltration areas must be located sufficiently far from structure foundations to avoid damage to structures (as determined by a certified structural or geotechnical engineer).
- Any parking areas bordering the biofiltration area must be monolithically poured concrete or deepended curb concrete to provide structural stability to the adjacent parking section.
- Geomembrane liners must be used in areas subject to spills or pollutant hot spots.
- During construction activities should avoid compaction of native soils below planting media layer or gravel zone.
- Stormwater runoff must be diverted around the biofiltration area during the period of vegetation establishment. If diversion is not feasible, the graded and seeded areas must be protected with suitable sediment controls (i.e., silt fences).All damaged areas should be repaired, seeded, or re-planted immediately.
- The general landscape irrigation system should incorporate the biofiltration area, as applicable.

Design Specifications

The following sections describe the design specifications for biofiltration areas.

Geotechnical

Due to the potential to contaminate groundwater, cause slope instability, impact surrounding structures, and potential for insufficient infiltration capacity, an extensive geotechnical site investigation must be conducted during the site planning process to verify site suitability for biofiltration. All geotechnical investigations must be performed according to the most recent GMED Policy GS 200.1. Soil infiltration rates and the

groundwater table depth must be evaluated to ensure that conditions are satisfactory for proper operation of a biofiltration area. The project applicant must demonstrate through infiltration testing, soil logs, and the written opinion of a licensed civil engineer that sufficiently permeable soils exist on-site to allow the construction of a properly functioning biofiltration system.

Biofiltration areas are appropriate for soils with a minimum corrected in-situ infiltration rate of 0.3 in/hr. The geotechnical report must determine if the proposed project site is suitable for a biofiltration area and must recommend a design infiltration rate (see "Design Infiltration Rate" under the "Sizing" section). The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move through the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Pretreatment

Pretreatment refers to design features that provide settling of large particles before stormwater runoff enters a stormwater quality control measure in order to reduce the long-term maintenance burden. Pretreatment should be provided to reduce the sediment load entering a biofiltration area in order to maintain the infiltration rate of the biofiltration area. To ensure that biofiltration areas are effective, the project applicant must incorporate pretreatment devices that provide sediment removal (e.g., vegetated swales, vegetated filter strips, sedimentation manholes, and proprietary devices). The use of at least two pretreatment devices is highly recommended for biofiltration areas.

Geometry

- Biofiltration areas must be sized to capture and treat 1.5 times the SWQDv that is not reliably retained on the project site with an 18-inch maximum ponding depth.
- The planting soil depth must be a minimum of two feet, although three feet is preferred. The planting soil depth should provide a beneficial root zone for the chosen vegetation and adequate water storage for the stormwater runoff. A deeper planting soil depth will also provide a smaller surface area footprint.
- A gravel storage layer below the biofiltration area soil media is required to provide adequate temporary storage to retain 1.5 times the SWQDv that is not reliably retained on the project site and to promote infiltration.

Sizing

Biofiltration areas are sized using a simple sizing method where 1.5 times the SWQDv that is not reliably retained on the project site must be completely filtered within 96 hours. If the incoming stormwater runoff flow rate is lower than the long term filtration rate, above ground storage does not need to be provided. If the incoming stormwater runoff flow rate is higher than the long term filtration rate, above ground storage shall be provided (see steps below).

Step 1: Calculate the design volume

Biofiltration areas should be sized to capture and treat 1.5 times the portion of the SWQDv (see Section 6 for SWQDv calculation procedures) that is not reliability retained on the project site, as calculated by the equation below:

$$V_B = 1.5 \times (SWQDv - V_R)$$

Where:

V_B = Biofiltration volume [ft^3];
SWQDv = Stormwater quality design volume [ft^3]; and
V_R = Volume of stormwater runoff reliably retained on-site [ft^3].

Step 2: Calculate the design infiltration rate

Determine the corrected in-situ infiltration rate (f_{design}) of the native soil using the procedures described in the most recent GMED Policy GS 200.1.

Step 3: Calculate the surface area

Select a surface ponding depth (d) that satisfies the geometric criteria and meets the site constraints. Selecting a deeper ponding depth (up to 1.5 ft) generally yields a smaller footprint, however, it will require greater consideration for public safety, energy dissipation, and plant selection.

Calculate the time for the selected ponding depth to filter through the planting media using the following equation:

$$\mathrm{d} = t_p \times \frac{\mathrm{f_{design}}}{12}$$

Where:

d = Ponding depth (max 1.5 ft) [ft];
t_p = Required detention time for surface ponding (max 96 hr) [hr]; and
f_{design} = Design infiltration rate [in/hr].

If t_p exceeds 96 hours, reduce surface ponding depth (d). In nearly all cases, t_p should not approach 96 hours unless f_{design} is low.

Calculate the required infiltrating surface (filter bottom area) using the following equation:

$$A = \frac{V_B}{d}$$

Where:

A = Bottom surface area of biofiltration area [ft^2];
V_B = Biofiltration design volume [ft^3]; and
d = Ponding depth (max 1.5 ft) [ft].

Flow Entrance and Energy Dissipation

Maintain a minimum slope of 1 percent for pervious surfaces and 0.5 percent for impervious surfaces to the biofiltration area inlet. The following types of flow entrance can be used for biofiltration cells:

- Level spreaders (i.e., slotted curbs) can be used to facilitate sheet flow.
- Dispersed, low velocity flow across a landscape area. Dispersed flow may not be possible given space limitations or if the biofiltration area is controlling roadway or parking lot flows where curbs are mandatory.
- Dispersed flow across pavement or gravel and past wheel stops for parking areas.
- Flow spreading trench around perimeter of biofiltration area. May be filled with pea gravel or vegetated with 3:1 side slopes similar to a swale. A vertical-walled open trench may also be used at the discretion of LACDPW.
- Curb cuts for roadside or parking lot areas, if approved by LACDPW: curb cuts should include rock or other erosion controls in the channel entrance to dissipate energy. Flow entrance should drop two to three inches from curb line and provide an area for settling and periodic removal of sediment and coarse material before flow dissipates to the remainder of the biofiltration area.
- Piped entrances, such as roof downspouts, should include rock, splash blocks, or other erosion controls at the entrance to dissipate energy and disperse flows.
- Woody plants (trees, shrubs, etc.) can restrict or concentrate flows and can be damaged by erosion around the root ball and must not be placed directly in the entrance flow path.

Drainage

Biofiltration areas must be designed to drain below the planting soil in less than 96 hours. Soils must be allowed to dry out periodically in order to restore hydraulic capacity to receive stormwater runoff from subsequent storm events, maintain infiltration rates, maintain adequate soil oxygen levels for healthy soil biota and vegetation, and provide proper soil conditions for biodegradation and retention of pollutants.

Underdrain

Biofiltration areas require an underdrain to collect and discharge stormwater runoff that has been filtered through the soil media, but not infiltrated, to another stormwater quality control measure, storm drain system, or receiving water. The underdrain must have a mainline diameter of eight inches using slotted PVC SDR 26 or PVC C9000. Slotted PVC allows for pressure water cleaning and root cutting, if necessary. The slotted pipe

should have two to four rows of slots cut perpendicular to the axis of the pipe or at right angles to the pitch of corrugations. Slots should be 0.04 to 0.1 inches wide with a length of 1 to 1.25 inches. Slots should be longitudinally-spaced such that the pipe has a minimum of one square inch opening per lineal foot and should face down.

The underdrain should be placed in a gravel envelope (Class 2 Permeable Material per Caltrans Spec. 68-1.025) that measures three feet wide and six inches deep. The underdrain is elevated from the bottom of the biofiltration area by six inches within the gravel envelope to create a fluctuating anaerobic/aerobic zone below the underdrain to facilitate denitrification within the anaerobic/anoxic zone and reduce nutrient concentrations. The top and sides of the underdrain pipe should be covered with gravel to a minimum depth of 12 inches. The underdrain and gravel envelope should be covered with a geomembrane liner to prevent clogging. The following aggregate should be used for the gravel envelope:

Particle Size (ASTM D422)	% Passing by Weight
¾ inch	100%
¼ inch	30-60%
#8	20-50%
#50	3-12%
#200	0-1%

Underdrains should be sloped at a minimum of 0.5 percent and must drain freely to an approved discharge point.

Rigid non-perforated observation pipes with a diameter equal to the underdrain diameter should be connected to the underdrain to provide a clean-out port as well as an observation well to monitor drainage rates. The wells/clean-outs should be connected to the perforated underdrain with the appropriate manufactured connections. The wells/clean-outs should extend six inches above the top elevation of the biofiltration area mulch, and should be capped with a lockable screw cap. The ends of underdrain pipes not terminating in an observation well/clean-out should also be capped.

Hydraulic Restriction Layer

Lateral infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent waterproofing, may be placed along the vertical walls to reduce lateral flows. This geomembrane liner must have a minimum thickness of 30 mils and meet the requirements of Table E-12. Generally, waterproof barriers should not be placed on the bottom of the biofiltration unit, as this would prevent incidental infiltration which is important to meeting the required pollutant load reduction.

Table E-12. Geomembrane Liner Specifications for Biofiltration Areas

Parameter	Test Method	Specifications
Material		Nonwoven geomembrane liner
Unit weight		8 oz/yd^3 (minimum)
Filtration rate		0.08 in/sec (minimum)
Puncture strength	ASTM D-751 (Modified)	125 lbs (minimum)
Mullen burst strength	ASTM D-751	400 lb/in^2 (minimum)
Tensile strength	AST D-1682	300 lbs (minimum)
Equiv. opening size	US Standard Sieve	No. 80 (minimum)

Planting/Storage Media

- The planting media placed in the biofiltration area should achieve a long-term, in-place infiltration rate of at least 5 in/hr. Higher infiltration rates of up to 12 in/hr are permissible. The biofiltration soil media must retain sufficient moisture to support vigorous plant growth.
- The planting media mix must consist of 60 to 80 percent sand and 20 to 40 percent compost.
- Sand should be free of wood, waste, coatings such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing the No. 200 sieve size should be non-plastic. Sand for biofiltration should be analyzed by an accredited laboratory using #200, #100, #40, #30, #16, #8, #4, and 3/8 sieves (ASTM D422 or as approved by the local permitting authority) and meet the following gradations (Note: all sand complying with ASTM C33 for fine aggregate comply with the gradation requirements listed below):

Particle Size (ASTM D422)	% Passing by Weight
3/8 inch	100%
#4	90-100%
#8	70-100%
#16	40-95%
#30	15-70%
#40	5-55%
#110	0-15%
#200	0-5%

Note: The gradation of the sand component of the biofiltration soil media is believed to be a major factor in the infiltration rate of the media mix. If the desired hydraulic conductivity of the biofiltration soil media cannot be achieved within the specified proportions of sand and compost (#2), then it may be necessary to utilize sand at the coarser end of the range specified minimum percent passing.

- Compost should be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes, or other organic material not including manure or biosolids meeting standards developed by the USCC. The product shall be certified through the USCC STA Program (a compost testing and information disclosure program). Compost quality shall be verified via a laboratory analysis to be:
    - Feedstock materials must be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
    - pH between 6.5 and 8.0 (may vary with plant palette)
    - Organic Matter: 35 to 75 percent dry weight basis
    - Carbon and Nitrogen Ratio: 15:1 < C:N < 25:1
    - Maturity/Stability: Compost must have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120°F) upon delivery or rewetting is not acceptable.
    - Toxicity: any one of the following measures is sufficient to indicate non-toxicity:
        - NH_4:NH_3 < 3
        - Ammonium < 500 ppm, dry weight basis
        - Seed germination > 80 percent of control
        - Plant trials > 80 percent of control
        - Solvita® > 5 index value
    - Nutrient content:
        - Total Nitrogen content ≥ 0.9 percent preferred
        - Total Boron should be < 80 ppm; soluble boron < 2.5 ppm
    - Salinity: < 6.0 mmhos/cm
    - Compost for biofiltration area should be analyzed by an accredited laboratory using #200, ¼-inch, ½-inch, and 1-inch sieves (ASTM D422) and meet the gradation requirements in the table below:

Particle Size (ASTM D422)	% Passing by Weight
1 inch	99-100
½ inch	90-100
¼ inch	40-90
#200	2-10

Tests should be sufficiently recent to represent the actual material that is anticipated to be delivered to the site. If processes or sources used by the supplier have changed significantly since the most recent testing, new tests should be requested.

The gradation of compost used in biofiltration soil media is believed to play an important role in the saturated infiltration rate of the media. To achieve a higher saturated infiltration rate, it may be necessary to utilize compost at the coarser end of the range (minimum percent passing). The percent passing the #200 sieve (fines) is believed to be the most important factor in hydraulic conductivity.

In addition, coarser compost mix provides more heterogeneity of the biofiltration soil media, which is believed to be advantageous for more rapid development of soil structure needed to support healthy biological processes. This may be an advantage for plant establishment with lower nutrient and water input.

- Biofiltration soil media not meeting the above criteria should be evaluated on a case-by-case basis. Alternative biofiltration soil media must meet the following specifications:

  "Soils for biofiltration facilities must be sufficiently permeable to infiltrate stormwater runoff at a minimum of rate of 5 in/hr during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation." The following steps shall be followed by LACDPW to verify that alternative biofiltration soil media mixes meet the specification:

  - Submittals – The applicant must submit to LACDPW for approval:
    - A sample of mixed biofiltration soil media.
    - Certification from the soil supplier or an accredited laboratory that the biofiltration soil media meets the requirements of this specification.
    - Certification from an accredited geotechnical testing laboratory that the biofiltration soil media has an infiltration rate between 5 and 12 in/hr.
    - Organic content test results of the biofiltration soil media. Organic content test shall be performed in accordance with the Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
    - Organic grain size analysis results of mixed biofiltration soil media performed in accordance with ASTM D422, Standard Test Method for Particle Size Analysis of Soils.
    - A description of the equipment and methods used to mix the sand and compost to produce the biofiltration soil media.
  - The name of the testing laboratory(ies) and the following information:

- Contact person(s)
- Address(es)
- Phone contact(s)
- E-mail address(es)
- Qualifications of laboratory(ies) and personnel including date of current certification by STA, ASTM, or approved equal.

o Biofiltration soils shall be analyzed by an accredited laboratory using #200 and ½-inch sieves (ASTM D422 or as approved by LACDPW), and meet the gradation described in the table below:

Particle Size (ASTM D422)	% Passing by Weight
½ inch	97-100
#200	2-5

- Biofiltration soil media shall be analyzed by an accredited geotechnical laboratory for the following tests:
  - o Moisture – density relationships (compaction tests) must be conducted on biofiltration soil media. Biofiltration soil media for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  - o Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.
- Mulch is recommended for the purpose of retaining moisture, preventing erosion, and minimizing weed growth. Projects subject to the California Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least 2 inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Biofiltration areas must be covered with two to four inches (average three inches) of mulch at the start and an annual placement (preferably in June after weeding) of one to two inches of mulch beneath plants.
- The planting media design height must be marked appropriately, such as a collar on the overflow device or with a stake inserted two feet into the planting media and notched, to show biofiltration surface level and ponding level.

Vegetation

Prior to installation, a licensed landscape architect must certify that all plants, unless otherwise specifically permitted, conform to the standards of the current edition of American Standard for Nursery Stock as approved by the American Standards Institute, Inc. All plant grades shall be those established in the current edition of American Standards for Nursery Stock.

- Shade trees must have a single main trunk. Trunks must be free of branches below the following heights:

CALIPER (in)	Height (ft)
1½-2½	5
3	6

- Plants must be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 96 hours.
- It is recommended that a minimum of three types of tree, shrubs, and/or herbaceous groundcover species be incorporated to protect against facility failure due to disease and insect infestations of a single species.
- Native plant species and/or hardy cultivars that are not invasive and do not require chemical inputs must be used to the maximum extent practicable.

The biofiltration area should be vegetated to resemble a terrestrial forest community ecosystem, which is dominated by understory trees, a shrub layer, and herbaceous ground cover. Select vegetation that:

- Is suited to well-drained soil;
- Will be dense and strong enough to stay upright, even in flowing water;
- Has minimum need for fertilizers;
- Is not prone to pests and is consistent with Integrated Pest Management practices; and
- Is consistent with local water conservation ordinance requirements.

Irrigation System

Provide an irrigation system to maintain viability of vegetation, if applicable. The irrigation system must be designed to local code or ordinance specifications.

Restricted Construction Materials

The use of pressure-treated wood or galvanized metal at or around a biofiltration area is prohibited.

Overflow Device

An overflow device is required at the 18-inch ponding depth. The following, or equivalent, should be provided:

- A vertical PVC pipe (SDR 26) to act as an overflow riser.
- The overflow riser(s) should be eight inches or greater in diameter, so it can be cleaned without damage to the pipe.

- The inlet to the riser should be at the ponding depth (18 inches for fenced biofiltration areas and 6 inches for areas that are not fenced), and be capped with a spider cap to exclude floating mulch and debris. Spider caps should be screwed in or glued (e.g., not removable). The overflow device should convey stormwater runoff in excess of 1.5 times the SWQDv that is not reliably retained on the project site to an approved discharge location (another stormwater quality control measure, storm drain system, or receiving water).

Maintenance Requirements

Maintenance and regular inspections are important for proper function of biofiltration areas. Biofiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. In general, biofiltration maintenance requirements are typical landscape care procedures and include:

- Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years).
- Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly-designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the biofiltration area and flow dissipation and erosion protection strategies in the pretreatment area and flow entrance should be reassessed. If sediment is deposited in the biofiltration area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.
- Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species.
- Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.
- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, biofiltration facilities are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters.
- In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two to three inch depth at least once every two years.

- Analyze soil for fertility and pollutant levels if necessary. Biofiltration soil media are designed to maintain long-term fertility and pollutant processing capability.
- Eliminate standing water to prevent vector breeding.
- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.
- Inspect, and clean if necessary, the underdrain.

A summary of potential problems that need to be addressed by maintenance activities is presented in Table E-13.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater quality control measures. The property owner is responsible for compliance with the maintenance agreement. A sample maintenance agreement is presented in Appendix H.

Table E-13. Biofiltration Troubleshooting Summary

Problem	Conditions When Maintenance Is Needed	Maintenance Required
Vegetation	Overgrown vegetation	Mow and prune vegetation as appropriate.
	Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	Remove this vegetation and plant native species as needed.
Trash and Debris	Trash, plant litter, and dead leaves present	Remove and properly dispose of trash and debris.
Irrigation (if applicable)	Not functioning correctly	Check irrigation system for clogs or broken lines and repair as needed.
Inlet/Overflow	Inlet/overflow areas clogged with sediment and/or debris	Remove material.
	Overflow pipe blocked or broken	Repair as needed.
Erosion/Sediment Accumulation	Splash pads or spreader incorrectly placed Presence of erosion or sediment accumulation	Check inlet structure to ensure proper function. Repair, or replace if necessary, the inlet device. Repair eroded areas with gravel as needed. Re-grade the biofiltration area as needed.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination from floatables such as oil and grease.
Standing water	Standing water observed more than 96 hours after storm event	Inspect, and clean as needed, the underdrain to ensure proper function. Clear clogs as needed. Remove and replace planter media (sand, gravel, topsoil, mulch) and vegetation.

Appendix C:
WetlandMOD System, Pipe Detention System

Preliminary details have been provided for this Preliminary LID. Project specific details and pre-treatment system detail will be provided during final engineering.

STORM WATER COLLECTION AND TREATMENT SYSTEM

11709 Artesia Boulevard Artesia, CA

12,817 cu ft

SPECIFICATION FOR CISTERN SYSTEM

THIS DOCUMENT WILL GOVERN THE FURNISHING AND INSTALLATION OF ALUMINIZED CORRUGATED METAL PIPE CISTERNS FOR UNDERGROUND WATER STORAGE FOR NOMINAL DIAMETERS 12" (300MM) THROUGH 120" (3000MM).

THE MANUFACTURER OF THE CISTERN SYSTEM SHALL BE ONE THAT HAS REGULARLY BEEN ENGAGED IN THE ENGINEERING DESIGN AND PRODUCTION OF THESE SYSTEMS AND WHICH HAS A HISTORY OF SUCCESSFUL PRODUCTION, ACCEPTABLE TO THE ENGINEER OF RECORD (EOR). IN ACCORDANCE WITH THE DRAWINGS, THE CISTERN SYSTEM SHALL BE SUPPLIED BY: SANTA FE WINWATER COMPANY, 10244 FREEMAN AVE, SANTA FE SPRINGS, CA 90670.
TEL: 1-562-777-9724

SAMPLING, TESTING, AND INSPECTION OF MATERIALS USED FOR MANUFACTURING OF THE CISTERN SYSTEM SHALL BE IN ACCORDANCE WITH APPLICABLE ASTM SPECIFICATIONS. ALL FABRICATION OF THE PRODUCT SHALL OCCUR WITHIN THE UNITED STATES UNLESS OTHERWISE NOTED.

THE CISTERN SHALL BE CAPABLE OF INSTALLATION IN SOIL WITH A pH RANGE OF 5 TO 9. FOR SOIL pH OUTSIDE THE RANGE OF 5 TO 9, CONSULT WITH SPECIFYING ENGINEER PRIOR TO ORDERING TO DETERMINE IF ADDITIONAL CISTERN COATING SYSTEM NEED BE CONSIDERED.

THE HYDRAULIC SYSTEM SHALL BE PRE-ASSEMBLED AND TESTED AT FACTORY PRIOR TO SHIPMENT. INSPECTION AND TESTING PROTOCOLS SHALL BE DECIDED BY THE SPECIFYING ENGINEER ACCORDING TO SYSTEM REQUIREMENTS. A COPY OF THE TEST REPORT MUST BE PROVIDED TO THE ENGINEER OF RECORD IF REQUESTED.

UPON REQUEST, THE CISTERN SYSTEM INLETS SHALL BE EQUIPPED WITH AN INLET CALMING DEVICE TO ALLOW INTRODUCTION OF WATER TO THE TANK WITH LITTLE TO NO TURBULENCE.

THE CISTERN SYSTEM SHALL BE FITTED WITH A MIN. 4" OUTLET OR PERFORATED MANHOLE COVERS FOR VENTING, DEPENDANT UPON SITE CONDITIONS AND DIRECTION BY SPECIFYING ENGINEER. OVERFLOW PIPE SHALL BE PROVIDED UPON REQUEST BY SPECIFYING ENGINEER.

SYSTEM TO MEET AASHTO HS20/HS25 LIVE LOADING, PER AASHTO LRFD SECTION 12.

ACCESS COVERS SHALL BE A MINIMUM OF 24-INCH DIAMETER TO PROVIDE ADEQUATE INSPECTION AND MAINTENANCE WITHOUT RESTRICTIONS AND OBSTRUCTIONS TO ENTRY INTO INTERIOR OF THE CISTERN. COVERS SHALL BE WATERTIGHT, DO NOT SLIDE, ROTATE, OR FLIP OPEN AND ARE CAPABLE OF SUPPORTING DESIGN LOADS.

PRIOR TO SHIPMENT, CISTERN SYSTEM MAY BE INSPECTED AT FACTORY BY OWNER'S AUTHORIZED REPRESENTATIVE UPON REQUEST.

INSTALLATION

THE CONTRACTOR SHALL FOLLOW OCCUPATIONAL SAFETY AND HEALTH ASSOCIATION (OSHA) GUIDELINES FOR SAFE PRACTICES IN EXECUTING THE INSTALLATION PROCESS IN ACCORDANCE WITH THE MANUFACTURER/SUPPLIER INSTALLATION RECOMMENDATIONS.

A NON-WOVEN GEOTEXTILE FILTER FABRIC IS RECOMMENDED TO BE INSTALLED IN EXCAVATION, OR OTHER MEASURES SHOULD BE TAKEN, TO PREVENT NATIVE SOIL FROM MIGRATING INTO THE INITIAL BACKFILL MATERIAL, WHEN REQUIRED BY THE GEOTECHNICAL ENGINEER OR E.O.R.

TRENCH BOTTOM (FOUNDATION) WITH UNSTABLE OR UNYIELDING MATERIAL SHALL BE EXCAVATED TO A DEPTH DIRECTED BY THE ENGINEER AND REPLACED WITH SUITABLE MATERIAL. FOR UNSTABLE MATERIALS, GEOTEXTILE MAY BE USED TO STABILIZE THE TRENCH BOTTOM, IF DIRECTED BY THE ENGINEER.

SUITABLE BEDDING MATERIAL SHALL BE CLASS I OR II, AS SPECIFIED BY ASTM D2321. MINIMUM BEDDING THICKNESS SHALL BE 4" (100 mm) AS MEASURED FROM OUTER PIPE DIAMETER.

INITIAL BACKFILL MATERIAL SHALL BE CLASS I OR II, AS SPECIFIED BY ASTM D2321. COMPACTION AND BACKFILL LIFTS SHALL BE IN ACCORDANCE WITH ASTM D2321. INITIAL BACKFILL SHALL EXTEND TO NOT LESS THAN 6" (150 mm) ABOVE THE TOP OF THE CISTERN.

MINIMUM COVER FOR UP TO H-25 TRAFFIC APPLICATIONS:
- 12" FOR PIPE DIAMETER UP TO 72" DIAMETER
- 18" FOR DIAMETER OVER 72".

MINIMUM COVER SHALL BE MEASURED FROM THE TOP OF THE PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO THE TOP OF RIGID PAVEMENT. ADDITIONAL COVER MAY BE REQUIRED FOR CONSTRUCTION LOADS, FOR VEHICLES OVER 75T (68 metric tons) OR TO PREVENT FLOATATION.

FINAL BACKFILL MATERIAL SHALL BE SUITABLE MATERIALS AS DIRECTED BY THE ENGINEER OR AS INDICATED BY MANUFACTURER. FOR AREAS SUBJECTED TO HEAVY TRAFFIC LOADING, A HIGHER DEGREE OF COMPACTION IS NECESSARY AND A SEPARATION LAYER OF NON-WOVEN GEOTEXTILE MAY BE REQUIRED. COMPACTION LEVELS AND/OR GEOTEXTILE MAY BE SPECIFIED AT THE DISCRETION OF THE DESIGN ENGINEER OR MANUFACTURER'S REPRESENTATIVE.

CONSULT THE INSTALLATION MANUAL FOR ADDITIONAL INFORMATION.

GENERAL NOTES

PRIOR TO COMMENCEMENT OF WORK, CONTRACTOR TO REVIEW MANUFACTURER'S INSTALLATION GUIDE. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND/OR PROJECT ENGINEER TO ENSURE THAT ALL QUESTIONS ABOUT INSTALLATION ARE ADDRESSED PRIOR TO APPROVAL OF SYSTEM. ALL DETAILS FOR INSTALLATION ARE LOCATED IN THIS DRAWING PACKAGE, OR UPON REQUEST TO PIPING MANUFACTURER. ANY QUESTIONS CONCERNING THESE STANDARD DETAILS CAN BE ADDRESSED BY THE CISTERN MANUFACTURER'S REPRESENTATIVE PRIOR TO APPROVAL.

ALL ELEVATIONS, DIMENSIONS AND LOCATIONS OF RISERS AND INLETS SHALL BE VERIFIED BY THE ENGINEER OF RECORD.

PRIOR TO INSTALLATION OF THE SYSTEM, A PRE-CONSTRUCTION MEETING SHALL BE CONDUCTED. THOSE REQUIRED TO ATTEND ARE THE SUPPLIER OF THE SYSTEM, THE GENERAL CONTRACTOR, SUB-CONTRACTORS AND THE ENGINEER.

CONTRACTOR(S) SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS NECESSARY TO INSTALL THE CISTERN SYSTEM, APPURTENANCES AND INCIDENTALS IN ACCORDANCE WITH THE DRAWINGS AND AS SPECIFIED HEREIN.

A STORM WATER TREATMENT DEVICE UPSTREAM OF THE CISTERN SYSTEM IS RECOMMENDED AS THE APPROPRIATE MEANS OF PRETREATING TO EXTEND THE MAINTENANCE INTERVAL ON THE SYSTEM AND REDUCE LIFE CYCLE COSTS. BOTH ENGINEERED SOLUTIONS SHALL BE PROVIDED BY A SINGLE SUPPLIER/MANUFACTURER.

PRIOR TO SYSTEM START UP, ANY ACCUMULATED WATER AND DEBRIS SHALL BE REMOVED FROM THE CISTERN TANK(S) AND ANY ACCOMPANYING TREATMENT SYSTEMS AND PUMP VAULTS.

BELOW GRADE SYSTEM MARKING TAPE, IF REQUIRED BY LOCAL ORDINANCE, CAN BE SUPPLIED UPON REQUEST. CONTACT SFWW WITH REQUIREMENT DETAILS.

ALL ITEMS SHOWN SHALL BE PROVIDED BY SANTA FE WINWATER AS A COMPLETE STORMWATER MANAGEMENT SYSTEM. ANY SUBSTITUTIONS OR OMISSIONS MAY VOID WARRANTY.

SANTA FE Winwater COMPANY
10244 Freeman Ave, Santa Fe Springs, CA 90670
562-777-9724 / www.santafewinwater.com

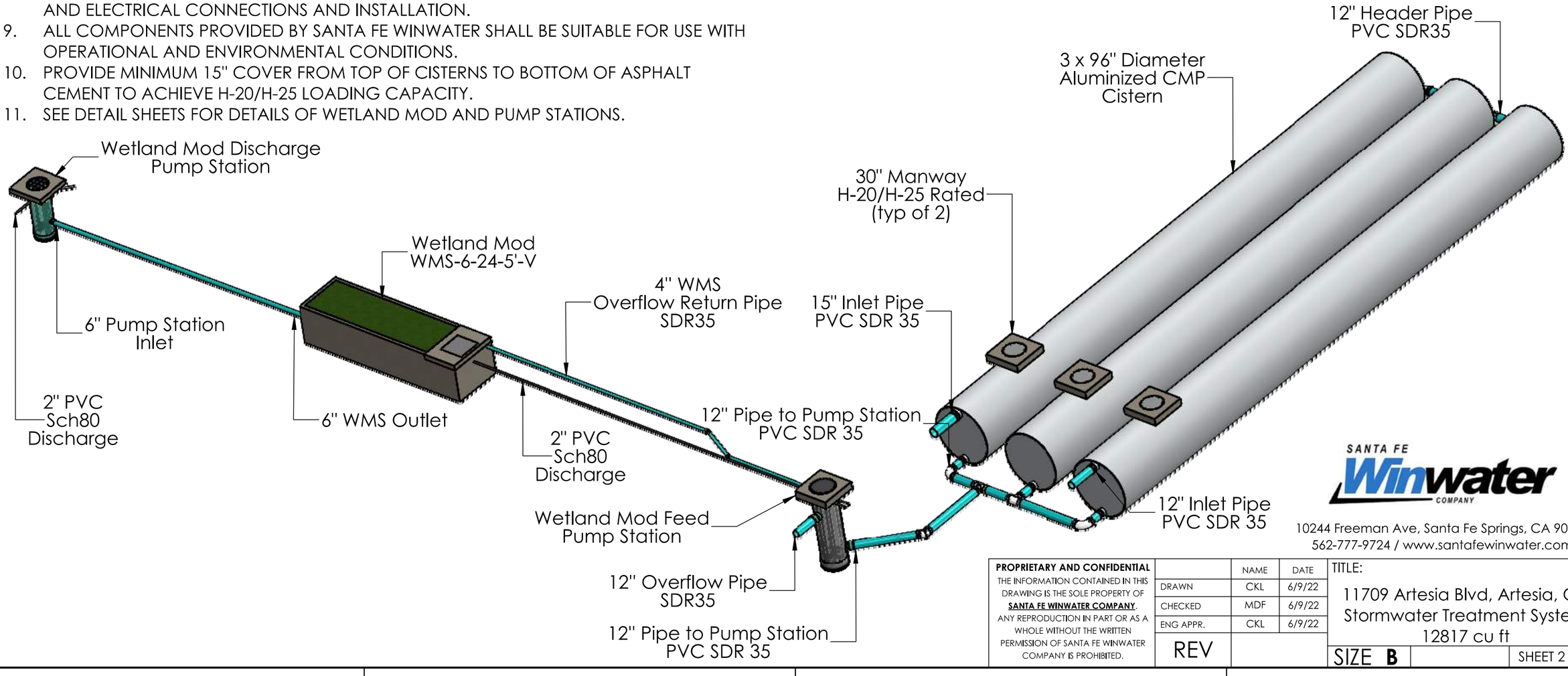
	NAME	DATE
DRAWN	CKL	6/9/22
CHECKED	MDF	6/9/22
ENG APPR.	CKL	6/9/22
REV		

TITLE:
11709 Artesia Blvd, Artesia, CA
Stormwater Treatment System
12817 cu ft

SIZE **B** | SHEET 1 OF 7

NOTES:

1. ALL ITEMS SHOWN SHALL BE PROVIDED BY SANTA FE WINWATER AS A COMPLETE STORMWATER MANAGEMENT SYSTEM. ANY SUBSTITUTIONS OR OMISSIONS MAY VOID WARRANTY.
2. MODULAR WETLAND TO BE MODEL WMS-6-24-5'-V, MANUFACTURED BY BIOCLEAN ENVIRONMENTAL SERVICES, INC. AND SUPPLIED BY SANTA FE WINWATER COMPANY.
3. STORAGE SYSTEM TO BE 96" ALUMINIZED CMP AS SUPPLIED BY SANTA FE WINWATER COMPANY.
4. SEE CIVIL SHEETS FOR UNIT LOCATIONS.
5. ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR CUSTOMER TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING OR INSTALLING ANY EQUIPMENT.
6. ALL MATERIALS SHALL BE DELIVERED TO THE SITE AFTER EXCAVATIONS HAVE BEEN EXCAVATED AND SHORED. THE CONTRACTOR SHALL SUPPLY A CRANE OF SUFFICIENT SIZE TO LOWER ALL PIECES INTO THE HOLE SAFELY. THE CONTRACTOR SHALL INSTALL ALL ITEMS.
7. UPON ESTABLISHMENT OF PRIOR AGREEMENT, SANTA FE WINWATER COMPANY WILL PROVIDE A REPRESENTATIVE FOR TECHNICAL ASSISTANCE ON THE DAY OF INSTALLATION TO ANSWER ANY QUESTIONS THAT MAY ARISE.
8. THE CONTRACTOR IS RESPONSIBLE FOR ALL REINFORCED CONCRETE PADS AND COLLARS, PLUMBING AND ELECTRICAL CONNECTIONS AND INSTALLATION.
9. ALL COMPONENTS PROVIDED BY SANTA FE WINWATER SHALL BE SUITABLE FOR USE WITH OPERATIONAL AND ENVIRONMENTAL CONDITIONS.
10. PROVIDE MINIMUM 15" COVER FROM TOP OF CISTERNS TO BOTTOM OF ASPHALT CEMENT TO ACHIEVE H-20/H-25 LOADING CAPACITY.
11. SEE DETAIL SHEETS FOR DETAILS OF WETLAND MOD AND PUMP STATIONS.



SANTA FE Winwater COMPANY
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	NAME	DATE
DRAWN	CKL	6/9/22
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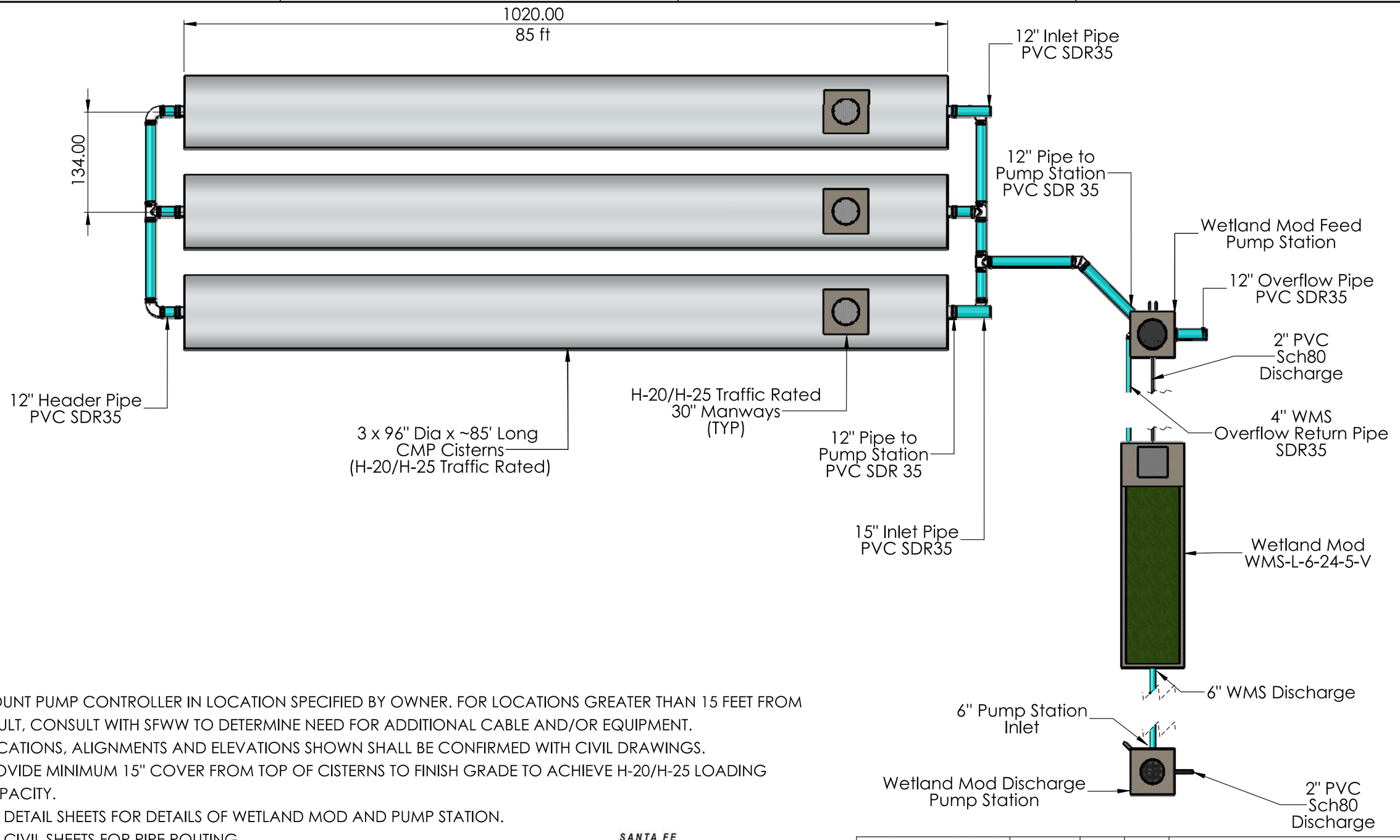
ENG APPR.	CKL	6/9/22
REV		

TITLE:
11709 Artesia Blvd, Artesia, CA
Stormwater Treatment System
12817 cu ft

SIZE **B** | SHEET 2 OF 7



NOTES:

1. MOUNT PUMP CONTROLLER IN LOCATION SPECIFIED BY OWNER. FOR LOCATIONS GREATER THAN 15 FEET FROM VAULT, CONSULT WITH SFWW TO DETERMINE NEED FOR ADDITIONAL CABLE AND/OR EQUIPMENT.
2. LOCATIONS, ALIGNMENTS AND ELEVATIONS SHOWN SHALL BE CONFIRMED WITH CIVIL DRAWINGS.
3. PROVIDE MINIMUM 15" COVER FROM TOP OF CISTERNS TO FINISH GRADE TO ACHIEVE H-20/H-25 LOADING CAPACITY.
4. SEE DETAIL SHEETS FOR DETAILS OF WETLAND MOD AND PUMP STATION.
5. SEE CIVIL SHEETS FOR PIPE ROUTING.
6. INVERT ELEVATION OF OVERFLOW PIPE SHALL PEAK ABOVE INSIDE TOP OF CISTERN.

SANTA FE Winwater COMPANY
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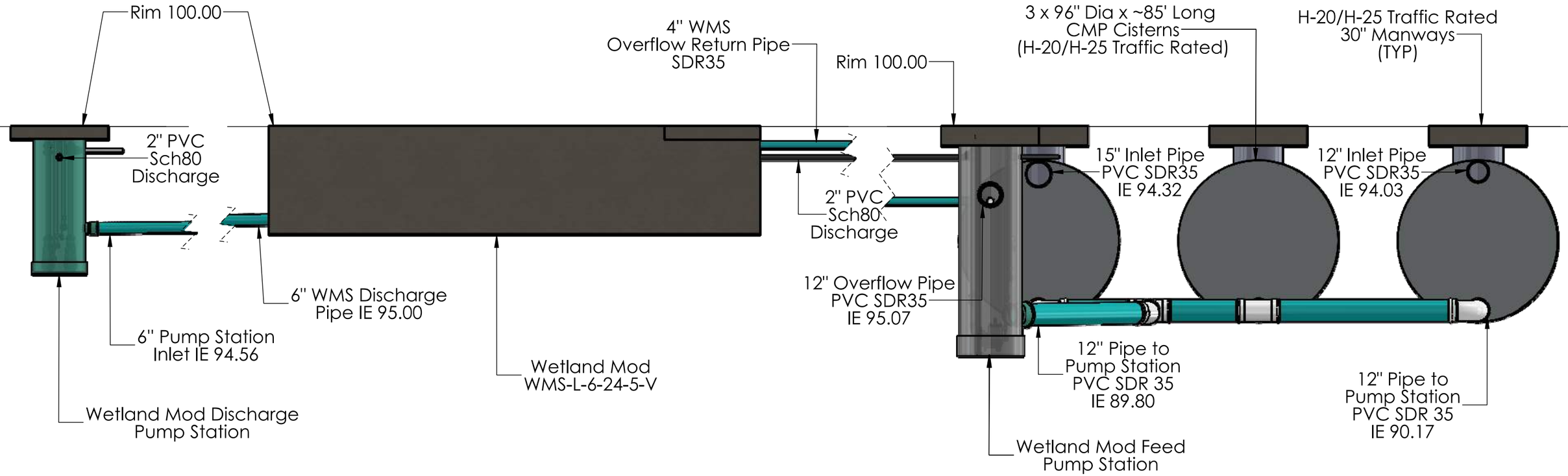
	NAME	DATE
DRAWN	CKL	6/9/22
CHECKED	MDF	6/9/22
ENG APPR.	CKL	6/9/22
REV		

TITLE:
11709 Artesia Blvd, Artesia, CA
Stormwater Treatment System
12817 cu ft

SIZE **B** | SHEET 3 OF 7



NOTES:

1. MOUNT PUMP CONTROLLER IN LOCATION SPECIFIED BY OWNER. FOR LOCATIONS GREATER THAN 15 FEET FROM VAULT, CONSULT WITH SFWW TO DETERMINE NEED FOR ADDITIONAL CABLE AND/OR EQUIPMENT.
2. LOCATIONS, ALIGNMENTS AND ELEVATIONS SHOWN SHALL BE CONFIRMED WITH CIVIL DRAWINGS.
3. PROVIDE MINIMUM 15" COVER FROM TOP OF CISTERNS TO FINISH GRADE TO ACHIEVE H-20/H-25 LOADING CAPACITY.
4. SEE DETAIL SHEETS FOR DETAILS OF WETLAND MOD AND PUMP STATION.
5. SEE CIVIL SHEETS FOR PIPE ROUTING.
6. INVERT ELEVATION OF OVERFLOW PIPE SHALL PEAK ABOVE INSIDE TOP OF CISTERN.
7. FINISH GRADE ELEVATIONS SHOWN ON THIS SHEET ARE GENERIC AND DO NOT MATCH SITE CONDITIONS. THEY ARE USED TO SHOW RELATIVE DEPTH OF THE SYSTEM COMPONENTS.

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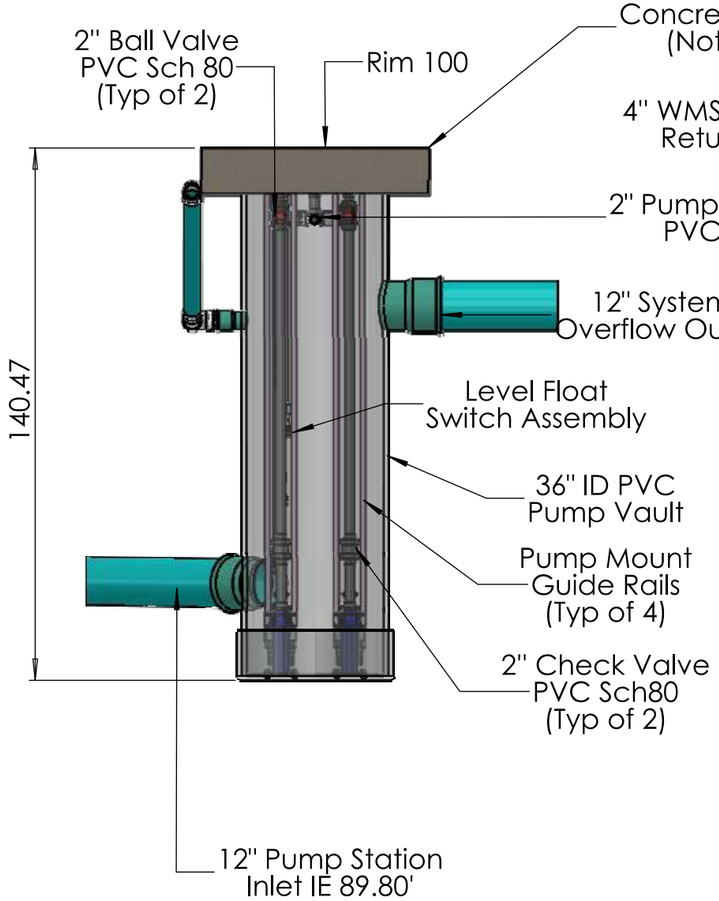
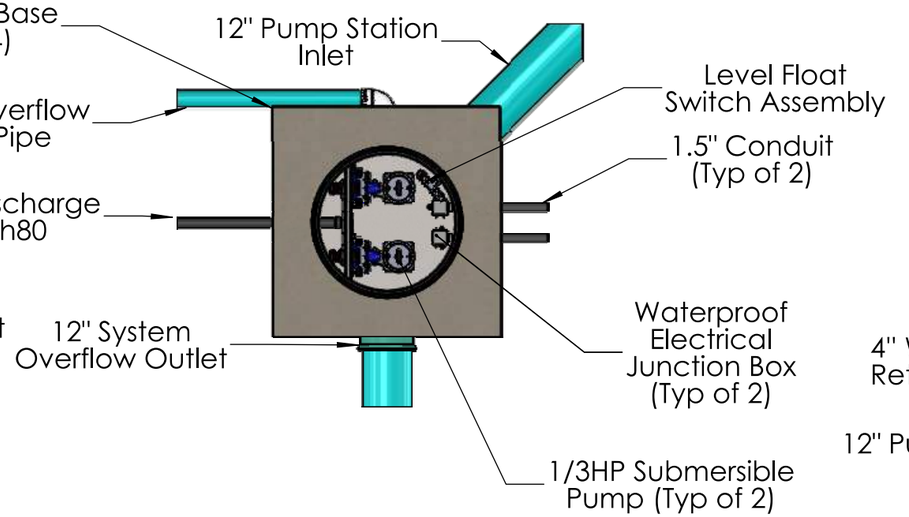
562-777-9724 / www.santafewinwater.com

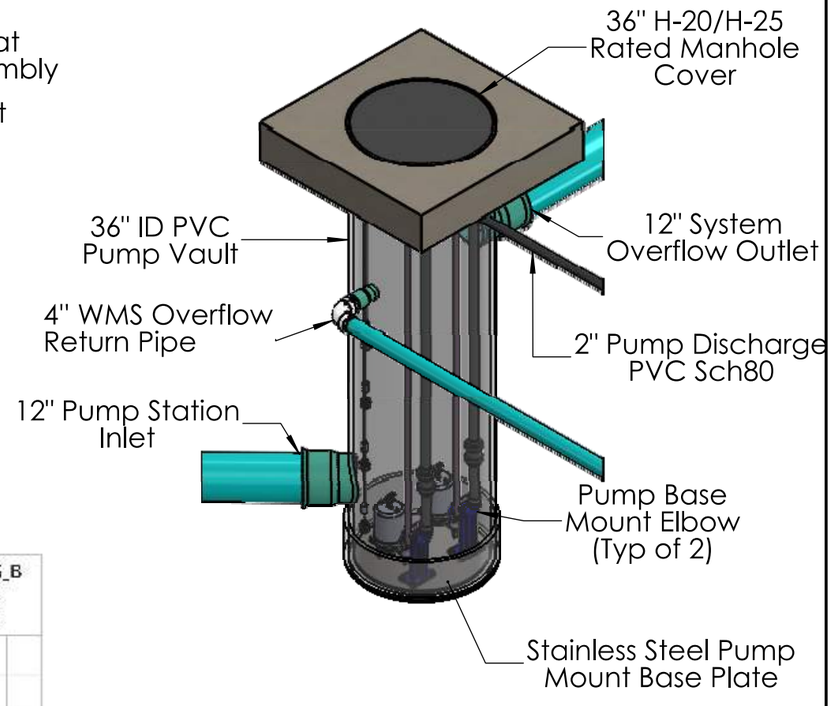
	NAME	DATE
DRAWN	CKL	6/9/22
CHECKED	MDF	6/9/22
ENG APPR.	CKL	6/9/22
REV		

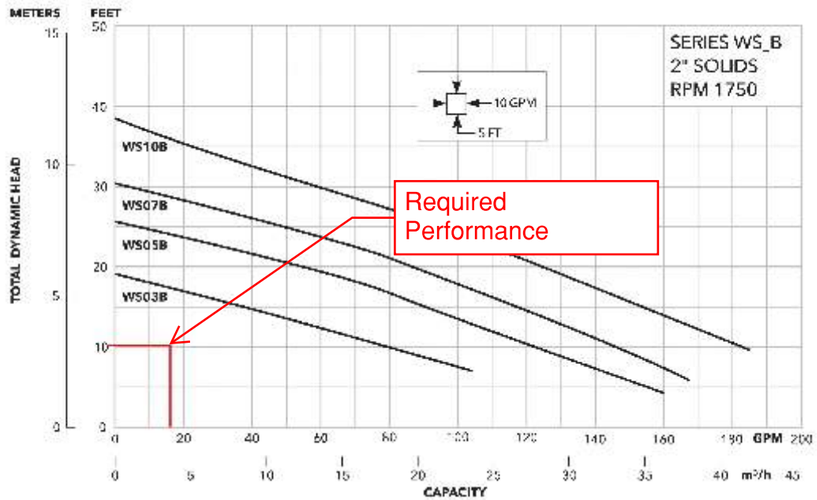
TITLE:
11709 Artesia Blvd, Artesia, CA
Stormwater Treatment System
12817 cu ft

SIZE **B** | SHEET 4 OF 7









NOTES:

1. All materials shown on this sheet shall be supplied by Santa Fe WinWater Company, Santa Fe Springs, CA, except where noted. Pumps shall be SFWW SWP-3, 115v, 12A. Substitution of any component may void warranty.
2. Locate Pump Controller as required for site conditions or Owner direction. Route power and signal cable conduit to vault from controller accordingly. Connections shall be provided by Contractor.
3. Route 2" pump system outlet and 12" Overflow pipe as shown on Civil Sheets. 12" Overflow pipe not required for treatment discharge pump systems.
4. Contractor to provide concrete collar around manhole cover suitable for surface loading conditions.
5. Anti-Floatation flange to be provided on pump vault where required for groundwater conditions.
6. Pump performance requirements based on 96 hour drawdown of 12,817 cu ft = 16.5 gpm.

Pump Station Headloss Calculation (Hazen-Williams) (For Complete Calculations, please contact SFWW)	
Pipe length 2" PVC Sch80 = 66'	0.53'
Check Valve (1)	0.12'
90 Degree Bends (2)	0.07'
Tee (Main to branch)	0.09'
Pipe Exit (1)	0.05'
Elevation Head	9.25'
TOTAL DISCHARGE HEAD REQ'D @ 16.5gpm	**10.11'**

SANTA FE Winwater COMPANY
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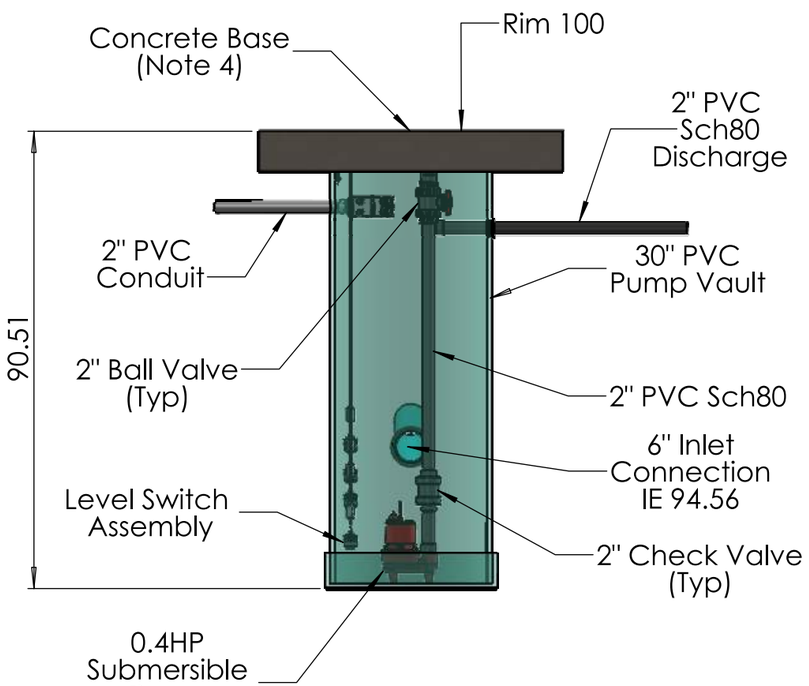
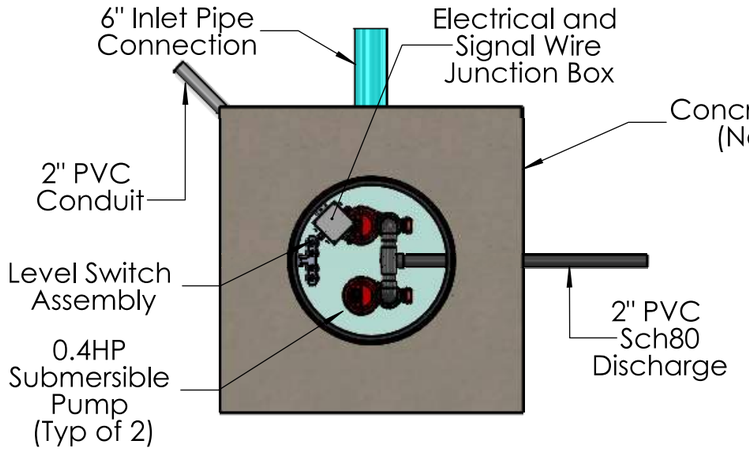
562-777-9724 / www.santafewinwater.com

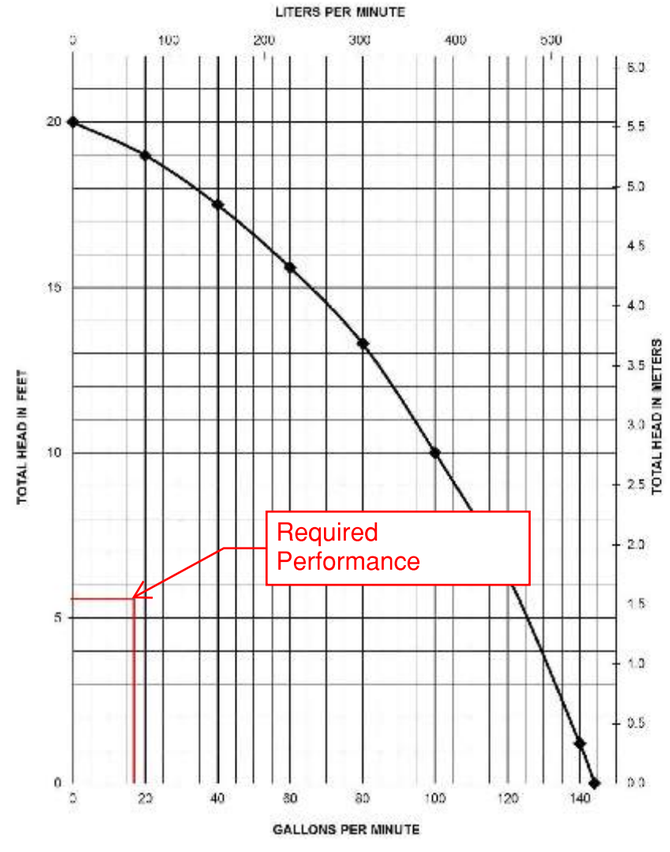
	NAME	DATE
DRAWN	CKL	6/9/22
CHECKED	DB	6/9/22
ENG APPR.	CKL	6/9/22
REV		

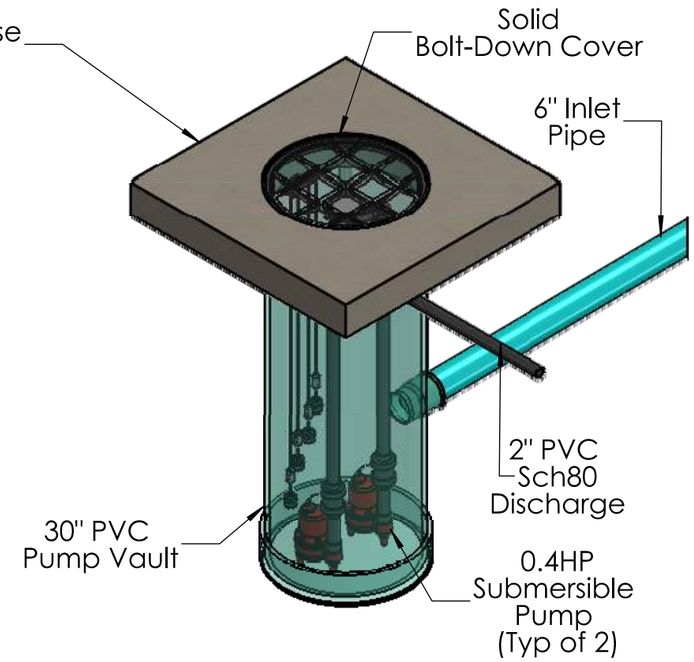
TITLE:
11709 Artesia Blvd. Artesia, CA
Stromwater Feed Pump
Station

SIZE **B** | SHEET 5 OF 7









NOTES:

1. All materials shown on this sheet shall be supplied by Santa Fe WinWater Company, Santa Fe Springs, CA, except where noted. Pumps shall be SFWW SWP-4, 115v, 3A. Substitution of any component may void warranty.
2. Locate Pump Controller as required for site conditions or Owner direction. Route power and signal cable conduit to vault from controller accordingly. Connections shall be provided by Contractor.
3. Route 2" pump system outlet and 12" Overflow pipe as shown on Civil Sheets. 12" Overflow pipe not required for treatment discharge pump systems.
4. Contractor to provide concrete collar around manhole cover suitable for surface loading conditions.
5. Anti-Floatation flange to be provided on pump vault where required for groundwater conditions.
6. Pump performance requirements based on 96 hour drawdown of 12,817 cu ft = 16.5 gpm.

Headloss Calculations		
Fitting	Qty / Length	Headloss
Pipe (2")	10.2'	0.08'
Check Valve	1	0.12'
90 Elbow	2	0.07'
Tee	1	0.09'
Exit	1	0.05'
Elevation Head		5.25'
Total Headloss @ 16.5 gpm		5.67'

SANTA FE Winwater COMPANY
10244 Freeman Ave, Santa Fe Springs, CA 90670
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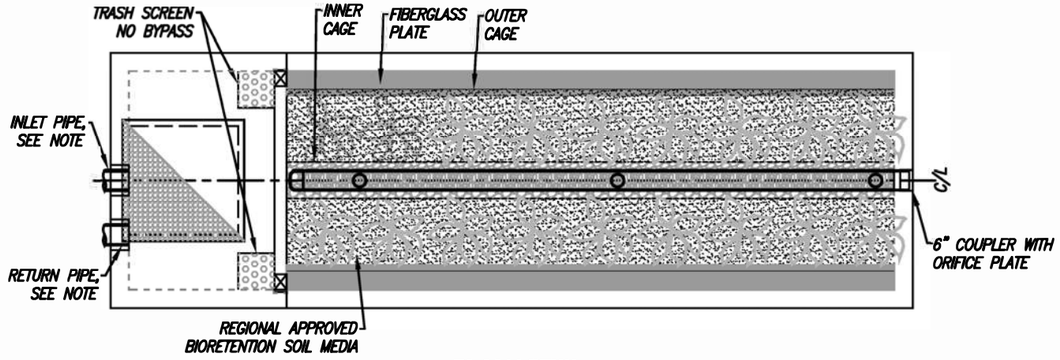
	NAME	DATE
DRAWN	CKL	6/9/22
CHECKED	MDF	6/9/22
ENG APPR.	CKL	6/9/22
REV		

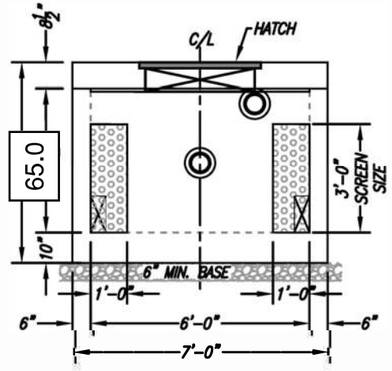
TITLE:
11709 Artesia Blvd, Artesia, CA
Stormwater Discharge Pump Station

SIZE **B** | SHEET 6 OF 7

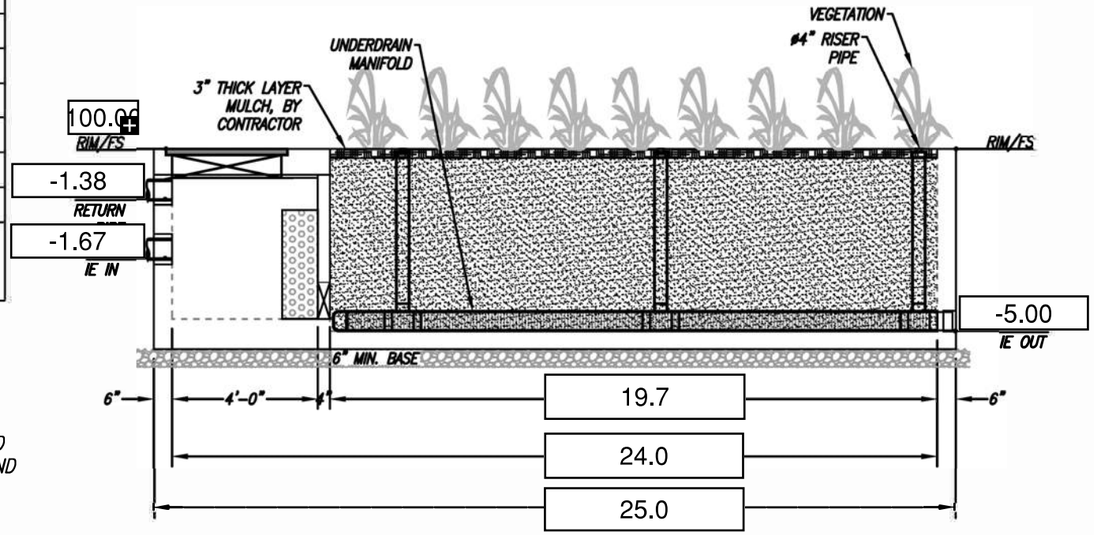
SITE SPECIFIC DATA			
PROJECT ID			
PROJECT NAME		11709 Artesia Blvd	
PROJECT LOCATION		Artesia, CA	
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
12,712.80		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE	-1.67	PVC SCH80	2"
RETURN PIPE	-1.38	PVC SDR35	4"
OUTLET PIPE	-5.00	PVC–SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	100.00	100.00	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	36" X 36"	N/A	N/A
LA COUNTY MEDIA MIX VOLUME (CY)			---
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			---
ORIFICE DIAMETER (IN)			---
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.			



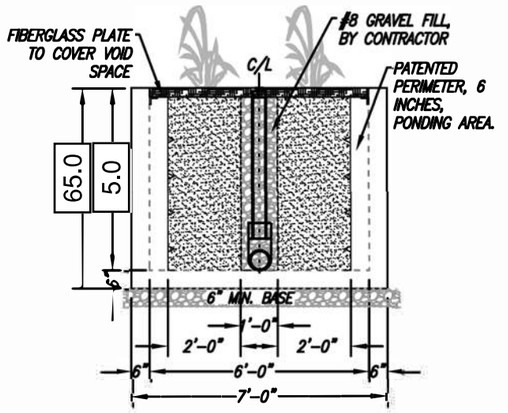
PLAN VIEW



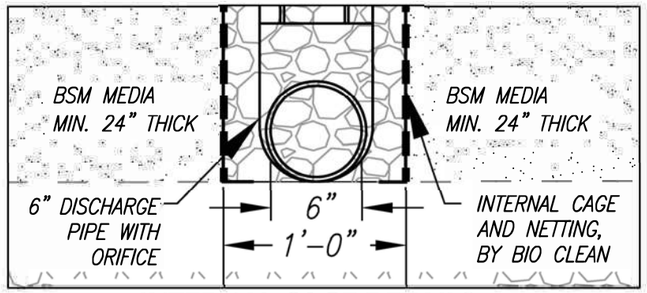
INLET VIEW



ELEVATION VIEW



OUTLET VIEW



INTERNAL CAGE DETAILS

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)	24
TREATMENT VOLUME (CF)	12,712.80
TARGETED DRAINDOWN DURATION (HR)	96.0
WETLANDMEDIA INFILTRATION RATE (IN/HR)	12.0
WETLANDMEDIA LOADING RATE (GPM/SF)	0.12
DISCHARGE RATE (CFS)	0.04
REQUIRED TOTAL MEDIA SURFACE AREA (SF)	137.57
PROVIDED TOTAL MEDIA SURFACE AREA (SF)	140.92
NUMBER OF ROW(S)	1

INSTALLATION NOTES

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

GENERAL NOTES

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

SANTA FE Winwater COMPANY

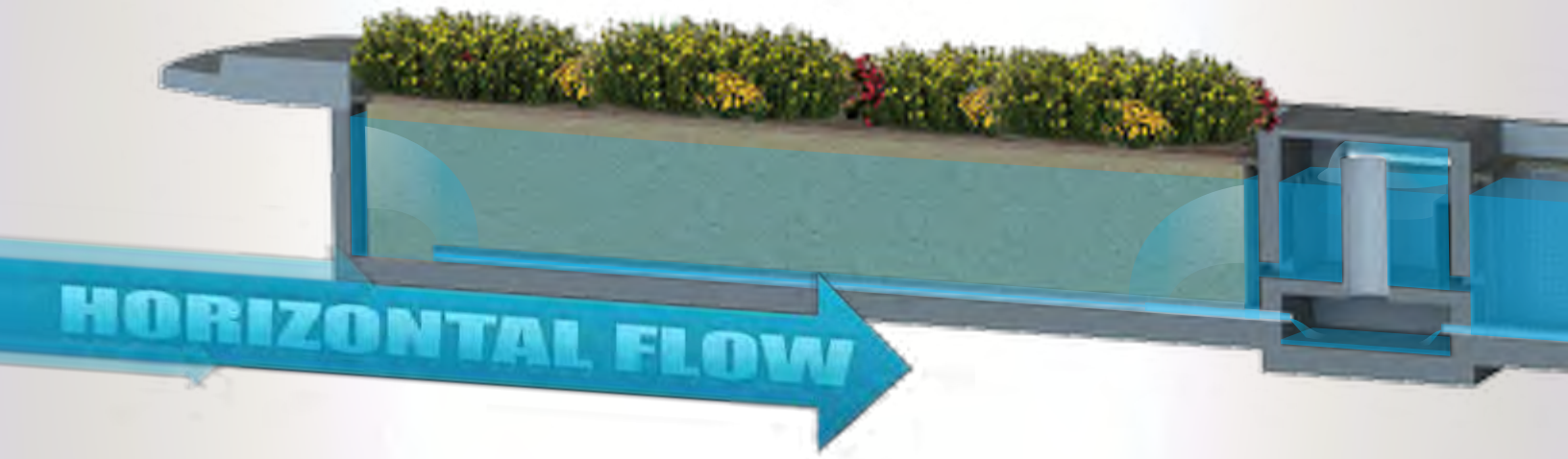
Bio Clean
A Forterra Company

WetlandMOD- 6-24.0-5.0 -V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

HDNS1227.6

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



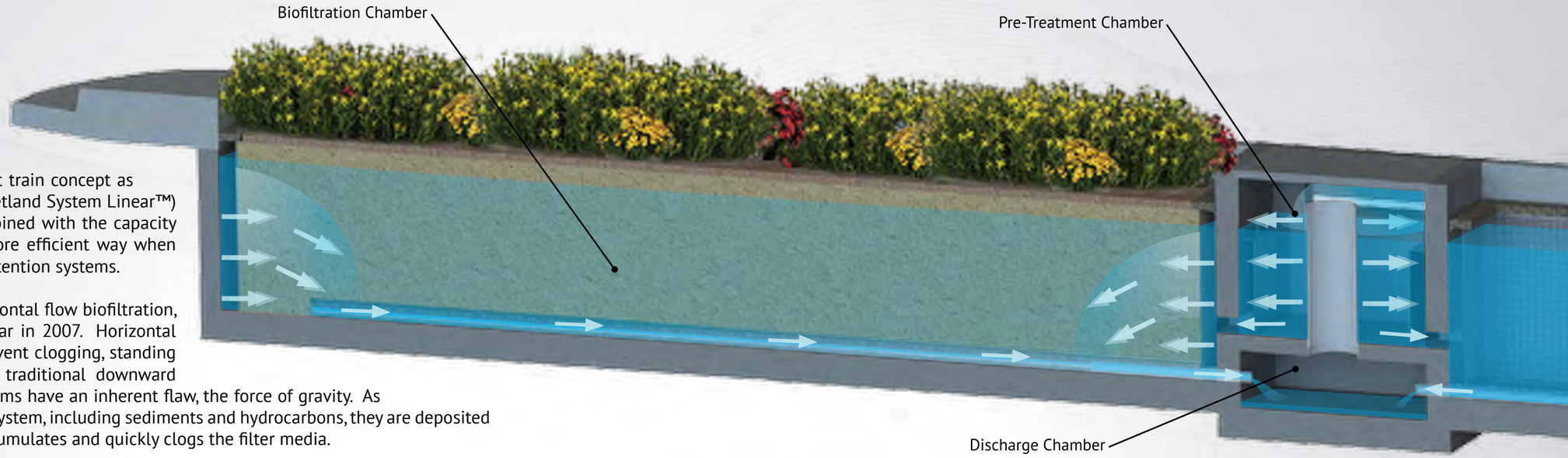
WetlandMod™

MODULAR WETLAND TREATMENT, VOLUME REDUCTION, REUSE & STORAGE SYSTEM

A NEW DIRECTION IN TRADITIONAL BIORETENTION / BIOFILTRATION SYSTEMS

Overview

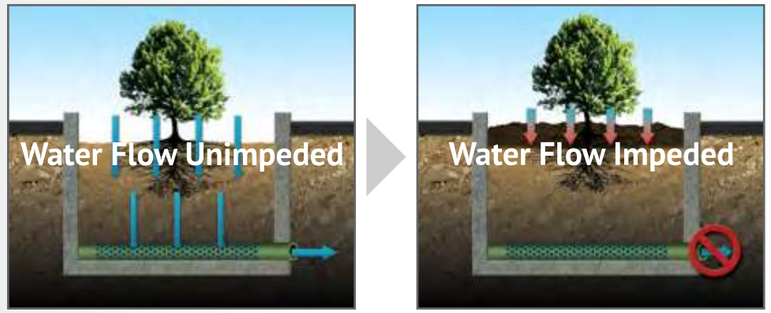
Modular Wetland Systems, Inc. continues to provide groundbreaking stormwater treatment and volume reduction/control technology with the **WetlandMod™**. This modular system provides the same treatment train concept as the industry leading MWS Linear (Modular Wetland System Linear™) - screening, separation, & biofiltration - combined with the capacity to reduce and control water volume in a more efficient way when compared to traditional downward flow bioretention systems.



The system is built upon the concept of horizontal flow biofiltration, which was first introduced by the MWS Linear in 2007. Horizontal flow works with gravity, not against it, to prevent clogging, standing water and other problems associated with traditional downward flow bioretention systems. Bioretention systems have an inherent flaw, the force of gravity. As stormwater runoff carries pollutants into the system, including sediments and hydrocarbons, they are deposited on top of the bioretention media where it accumulates and quickly clogs the filter media.

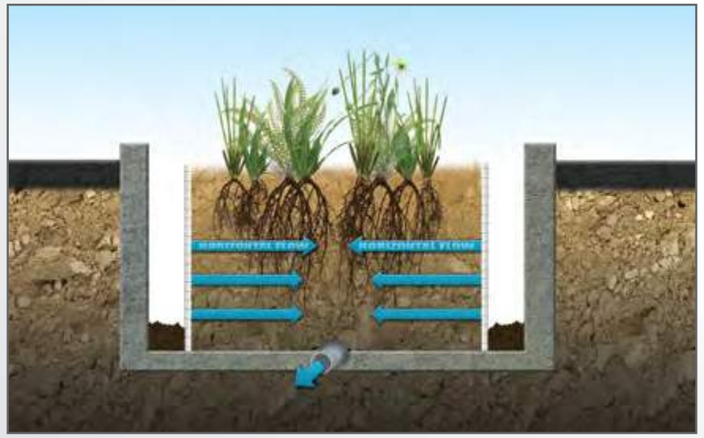
It has been documented that sediment accumulation from just a few storm events can completely clog a bioretention system. This leads to drastically reduced infiltration rates, expensive maintenance burdens, and safety issues associated with standing water, depressed landscaping and vector control.

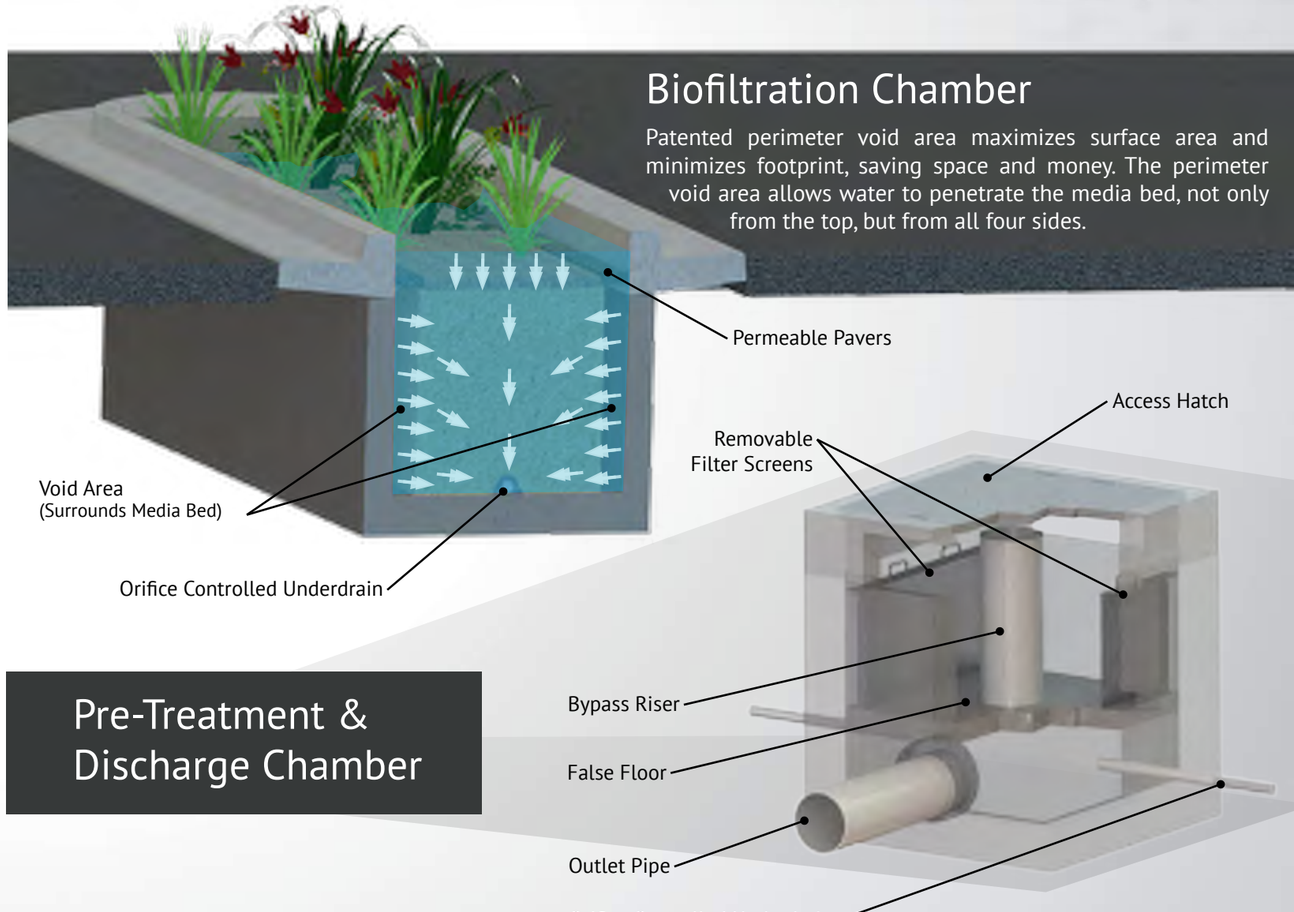
Downward Flow



Sediments Accumulate on Top of the Media Leading to Clogging

The **WetlandMod™** overcomes these challenges by utilizing pre-treatment, a horizontal flow biofiltration bed, and orifice flow control. The initial surface of the media bed in the **WetlandMod™** is oriented on a vertical plane, as opposed to horizontally, therefore running parallel with the force of gravity as opposed to perpendicular. This simple concept, increases surface area, reduces BMP footprint, prevents clogging and leads to an enhanced overall system with lower maintenance costs. The **WetlandMod™** can utilize various blends to meet local stormwater bioretention media specifications. The system is also available with an organic-free WetlandMEDIA to prevent nutrient leaching and maximize pollutant removal.





Configuration

One of the biggest challenges of the implementation of LID and bioretention/biofiltration systems is the associated space requirements. The large space requirements of traditional bioretention systems can cause design and feasibility issues, increasing the overall cost to comply with local and state stormwater regulations.

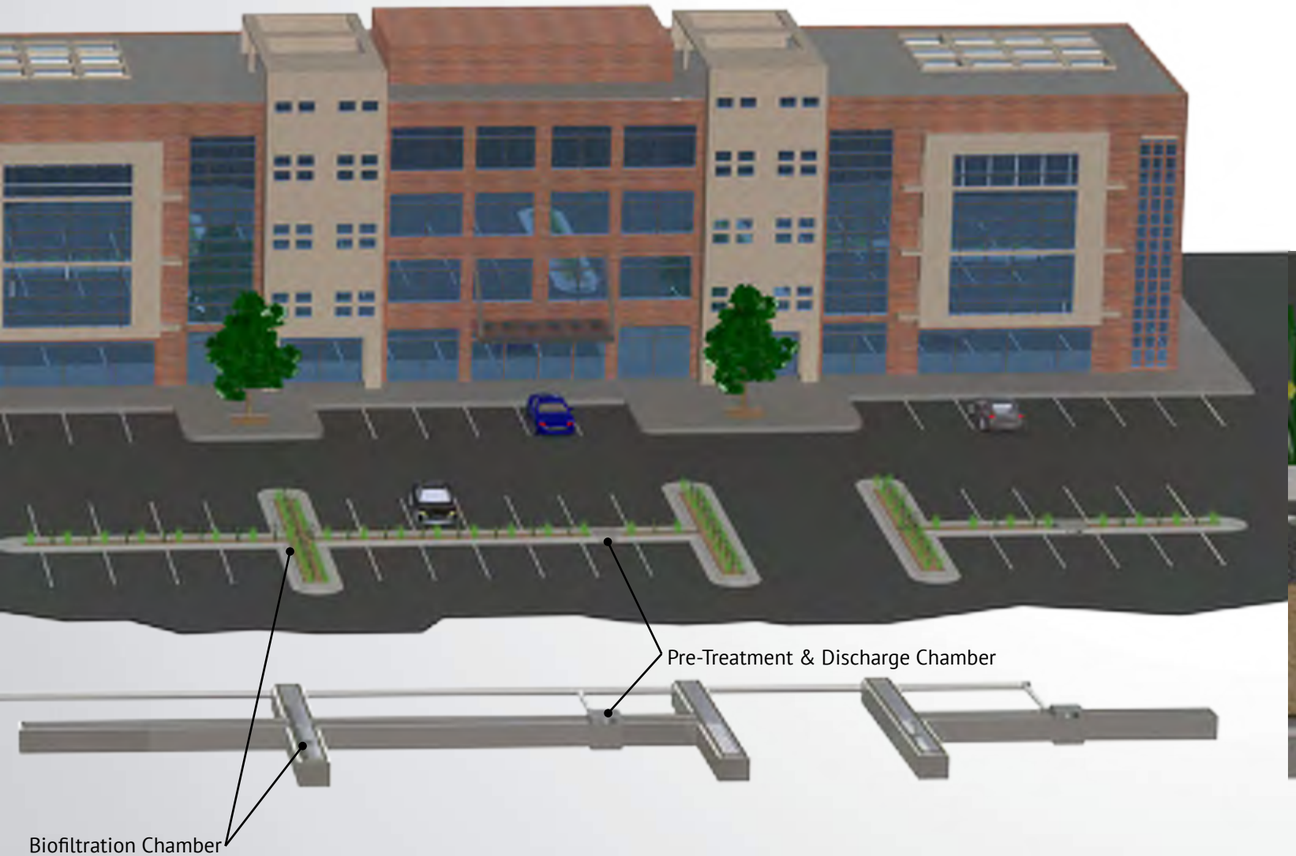
The **WetlandMod™** marks the first technological breakthrough to address how we comply with these regulations. The goal of the system is to minimize footprint and land costs associated with traditional bioretention/ biofiltration systems. This is acheived by utilizing horizontal flow technology and combining it with traditional downward flow, therefore maximizing the surface area for a given footprint.

Designed To Minimize Required BMP Footprint and Maximize Buildable Space

This system is constructed from modular precast concrete structures. The system comes standard with a curb-type pre-treatment structure, including internal bypass. The biofiltration chambers can be made in any length and shape (shown below) to allow for easy integration with parking lot island designs. The system comes in two standard widths, 4 feet (18" minimum media requirement - San Diego County) and 5 feet (24" minimum media requirement - Los Angeles County).

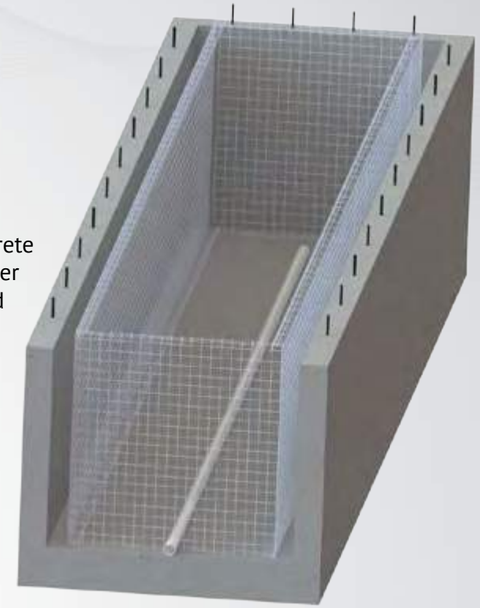
Footprint Reduction Up To 61% Over Traditional Bioretention Systems

(Example: Planter Boxes, Rain Gardens, Biofiltration)



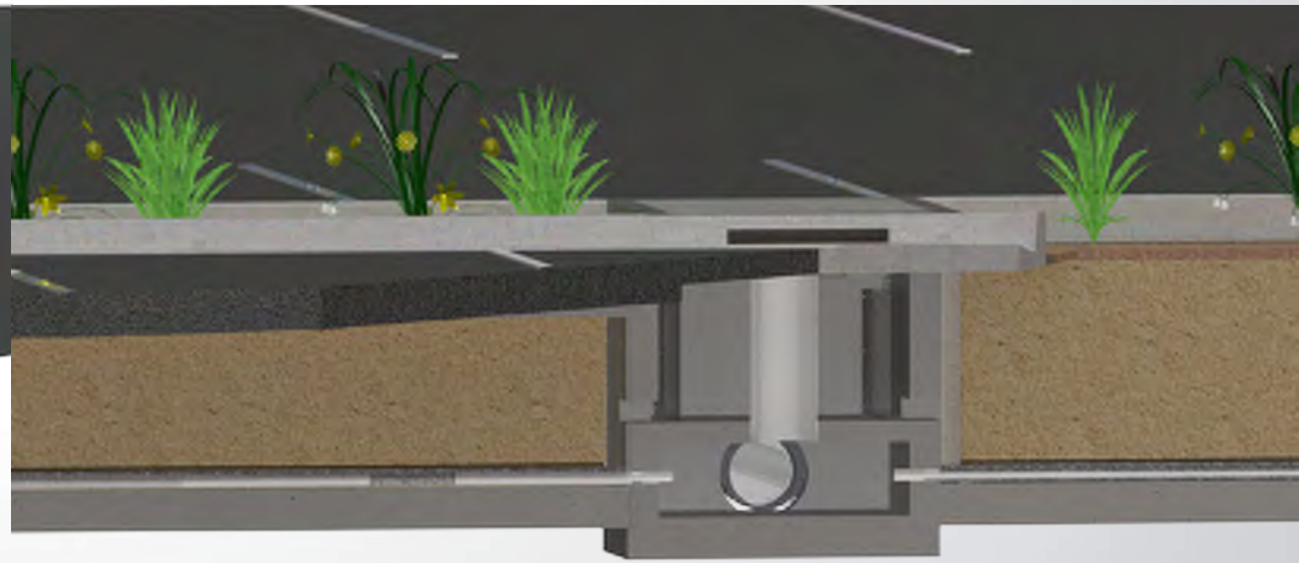
Wetland Chamber Module

The *Wetland Chamber Module* is constructed of precast concrete and available in various lengths and heights. The chamber also includes rebar dowels to attach structure to curb and gutter. Units can be connected mechanically end-to-end for longer modules.



Pre-Treatment Chamber Module

Pre-treatment Chambers come standard with built-in curb inlets to intercept sheet flows from surrounding areas. The pre-treatment chamber is available with an optional internal bypass for high flows and it is easily accessible for quick maintenance. Trash, debris and sediments are isolated in a central location, minimizing maintenance requirements on the biofiltration chamber.

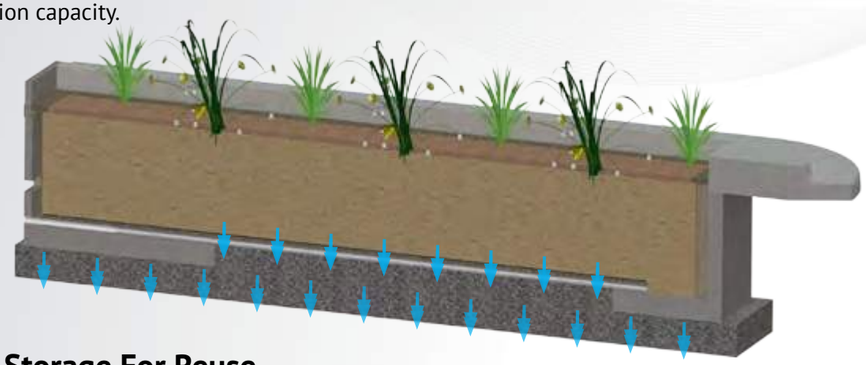


Curb Inlet

Configurations

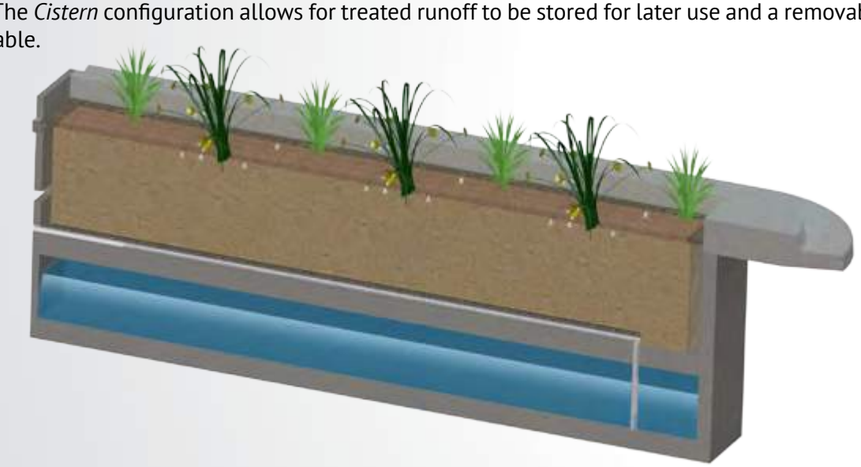
Open Bottom - Infiltration

This configuration is available with an open basin to maximize infiltration and meet "partial infiltration" requirements in many jurisdictions. A 12" rock base is recommended under the structure to maximize storage and infiltration capacity.



Cistern - Storage For Reuse

An optional storage vessel under the biofiltration chamber stores water for reuse, including irrigation and grey water. The *Cistern* configuration allows for treated runoff to be stored for later use and a removable sump pump is available.



WetlandMEDIA

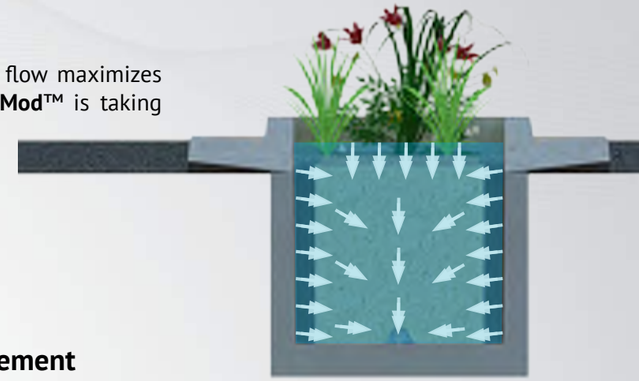
WetlandMEDIA is an organic free alternative to traditional bioretention media. It offers higher infiltration rates and a sorptive media mix with high ion exchange capacity. This makes it ideal for nutrient removal. WetlandMEDIA also supports robust vegetation and prevents standing water.

Bioretention Mix

The **WetlandMod™** is designed to utilize any type of bioretention mix required to meet local requirements and specifications, including a *5-Inch Per Hour* sand compost mix found in most LID manuals.

Sizing

The combination of horizontal flow and downward flow maximizes surface area and minimizes footprint. The **WetlandMod™** is taking bioretention/biofiltration to a new level.



18" Media - San Diego County Minimum Requirement

18" Media Thickness	WetlandMod	Traditional Bioretention
Chamber Width I.D. (ft.)	4.00	4.00
Cage Width (ft.)	3.34	n/a
Void Width (ft.)	0.33	n/a
Chamber Height Max (TC) (ft.)	4.40	n/a
Assoc. Cage Height Max (ft.)	3.52	n/a
TC to Top of Cage Distance (ft.)	0.88	n/a
Ponding Over Media (ft.)	0.33	Variable
Chamber Height Min (ft.)	1.61	Variable
Assoc. Cage Height Min (ft.)	1.83	Variable
TC to Top of Cage Distance (ft.)	0.88	Variable
MAX Surface Area Per Linear Foot (sq. ft.)	**10.38**	**4**
Footprint Reduction Provided	**61%**	
MIN Surface Area Per Linear Foot (sq. ft.)	**7**	**4**
Footprint Reduction Provided	**43%**	

24" Media - Los Angeles County Minimum Requirement

24" Media Thickness	WetlandMod	Traditional Bioretention
Chamber Width I.D. (ft.)	5.00	5.00
Cage Width (ft.)	4.34	n/a
Void Width (ft.)	0.33	n/a
Chamber Height Max (TC) (ft.)	4.40	n/a
Assoc. Cage Height Max (ft.)	3.52	n/a
TC to Top of Cage Distance (ft.)	0.88	n/a
Ponding Over Media (ft.)	0.33	Variable
Chamber Height Min (ft.)	2.05	Variable
Assoc. Cage Height Min (ft.)	2.33	Variable
TC to Top of Cage Distance (ft.)	0.88	Variable
MAX Surface Area Per Linear Foot (sq. ft.)	**11.38**	**5**
Footprint Reduction Provided	**56%**	
MIN Surface Area Per Linear Foot (sq. ft.)	**9**	**5**
Footprint Reduction Provided	**44%**	

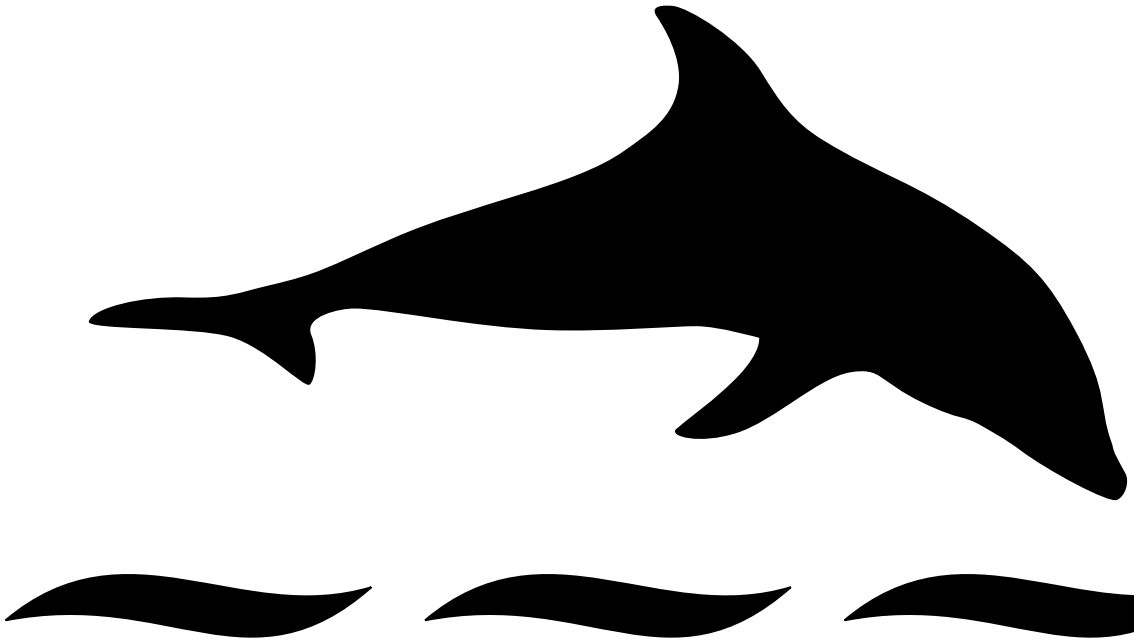
Advantages of WetlandMod™ Over Traditional Downward Flow Bioretention/Biofiltration Systems

- Minimizes Clogging
- Advanced Pre-Treatment
- Maximized Surface Area
- Minimal Footprint
- High Nutrient Removal
- Easy Maintenance
- No Standing Water Concerns
- Greater Volume Reduction, Moisture Retention and Evapotranspiration
- Orifice Controlled Discharge

Appendix D:
"NO DUMPING – DRAINS TO OCEAN" Stencil Examples

Sample Stencil 1

NO DUMPING



DRAINS TO OCEAN

Sample Stencil 2

Appendix E:
Catch Basin Cleaning

United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-99-011 September 1999

EPA

Storm Water O&M Fact Sheet Catch Basin Cleaning

DESCRIPTION

Catch basins are chambers or sumps, usually built at the curb line, which allow surface water runoff to enter the storm water conveyance system. Many catch basins have a low area below the invert of the outlet pipe intended to retain coarse sediment. By trapping sediment, the catch basin prevents solids from clogging the storm sewer and being washed into receiving waters. Catch basins must be cleaned periodically to maintain their ability to trap sediment, and consequently their ability to prevent flooding. The removal of sediment, decaying debris, and highly polluted water from catch basins has aesthetic and water quality benefits, including reducing foul odors, reducing suspended solids, and reducing the load of oxygen-demanding substances that reach receiving waters.

APPLICABILITY

Catch basin cleaning should be performed at any facility that has an on-site storm sewer system that includes catch basins and manholes.

Although catch basin cleaning is easily implemented, it is often overlooked in an overall storm water management plan. In addition, many of the catch basin cleaning programs that have been implemented focus only on removal of debris from grate openings; full implementation of the catch basin cleaning BMP should also include removal of debris from the catch basin itself.

ADVANTAGES AND DISADVANTAGES

Catch basin cleaning is an efficient and cost-effective method for preventing the transport of sediment and pollutants to receiving water bodies. This improves both the aesthetics and the quality of the receiving water body.

Limitations associated with cleaning catch basins include:

- Catch basin debris usually contains appreciable amounts of water and offensive organic material which must be properly disposed.
- Catch basins may be difficult to clean in areas with poor accessibility and in areas with traffic congestion and parking problems.
- Cleaning is difficult during the winter when snow and ice are present.

Sediment and debris removed from catch basins can potentially be classified as hazardous waste. As a result, the materials must be disposed in a proper manner to avoid negative environmental impacts.

PERFORMANCE

Based on current data, it is not possible to quantify the water quality benefits to receiving waters resulting from catch basin cleaning. The rate at which catch basins fill with debris, as well as the total amount of material which can be removed by different frequencies of cleaning, are highly variable and cannot be readily predicted. Past studies have estimated that typical catch basins retain up to 57 percent of coarse solids and 17 percent of equivalent biological oxygen demand (BOD).

In addition, data collected as part of a Nationwide Urban Runoff Program (NURP) project in Castro Valley Creek, California, indicated that catch basins, cleaned on an average of once every year and a half, contained approximately 60 pounds of material each at the time of the cleaning.

OPERATION AND MAINTENANCE

Catch basins should be inspected at least annually to determine if they need to be cleaned. Typically, a catch basin should be cleaned if the depth of deposits is greater than or equal to one-third the depth from the basin to the invert of the lowest pipe or opening into or out of the basin. If a catch basin significantly exceeds the one-third depth standard during the annual inspection, then it should be cleaned more frequently. If woody debris or trash accumulates in a catch basin, then it should be cleaned on at least a weekly basis.

Catch basins can be cleaned either manually or by specially designed equipment. This equipment may include bucket loaders and vacuum pumps. Material removed from catch basins is usually disposed in conventional landfills. Before any materials can be disposed, it is necessary to perform a detailed chemical analysis to determine if the materials meet the EPA criteria for hazardous waste. This will help determine how the materials should be stored, treated, and disposed.

COSTS

Catch basin cleaning costs will vary depending upon the method used, the required cleaning frequency, the amount of debris removed, and debris disposal costs.

Cleaning costs for catch basins were estimated in three NURP program studies (Midwest Research Institute, 1982). These estimates are summarized in Table 1.

In communities equipped with vacuum street sweepers, a cleaning cost of $8 per basin cleaned is recommended for budgetary purposes (Southeastern Wisconsin Regional Planning Commission, 1991.) Cleaning catch basins manually costs approximately twice as much as cleaning the basins with a vacuum attached to a sweeper. Therefore, a cost estimate of $16 per catch basin cleaned may be used for manual cleaning. It should be noted that costs vary depending on local market conditions.

TABLE 1 CLEANING COST PER CATCH BASIN

Location	Method	Cost
Castro Valley, CA	Vacuum attached to street sweeper	$7.70
Salt Lake County, UT	Vacuum attached to street sweeper	$10.30
Winston-Salem, NC	Vacuum attached to street sweeper	$6.30

Source: MRI, 1982.

REFERENCES

1. Midwest Research Institute, 1982. *Collection of Economic Data from Nationwide Urban Runoff Program Projects-Final Report.* Report to U.S. Environmental Protection Agency.

2. Minnesota Pollution Control Agency, 1989. *Protecting Water Quality in Urban Areas.*

3. Southeastern Wisconsin Regional Planning Commission, 1991. *Cost of Urban Nonpoint Source Water Pollution Control Measures,* Technical Report No. 31.

4. U.S. EPA, 1983. *Final Report of the Nationwide Urban Runoff Program.* EPA 841/583109.

5. U.S. EPA, 1977. *Catch Basin Technology Overview and Assessment.* EPA-600/2-77-051.

6. Washington State Department of Ecology, 1992. *Storm Water Management Manual for Puget Sound.*

ADDITIONAL INFORMATION

Alameda County, California
Jim Scanlin
Alameda Countywide Clean Water Program
951 Turner Court, Room 300
Hayward, CA 94545

King County, Washington
Dave Hancock
Department of Natural Resources, Water and Land Resources Division, Drainage Services Section
700 5th Avenue, Suite 2200
Seattle, WA 98104

Salt Lake County, Utah
Terry Way
Salt Lake County Engineering Division
2001 South State Street, Suite N3300
Salt Lake City, UT 84190

Southeastern Wisconsin Regional Planning Commission
Bob Biebel
916 N. East Avenue, P.O. Box 1607
Waukesha, WI 53187

City of Winston Salem, North Carolina
Terry Cornett
Department of Public Works, Streets Division
P.O. Box 2511
Winston Salem, NC 27106

The mention of trade names or commercial products does not constitute endorsement or recommendation for the use by the U.S. Environmental Protection Agency.

For more information contact:

Municipal Technology Branch
U.S. EPA
Mail Code 4204
401 M St., S.W.
Washington, D.C., 20460

OWM MTB
Excellence in compliance through optimal technical solutions
MUNICIPAL TECHNOLOGY BRANCH

Appendix F:
General Education Materials

Storm Drains are for Rain...

More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

Please use pesticides wisely, not before a rain, and water carefully.

...not pesticides.

1(888)CLEAN LA
www.888CleanLA.com

Pesticide Tips:

You can keep your lawn and garden green and at the same time solve the pollution problem by taking these easy steps...

- Never dispose of lawn or garden chemicals in storm drains. This is called illegal dumping. Take them to a household hazardous waste roundup. Call 1(888)CLEAN LA or visit www.888CleanLA.com to locate a roundup or collection facility near you.
- More is not better. Use pesticides sparingly. "Spot" apply, rather than "blanket" apply.
- Read labels! Use only as directed.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides, make sure they are in a sealed, water-proof container that cannot leak.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street and carry pesticide chemicals with it. Don't use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

Printed on recycled paper

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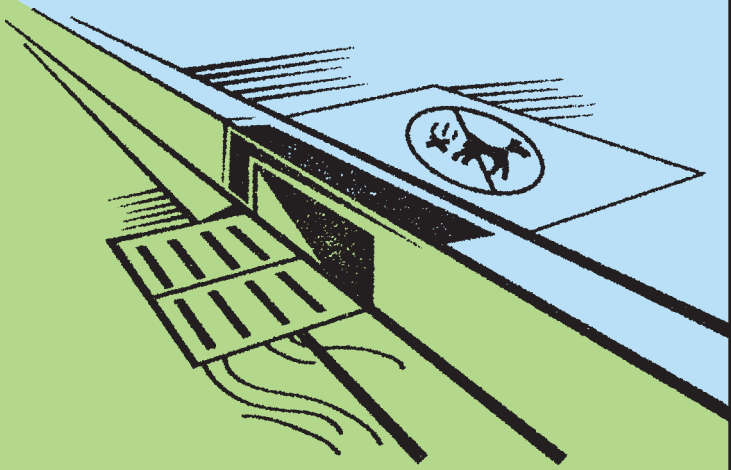
Pick Up After Your Pooch!



Storm drains are for rain…
they're not pooper scoopers.

L.A. County residents walk a dog without picking up the droppings more than **62,000** times per month.

Disease-causing dog waste washes from the ground and streets into storm drains and flows straight to the ocean — untreated.

Remember to bring a bag and clean up after your dog.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Dog Owners:

Dog owners can help solve the stormwater pollution problem by taking these easy steps…

- Clean up after your dog every single time.
- Take advantage of the complimentary waste bags offered in dispensers at local parks.
- Ensure you always have extra bags in your car so you are prepared when you travel with your dog.
- Carry extra bags when walking your dog and make them available to other pet owners who are without.
- Teach children how to properly clean up after a pet. Encourage them to throw the used bags in the nearest trash receptacle if they are away from home.
- Put a friendly message on the bulletin board at the local dog park to remind pet owners to clean up after their dogs.
- Tell friends and neighbors about the ill effects of animal waste on the environment. Encourage them to clean up after their pets as well.

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Are You a Litter Bug and Don't Know It?

Take our quiz!

Have you ever...

- Dropped a cigarette butt or trash on the ground?
- Failed to pick up after your dog while out on a walk?
- Overwatered your lawn after applying fertilizers/pesticides?
- Disposed of used motor oil in the street, gutter or garbage?

If you answered **yes** to any of these actions, then **YOU ARE A LITTER BUG**!

Each of these behaviors contribute to stormwater pollution, which contaminates our ocean and waterways, kills marine life and causes beach closures.

You can become part of the solution!
To find out how, flip this card over.

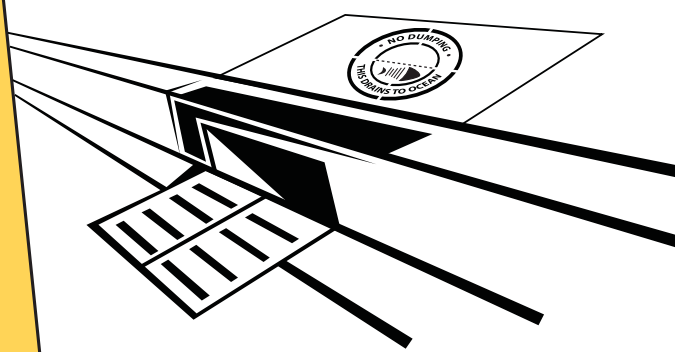
For more information, call or visit:

1 (888) CLEAN LA
www.888CleanLA.com

PROJECT Pollution PREVENTION

Follow these simple steps to prevent stormwater pollution:

- Put your garbage where it belongs — in the trash can.
- Pick up after your dog when out on a walk.
- Reduce pesticide and fertilizer use; don't overwater after application or apply if rain is forecast.
- Dispose of used motor oil at an oil recycling center or at a free Household Hazardous Waste/E-Waste collection event.



A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

Stormdrains take runoff directly to creeks and the ocean without treatment. Pool chemicals can harm our natural creeks and waterways. Anything going into our stormdrains that isn't rainwater contributes to stormwater pollution, which contaminates our creeks and ocean, kills marine life and causes beach closures.

...not pool chemicals

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Swimming Pool Tips

Follow these simple steps to prevent stormwater pollution...

- Make sure all chemicals are dissipated before draining a pool or spa
- Do not drain pools within 5 days of adding chemicals
- Never backwash a filter into the street or stormdrain
- Cleanup chemical spills with absorbent, don't wash it down the drain
- Dispose of leftover chemicals and paints through a licensed hazardous waste disposal provider

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

...they're not recycling centers.

1(888)CLEAN LA
www.888CleanLA.com

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters...

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

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- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

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PROJECT Pollution PREVENTION

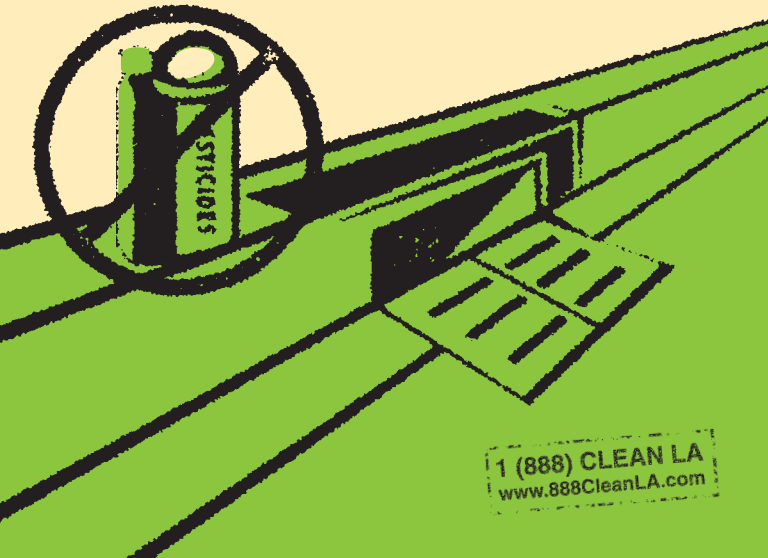
A Yard is a Terrible Thing to Waste!

Storm drains are for rain…**not yard waste.**

Residential yard waste represents about **13 percent** of the total waste generated in L.A. County.

Pesticides, fertilizer and yard waste such as leaves and mowed grass wash from the ground and streets into storm drains and flow straight to the ocean — **untreated**.

Remember to use pesticides and fertilizer wisely and pick-up yard waste.



Tips For Yard Care:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps…

- Do not over-fertilize and do not use fertilizer or pesticides near ditches, gutters or storm drains.
- Do not use fertilizer or pesticides before a rain.
- Follow the directions on the label carefully.
- Use pesticides sparingly — more is not better. "Spot" apply, rather than "blanket" apply.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street carrying pesticides and other chemicals with it.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides or fertilizer, make sure they are in a sealed, water-proof container in a covered area to prevent runoff.
- Do not blow, sweep, hose or rake leaves or other yard trimmings into the street, gutter or storm drain.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids in the street or gutter. Take them to your local auto parts store, gas station or repair shop, or a household hazardous waste Roundup for recycling.

1(888)CLEAN LA
www.888CleanLA.com

...not automotive fluids.

Car Care Tips:

You can keep your car running smoothly and efficiently, and at the same time help prevent stormwater pollution by taking these easy steps...

- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visitwww.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

PROJECT Pollution PREVENTION

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- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

PROJECT Pollution PREVENTION

Printed on recycled paper

Don't Paint the Town Red!

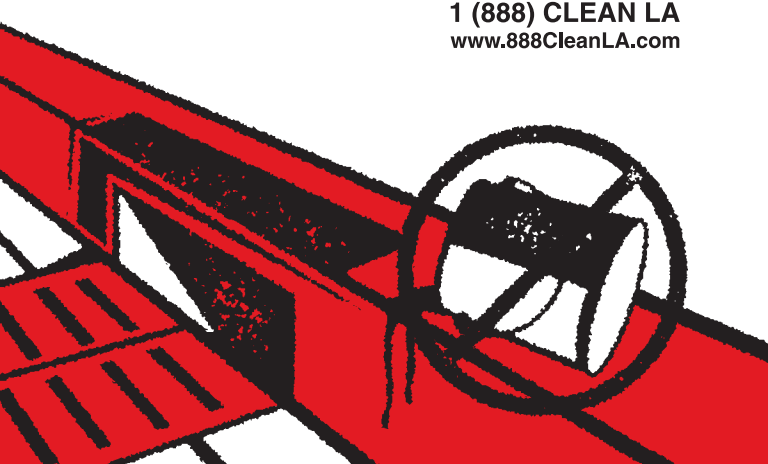
Storm drains are for rain…
they're not for paint disposal.

More than **197,000** times each month, L.A. County residents wash their dirty paint brushes under an outdoor faucet.

This dirty rinse water flows into the street, down the storm drain and straight to the ocean — **untreated**.

Remember to clean water-based paint brushes in the sink, rinse oil-based paint brushes with paint thinner, and take old paint and paint-related products to a Household Hazardous Waste/E-Waste collection event.

1 (888) CLEAN LA
www.888CleanLA.com



Tips for Paint Clean-Up:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps when working with paint and paint-related products…

- Never dispose of paint or paint-related products in the gutters or storm drains. This is called illegal dumping. Take them to a Household Hazardous Waste/E-Waste collection event. Call 1 (888) CLEAN LA or visit www.888CleanLA.com to locate an event near you.
- Buy only what you need. Reuse leftover paint for touch-ups or donate it to a local graffiti abatement program. Recycle or use excess paint.
- Clean water-based paint brushes in the sink.
- Oil-based paints should be cleaned with paint thinner. Filter and reuse paint thinner. Set the used thinner aside in a closed jar to settle-out paint particles.
- Store paints and paint-related products in rigid, durable and watertight containers with tight-fitting covers.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Appendix G:
Operation and Maintenance Plan

To be provided during final engineering

Appendix H:
Geotechnical Investigation

December 7, 2021
J.N.: 3027.00

Mr. Mitchell Gardner
G3 Urban
15235 S. Western Avenue
Gardena, California 90249

Subject: **Preliminary Geotechnical Investigation, Proposed Industrial Development, 11709 Artesia Blvd., Artesia, California**

Dear Mr. Gardner,

Pursuant to your request, ***Albus & Associates, Inc***. is pleased to present to you our preliminary geotechnical investigation report for the proposed development at the subject site. This report presents the results of our aerial photo and literature review, subsurface exploration, laboratory testing, and engineering analyses. Conclusions relevant to the feasibility of the proposed site development and recommendations for site development are also presented herein based on the findings of our work.

We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS & ASSOCIATES, INC.

David E. Albus
Principal Engineer

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FIGURES AND PLATES

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Plate 1 - Geotechnical Map

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APPENDIX C – LIQUEFACTION ANALYSIS

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purposes of our preliminary geotechnical investigation were to evaluate geotechnical conditions within the project area and to provide conclusions and recommendations relevant to the design and construction of the proposed improvements at the subject site. The scope of this investigation included the following:

- Review of the historical aerial photographs;
- Review of published geologic and seismic data for the site and surrounding area;
- Exploratory drilling and soil sampling;
- Laboratory testing of selected soil samples;
- Engineering analyses of data obtained from our review, exploration, and laboratory testing;
- Evaluation of site seismicity, liquefaction potential, and settlement potential; and,
- Preparation of this report

1.2 SITE LOCATION AND DESCRIPTION

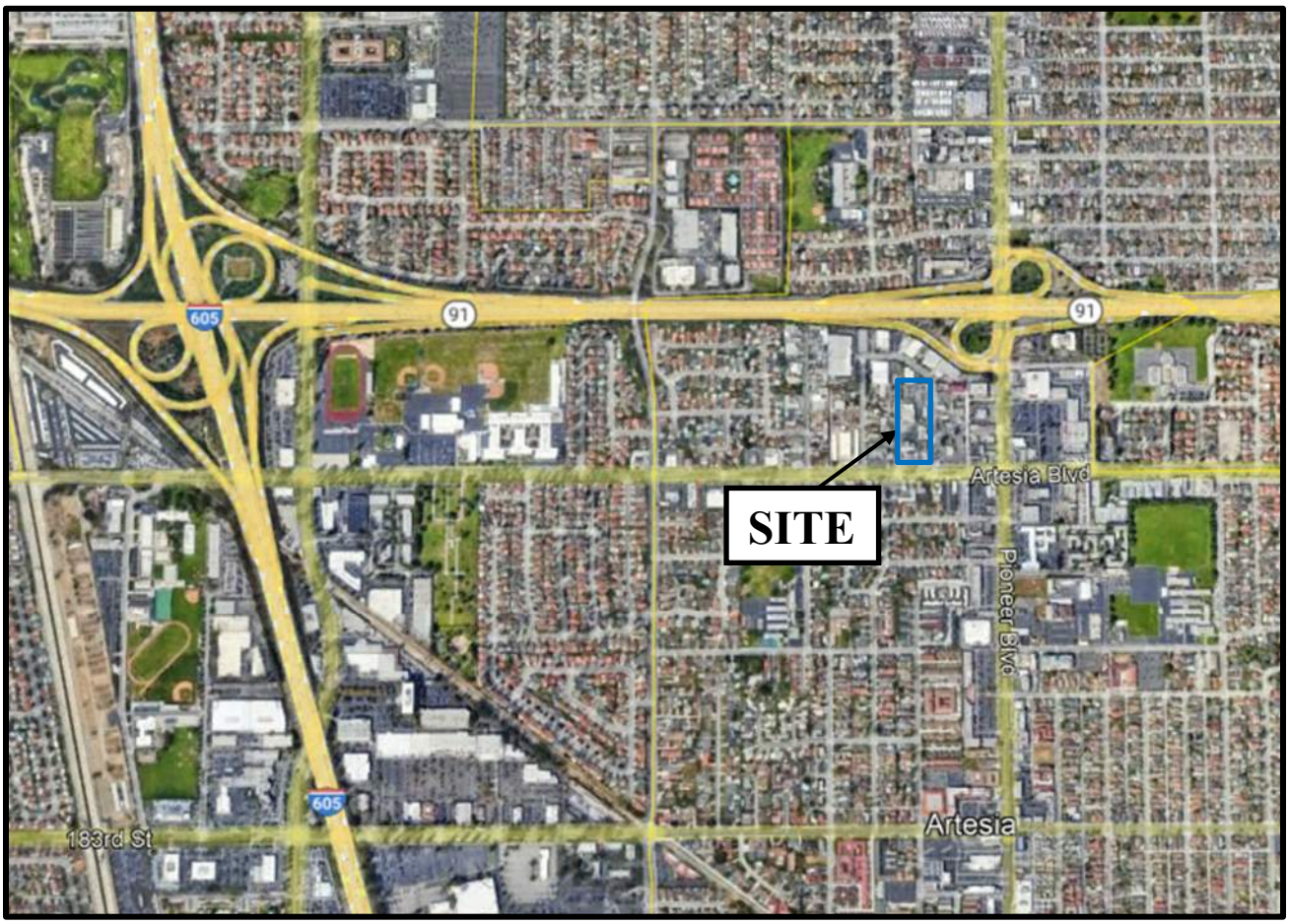
The site is located at the address of 11709 Artesia Boulevard within the city of Artesia, California. The site is bordered by Artesia Boulevard to the south, Fallon Avenue to the west, Alburtis Avenue to the east, and a commercial building and surface parking lots to the north. The location of the site and its relationship to the surrounding areas are shown in Figure 1, Site Location Map.

The site consists of approximately 3.33 acres of land with several industrial buildings, above-ground tanks, processing equipment, and above-ground piping. The remainder of the site consists of asphalt- and concrete-covered paving.

1.3 PROPOSED DEVELOPMENT

Based on the project brochure prepared by Colliers, we understand that the proposed development will likely consist of one or two new industrial buildings at-grade parking as well as associated interior driveways, parking, underground utilities, and decorative hardscape and landscape areas.

No grading or structural plans were available in preparing this report. However, we anticipate that minor rough grading of the site will be required to achieve future surface configuration. Structural loads are anticipated to typically consist of 250 kips for columns and 6 kips/ft for walls.



N

SITE LOCATION MAP

G3 Urban
11709 Artesia Boulevard,
Artesia, California

NOT TO SCALE

FIGURE 1

2.0 INVESTIGATION

2.1 RESEARCH

We have reviewed the referenced geologic publications and maps (see references). Data from these sources were utilized to develop some of the findings and conclusions presented herein.

We have also reviewed available historical aerial photographs. The aerial photos indicate that as early as 1967, the subject site was developed with industrial facilities. The site has remained relatively unchanged since 1967.

2.2 SUBSURFACE EXPLORATION

Subsurface exploration for this investigation was conducted on November 2, 2021 and consisted of drilling three (3) soil borings to depths ranging from approximately 11.5 to 51.5 feet below the existing ground surface (bgs) and advancing four (4) Cone Penetration Tests (CPTs) to a depth of 50 feet bgs. The borings were drilled using a truck-mounted, continuous flight, hollow-stem-auger drill rig. A representative of Albus & Associates, Inc. logged the exploratory borings. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented in the Exploration Logs in Appendix A. The approximate locations of the exploratory excavations and CPT soundings completed by this firm are shown on the enclosed Geotechnical Map, Plate 1.

Bulk, relatively undisturbed, and Standard Penetration Test (SPT) samples were obtained at selected depths within the exploratory borings for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with brass rings. SPT samples were obtained from the boring using a standard, unlined SPT soil sampler. During each sampling interval, the sampler was driven 18 inches with successive drops of a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the sampler was recorded for each six inches of advancement. The total blow count for the lower 12 inches of advancement per soil sample is recorded on the exploration log. Samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses. The borings were backfilled with auger cuttings upon completion of sampling.

2.3 LABORATORY TESTING

Selected samples obtained from our subsurface exploration were tested in our soil laboratory. Tests consisted of maximum dry density and optimum moisture content, in-situ moisture content and dry density, expansion index, soluble sulfate content, direct shear, consolidation/collapse potential, grain-size distribution analysis, percent passing No. 200 sieve, direct shear strength, corrosivity testing (pH, chloride, and resistivity), and Atterberg limits. A description of laboratory test criteria and test results are presented in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

Descriptions of the earth materials encountered during our investigation are summarized below and are presented in detail on the Exploration Logs presented in Appendix A.

Soil materials encountered at the subject site consisted of approximately 2 feet of artificial fill over alluvial soils. The artificial fill is predominately comprised of grayish brown sandy silt and silty sand. These fill materials typically were observed to be damp to moist and medium dense.

Underlying the artificial fills are native soils consisting of young alluvial fan deposits (Qyf_a). The alluvial fan deposit materials were encountered to the maximum depth explored of 51.5 feet and are comprised of grayish brown to light gray, interlayered silty sand and sand that are damp to wet and loose to very dense. Occasional lenses and layers of sandy silt are also present that are generally very moist to wet and firm to very stiff.

3.2 GROUNDWATER

Groundwater was encountered during this firm's subsurface exploration at a depth of 14 feet. The CDMG Special Report 019 suggests that historic high groundwater for the subject site is below 10 feet.

3.3 FAULTING

Based on our review of the referenced publications and seismic data, no active faults are known to project through or immediately adjacent to the subject sites and the site does not lie within an "Earthquake Fault Zone" as defined by the State of California in Earthquake Fault Zoning Act. Table 3.1 summarizes the known seismically active faults within 10 miles of the sites based on the 2008 USGS National Seismic Hazard Maps.

TABLE 3.1
Summary of Faults

Name	Dist. (miles)	Slip Rate (mm/yr.)	Preferred Dip (degrees)	Slip Sense	Rupture Top (km)	Fault Length (km)
Puente Hills (Coyote Hills)	2.67	0.7	26	thrust	2.8	17
Puente Hills (Santa Fe Springs)	2.82	0.7	29	thrust	2.8	11
Newport Inglewood Connected alt 2	6.87	1.3	90	strike slip	0	208
Newport-Inglewood, alt 1	6.95	1	88	strike slip	0	65
Newport Inglewood Connected alt 1	6.95	1.3	89	strike slip	0	208
Puente Hills (LA)	7.01	0.7	27	thrust	2.1	22
Elsinore;W+GI+T+J+CM	8.40	n/a	84	strike slip	0	241
Elsinore;W+GI	8.40	n/a	81	strike slip	0	83
Elsinore;W+GI+T	8.40	n/a	84	strike slip	0	124
Elsinore;W+GI+T+J	8.40	n/a	84	strike slip	0	199
Elsinore;W	8.40	2.5	75	strike slip	0	46

4.0 ANALYSES

4.1 SEISMICITY

2019 CBC requires seismic parameters in accordance with ASCE 7-16. Unless noted otherwise, all section numbers cited in the following refer to the sections in ASCE 7-16.

Per Section 20.3 the project site was designated as Site Class D. We used the OSHPD seismic hazard tool to obtain the basic mapped acceleration parameters, including short periods (S_S) and 1-second period (S_1) MCE_R Spectral Response Accelerations. Section 11.4.8 requires site-specific ground hazard analysis for structures on Site Class E with S_S greater than or equal to 1.0 or Site Class D or E with S_1 greater than or equal to 0.2. Based on the mapped values of S_S and S_1 the project site falls within this category, requiring site-specific hazard analysis in accordance with Section 21.2.

However, "A ground motion hazard analysis is not required for structures where: Structures on Site Class D sites with S_1 greater than or equal to 0.2, provided the value of the seismic response coefficient Cs is determined by Eq. (12.8-2) for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq T > 1.5T_s$ or Eq. (12.8-4) for $T > T_L$." Assuming this exception is met for this project, a ground motion hazard analysis is not required and mapped seismic values can be used. Should this exception not be met, a ground motion hazard analysis is required to determine the Design response spectra for the proposed structures at this site. Both mapped and site-specific seismic design parameters are provided in this report, as presented in Section 6.2. Details of a ground motion hazard analysis are explained below.

According to Section 21.2.3 (Supplement 1), the site-specific Risk Targeted Maximum Considered Earthquake (MCER) spectral response acceleration at any period is the lesser of the probabilistic and the deterministic response accelerations, subject to the exception specified in the same section. The probabilistic response spectrum was developed using the computer program OpenSHA (Field et al., 2013), which implements Method 1 as described in Section 21.2.1.1. Fault Models 3.1 and 3.2 from the Third Uniform California Earthquake Rupture Forecast (UCERF3) were used as the earthquake rupture forecast models for the PSHA. In addition to known fault sources, background seismicity was also included in the PSHA. The ground motion Prediction Equations (GMPEs) selected for use in this analysis are those developed for the Pacific Earthquake Engineering Research Center (PEER) Next Generation Attenuation (NGA) West 2 project. Four GMPEs - Abrahamson et al. (2014), Boore et al. (2014), Campbell and Bozorgnia (2014), and Chiou and Youngs (2014) were used to perform the analysis.

In accordance with Section 21.2.2 (Supplement 1), the deterministic spectral response acceleration at each period was calculated as the 84th percentile, 5% damped response acceleration, using NGA-West2 GMPE Worksheet. For this, the information from at least three causative faults with the greatest contribution per deaggregation analysis were used and the larger acceleration spectrum among these was selected as the deterministic response spectrum. The deterministic spectrum was adjusted per requirements in Section 21.2.2 (Supplement 1) where applicable. Both probabilistic and deterministic spectra were subjected to the maximum direction scale factors specified in Section 21.2 to produce the maximum acceleration spectra.

Design response spectrum was developed by subjecting the site-specific MCE_R response spectrum to the provisions outlined in Section 21.3. This process included comparison with 80% code-based

design spectrum determined in accordance with Section 11.4.6. The short period and long period site coefficients (Fa and Fv, respectively) were determined per Section 21.3 in conjunction with Table 11.4-1. Site-specific design acceleration parameters (S_{MS}, S_{M1}, S_{DS}, and S_{D1}) were calculated according to Section 21.4.

Per Section 11.2 (definitions on Page 79 of ASCE7-16) for evaluation of liquefaction, lateral spreading, seismic settlements, and other soil-related issues, Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration PGA_M shall be used. The site-specific PGA_M is calculated per Section 21.5.3, as the lesser of the probabilistic PGA_M (Section 21.5.1) and deterministic PGA_M (Section 21.5.2), but no less than 80% site modified peak ground acceleration, PGA_M, obtained from OSHPD seismic hazard tool. From our analyses, we obtain a PGA_M of 0.662g.

4.2 STATIC SETTLEMENT

Analyses were performed to estimate the maximum static settlement due to the anticipated maximum foundation loads. The analyses were based on the results of subsurface exploration and laboratory testing conducted at the site. Settlements were calculated based on the elastic method using the sampler blow counts to estimate the elastic property of the soils. Stresses induced by the footings were based on a Boussinesq distribution.

Settlement of the proposed buildings will depend on the magnitude of the structural loads. Assuming a column load of 250 kips, bearing pressure of 4,000 psf, and footing depth of 2 foot, total static settlement of a column footing is estimated to be 0.9 inches. A continuous footing that supports a load of 6 kips/ft, bearing pressure of 3,000 psf, 2 feet wide, and 2 feet deep is estimated to have a total static settlement of 0.5 inches.

4.3 LIQUEFACTION

Engineering research of soil liquefaction potential (Youd et al., 2001) indicates that generally three basic factors must exist concurrently in order for liquefaction to occur. These factors include:

- A source of ground shaking, such as an earthquake, capable of generating soil mass distortions.
- A relatively loose silty and/or sandy soil.
- A relative shallow groundwater table (within approximately 50 feet below ground surface) or completely saturated soil conditions that will allow positive pore pressure generation.

The site is located within a State-designated zone of potentially liquefiable soils. As a result, we conservatively have evaluated the potential for liquefaction.

The liquefaction susceptibility of the onsite soils was evaluated by analyzing the potential concurrent occurrence of the above-mentioned three basic factors. The liquefaction evaluation for the site was completed under the guidance of Special Publication 117A: Guidelines for Evaluating and Mitigating Seismic Hazards in California (CDMG, 2008).

Our liquefaction analyses were based on the field test data results from our CPT data. The liquefaction analyses were performed utilizing the CLiq software by GeoLogismiki. Among the methods available in this program for analysis of liquefaction potential, Robertson (NCEER 2001, 2009) was used for

the current project. The seismic event was defined by peak ground acceleration PGA of 0.73 and mean moment magnitude of 6.83. The historic-high groundwater level, which is used as the design level for evaluation of liquefaction potential, is taken at a depth of 10 feet below ground surface, as discussed in Section 3.2.

Based on our analyses, several sublayers below the assumed shallowest groundwater level of 10 feet have a factor of safety less than 1.3 and are therefore considered prone to liquefaction during the design earthquake event. Liquefaction analyses are provided in Appendix C.

4.4 SEISMIC-INDUCED SETTLEMENT

To quantify the consequences of liquefaction at the site, seismic-induced settlement has been evaluated using the four CPT soundings. Robertson (NCEER 2001 and 2009) method was used for this evaluation.

Analyses were performed to evaluate the potential for seismic settlement from saturated liquefied and unsaturated dry soils. The calculated seismic-induced settlements of saturated soil using various methods for CPT analysis are ranging from 3.7 to 5.3 inches. Liquefaction induced-settlement analyses are provided in Appendix C.

Seismic-induced settlement can occur both above and below the groundwater table during a strong seismic event. We have estimated the dry seismic settlement using the Robertson and Shao (2010) Method. The total seismic dry settlement we calculated ranges from 0 to 0.2 inches.

5.0 CONCLUSIONS

5.1 FEASIBILITY OF PROPOSED DEVELOPMENT

From a geotechnical point of view, the proposed site development is considered feasible provided the recommendations presented in this report are incorporated into the design and construction of the project. Furthermore, it is also our opinion that the proposed development will not adversely impact the stability of adjoining properties.

5.2 GEOLOGIC HAZARDS

5.2.1 Ground Rupture

No known active faults are known to project through the subject sites nor do the sites lie within the boundaries of an “Earthquake Fault Zone” as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. The closest known active fault is the Puente Hills (Coyote Hills) fault located approximately 2.7 miles to the northeast. Therefore, potential for ground rupture due to an earthquake beneath the sites is considered low.

5.2.2 Ground Shaking

The site is situated in a seismically active area that has historically been affected by generally moderate to occasionally high levels of ground motion. The site lies in relatively close proximity to several seismically active faults; therefore, during the life of the proposed improvements, the property will

probably experience similar moderate to occasionally high ground shaking from these fault zones, as well as some background shaking from other seismically active areas of the Southern California region. Design and construction in accordance with the current California Building Code (CBC) requirements are anticipated to address the issues related to potential ground shaking.

5.2.3 Landsliding

Geologic hazards associated with landsliding are not anticipated at the site since the site is relatively level.

5.2.4 Liquefaction

Our analyses indicate liquefaction could in soils located below a depth of 10 feet if groundwater were to rise to shallowest historic levels concurrent with a strong ground motion. Liquefaction could lead to a total seismic settlement (saturated and dry) of the ground surface of up to 5.3 inches due to seismic consolidation during liquefaction. The differential settlement due to seismic settlement would likely be on the order of ½ of the total seismic settlement or approximately 2.7 inches over 30 feet. Lateral spreading is not a significant risk at the site in consideration of the relatively flat site topography and lack of an nearby channel face or slope.

Based on the State of California Special Publication (SP) 117A, the seismic-induced settlement at the site does not fall within the Level of Liquefaction Hazard of "Large-scale Displacements." "Large scale Displacements" are defined as those that ***exceed*** 1-3 feet horizontally and 4-6 inches vertically. Therefore, the Level of Liquefaction Hazard is classified as a "Localized Failure." One of the suitable mitigation alternatives presented in the SP 117A for Localized Failures is the use of reinforced shallow foundations and improved structural design to withstand predicted vertical and lateral ground displacements.

The SP 117A also stated that hazards from liquefaction should be mitigated to the extent required to reduce seismic risk to "acceptable levels." The acceptable level of risk means, "that level that provides reasonable protection of the public safety" [California Code of Regulations Title 14, Section 3721 (a)]. The use of well-reinforced foundations, such as post-tensioned slabs, grade beams with structural slabs, or mat foundations have been proven to adequately provide basal support for similar structures during comparable liquefaction events. Specific recommendations to mitigate risks associated with liquefaction are provided in Section 6.3.

5.3 STATIC SETTLEMENT

As discussed in Section 4.2, analyses were performed to evaluate potential for static settlement of the underlying alluvium. Provided site grading is performed in accordance with the recommendations provided herein and based on the anticipated foundation loads, total and differential static settlement is not anticipated to exceed 1 inch and ½-inch over 30 feet, respectively, for the proposed commercial buildings. The estimated magnitudes of static settlements are considered within tolerable limits for the proposed structure.

5.4 EXCAVATION AND MATERIAL CHARACTERISTICS

Onsite earth materials are anticipated to be relatively easy to excavate with conventional heavy earthmoving equipment. The site earth materials are generally considered suitable for reuse as fill provided, they are cleared on deleterious debris and oversized rocks (greater than 4 inches in greatest dimension). Site materials are generally near the optimum moisture content. As such, fill soils derived from onsite soils will likely require the addition of nominal amounts of water and mixing in preparation for reuse as compacted fill.

Temporary construction slopes will be required to complete removal of unsuitable soils and for construction of underground utilities. Such excavations will require laybacks where they are surcharged or where they exceed 4 feet in height. Specific recommendations are provided in Section 6.1.8.

If encountered, portions of concrete debris and asphalt can likely be reduced in size (4 inches minus) and incorporated within fill soils during earthwork operations.

If onsite disposal systems, clarifiers, and other underground improvements are present beneath the site, these improvements will require proper abandonment or removal per the City guidelines.

5.5 SHRINKAGE AND SUBSIDENCE

Volumetric changes in earth quantities will occur when excavated onsite soil materials are replaced as properly compacted fill. We estimate that the near surface soils will shrink about 5 to 10 percent when removed and replaced as compacted fill. Subsidence due to reprocessing of removal bottoms is anticipated to be about 0.05 feet. The estimates of shrinkage and subsidence are intended as an aid for project engineers in determining earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during the grading process.

5.6 SOIL EXPANSION

Based on our laboratory test results and the USCS visual manual classification, the near-surface soils are generally anticipated to possess a **Low** expansion potential. Additional testing for soil expansion will be required prior to construction of foundations and other concrete work to confirm these conditions.

6.0 RECOMMENDATIONS

6.1 EARTHWORK

6.1.1 General Earthwork and Grading Specifications

All earthwork and grading should be performed in accordance with applicable requirements of Cal/OSHA, applicable specifications of the Grading Codes of the City of Artesia, California in addition to the recommendations presented herein.

6.1.2 Pre-Grade Meeting and Geotechnical Observation

Prior to commencement of grading, we recommend a meeting be held between the developer, City Inspector, grading contractor, civil engineer, and geotechnical consultant to discuss the proposed grading and construction logistics. We also recommend a geotechnical consultant be retained to provide soil engineering and engineering geologic services during site grading and foundation construction. This is to observe compliance with the design specifications and recommendations and to allow for design changes in the event that subsurface conditions differ from those anticipated. If conditions are encountered that appear to be different than those indicated in this report, the project geotechnical consultant should be notified immediately. Design and construction revisions may be required.

6.1.3 Site Clearing

Areas to be graded should be cleared of vegetation, existing asphalt and concrete, underground improvements to be abandoned and deleterious materials. Existing underground utility lines within the project area that will be protected in place and that fall within a 1 to 1 (H:V) plane projected down from the edges of footings may be subject to surcharge loads. Under such conditions, this office should be made aware of these conditions for evaluation of potential surcharging. Supplemental recommendations may be required to protect such improvements in place.

The project geotechnical consultant should be notified at the appropriate times to provide observation services during clearing operations to verify compliance with the above recommendations. Voids created by clearing and excavation should be left open for observation by the geotechnical consultant. Should any unusual soil conditions or subsurface structures be encountered during site clearing or grading that are not described or anticipated herein, these conditions should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations as needed.

Temporary construction equipment (office trailers, power poles, etc.) should be positioned to allow adequate room for clearing and recommended ground preparation to be performed for proposed structures, pavements, and hardscapes.

6.1.4 Ground Preparation

In general, the artificial fill is considered unsuitable for support of the proposed development. Based on our exploratory borings, the depth of the artificial fill material is anticipated to be about 2 feet in depth. However, deeper fills are expected in the areas of the previous site improvements (i.e. utility lines) and where the current buildings and structures are located. All artificial fill soils should be removed to expose the underlying alluvial soils within the limits of the structures (buildings and site walls) and paving.

Removal of unsuitable materials should extend laterally beyond the limits of the proposed buildings a distance equal to the depth of removal (i.e. 1:1 projection) but not less than 5 feet. Removals within pavements and footings for site walls may be limited to the edge of foundations or pavement where lateral restrictions to removals are present such as property lines.

All removal and overexcavations should be evaluated by the geotechnical consultant during grading to confirm the exposed conditions are as anticipated and to provide supplemental recommendations if required.

6.1.5 Scarification

Prior to placement of compacted fill, the exposed ground should be scarified to a depth of 6 to 8 inches, moisture conditioned to at least 110 percent of the optimum moisture content, then compacted to at least 90 percent of the laboratory standard. The laboratory standard for maximum dry density and optimum moisture content for each soil type should be determined in accordance with ASTM D 1557.

6.1.6 Fill Placement

Materials excavated from the site may be reused as fill provided, they are free of deleterious materials and particles greater than 4 inches in maximum dimension (oversized materials). Asphaltic and concrete debris generated during site demolition or encountered within the existing fill can be incorporated within new fill soils during earthwork operations provided they are reduced to no more than 4 inches in maximum dimension. Such materials should be mixed thoroughly with fill soils to prevent nesting. All fill should be placed in lifts no greater than 8 inches in loose thickness, moisture conditioned to at least 110% of optimum moisture content, then compacted in place to at least 90 percent of the laboratory standard. Each lift should be treated in a similar manner. Subsequent lifts should not be placed until the project geotechnical consultant has approved the preceding lift.

6.1.7 Import Materials

If import materials are required to achieve the proposed finish grades, the proposed import soils should have an Expansion Index (EI, ASTM D 4829) less than 20 and possess negligible soluble sulfate concentrations. Import sources should be indicated to the geotechnical consultant prior to hauling the materials to the site so that appropriate testing and evaluation of the fill materials can be performed in advance.

6.1.8 Temporary Excavations

Temporary construction slopes in site materials that are not surcharged may be cut vertically up to a height of 4 feet. Temporary excavations greater than 4 feet but no greater than 10 feet in height that are not surcharged should be laid back at a maximum gradient of 1:1 (H:V) or properly shored.

Excavations should not be left open for prolonged periods of time. The project geotechnical consultant should observe all temporary cuts to confirm anticipated conditions and to provide alternate recommendations if conditions dictate. All excavations should conform to the requirements of Cal/OSHA. The current removal requirement is 12 inches below existing grade and not expected to undermine the existing foundations. However, if deeper removals are required during grading and where insufficient room exists for recommended lay back cuts, shoring or slot cutting methods may be required. Additional recommendations for such conditions can be provided at that time based on the observed materials and subsequent lab testing.

6.2 SEISMIC DESIGN PARAMETERS

6.2.1 Mapped Seismic Design Parameters

For design of the project in accordance with Chapter 16 of the 2019 CBC, the mapped seismic parameters may be taken as presented in the tables below.

TABLE 6.1
2019 CBC Mapped Seismic Design Parameters

Parameter	Value
Site Class	D
Mapped MCE_R Spectral Response Acceleration, short periods, S_S	1.552
Mapped MCE_R Spectral Response Acceleration, at 1-sec. period, S_1	0.552
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.7445*
Adjusted MCE_R Spectral Response Acceleration, short periods, S_{MS}	1.552
Adjusted MCE_R Spectral Response Acceleration, at 1-sec. period, S_{M1}	0.968
Design Spectral Response Acceleration, short periods, S_{DS}	1.034
Design Spectral Response Acceleration, at 1-sec. period, S_{D1}	0.645
Long-Period Transition Period, T_L (sec.)	8
Seismic Design Category for Risk Categories I-IV	II

MCE_R = Risk-Targeted Maximum Considered Earthquake

*According to Section 11.4.8 in ASCE 7-16, "a ground motion hazard analysis shall be performed in accordance with Section 21.2 for the following structures on Site Class D and E sites with S_1 greater than or equal to 0.2." However, "A ground motion hazard analysis is not required for structures where: Structures on Site Class D sites with S_1 greater than or equal to 0.2, provided the value of the seismic response coefficient C_s is determined by Eq. (12.8-2) for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq T > 1.5T_s$ or Eq. (12.8-4) for $T > T_L$." The F_v value of 1.7 above from Table 11.4-2 assumes that this exception is met and that a ground motion hazard analysis is not required. Should this exception not be met, the site-specific seismic design parameters provided in the next section should be used.

6.2.2 Site-Specific Seismic Design Parameters

In addition to the Code Spectra parameters presented in Table 6.1, we have performed a site-specific ground motion hazard analysis in accordance with Chapter 21 of ASCE 7-16 to obtain site-specific seismic design acceleration parameters, the risk-targeted maximum considered earthquake response spectrum, and the design earthquake response spectrum. The site-specific seismic design parameters are presented below.

TABLE 6.2
2019 CBC Site Specific Seismic Design Parameters

Parameter	Value
Site Class	D
Site Coefficient, F_a	1.0
Site Coefficient, F_v	2.5
Adjusted MCE Spectral Response Acceleration, short periods, S_{MS}	1.833
Adjusted MCE Spectral Response Acceleration, at 1-sec. period, S_{M1}	1.822
Design Spectral Response Acceleration, short periods, S_{DS}	1.222
Design Spectral Response Acceleration, at 1-sec. period, S_{D1}	1.214

MCE = Maximum Considered Earthquake

6.3 CONVENTIONAL FOUNDATION DESIGN

6.3.1 General

As discussed in Section 5.2.4, the site is prone to liquefaction. To mitigate this condition, we recommend structures be supported by a foundation system consisting of a mat, post-tensioned slab, or spread footings tied together with a structural slab with grade beams. For this project, we have assumed the foundation system will utilize spread footings tied together with a structural slab with grade beams. Specific recommendations for this system is provided in the following sections. Recommendations for other systems can be provided upon request.

The following design parameters are provided to assist the project structural engineer to design foundations for structures at the site. These design parameters are based on typical site materials encountered during subsurface exploration and are provided for preliminary design and estimating purposes. The project geotechnical consultant should provide final design parameters following observation and testing of site materials during grading. Depending on actual materials encountered during site grading, the design parameters presented herein may require modification.

6.3.2 Soil Expansion

The recommendations presented herein are based on soils with a **Low** expansion potential. Following site grading, additional testing of site soils should be performed by the project geotechnical consultant to confirm the basis of these recommendations. If site soils with higher expansion potentials are encountered or imported to the site, the recommendations contained herein may require modification.

6.3.3 Static and Seismic Settlement

Based on anticipated foundation loads and provided that the recommendations for ground preparation in this report are followed, total and differential static settlement are anticipated to be less than 1 inch and ½ inch over 30 feet, respectively. These values are considered within tolerable limits of proposed structures and site improvements. Design of the structures should consider these maximum anticipated settlements.

6.3.4 Allowable Bearing Value

Foundations may utilize a bearing value of 2,000 pounds per square foot (psf) for continuous and pad footings a minimum width of 12 inches and founded at a minimum depth of 12 inches below the lowest adjacent grade. This value may be increased by 260 psf and 700 psf for each additional foot in width and depth, respectively, up to a maximum value of 4,000 psf. Recommended allowable bearing values include both dead and live loads may be increased by one-third for wind and seismic forces.

6.3.5 Lateral Resistance

For foundations that are founded in the native alluvial soils or compacted fill, a passive earth pressure of 300 pounds per square foot per foot of depth (psf/ft) up to a maximum value of 1,500 pounds per square foot (psf) may be used to determine lateral bearing for footings. This value may be increased by one-third when designing for wind and seismic forces. A coefficient of friction of 0.33 times the dead load forces may also be used between concrete and the supporting soils to determine lateral sliding resistance. No increase in the coefficient of friction should be used when designing for wind and seismic forces.

The above values are based on footings placed directly against compacted fill or competent native soils. In the case where footing sides are formed, all backfill against the footings should be compacted to at least 90 percent of the laboratory standard.

6.3.6 Footing Dimensions and Reinforcement

Exterior and interior pad footings should be founded at a minimum depth of 12 inches below the lowest adjacent grade and have a minimum width of 12 inches. All continuous footings should have a minimum depth of 12 inches below lowest adjacent grade and a minimum width of 12 inches.

All continuous footings should be reinforced with a minimum of four No. 5 bars, two top and two bottom. The structural engineer may require different reinforcement and should dictate if greater than the recommendations provided herein.

All isolated pad footings should be tied in both directions with a concrete grade beam to the nearest foundation. Grade beams should be at least 12 inches wide by 12 inches deep and be reinforced with four No. 5 bars, two top and two bottom. Reinforcing for the grade beams should tie into the adjacent footings.

6.3.7 Slabs on Grade

Interior concrete slabs constructed on grade should be a minimum 6 inches thick and should be reinforced with No. 3 bars spaced 18 inches each way. Care should be taken to ensure the placement of reinforcement at mid-slab height. The structural engineer may recommend a greater slab thickness and reinforcement based on proposed use and loading conditions and such recommendations should govern if greater than the recommendations presented herein. No. 4 tie bars should be provided between the slab and connecting grade beams at a spacing of 18 inches.

For consideration of point loading that may occur on the slab, a subgrade of modulus, K_{V1}, of 100 pci may be used.

Concrete floor slabs in areas to receive carpet, tile, or other moisture sensitive coverings should be underlain with a moisture vapor barrier 10-mil Visqueen, or equal. The membrane should be properly lapped, sealed, and protected with at least 2 inches of sand having an SE of 30 or more. This vapor barrier system is anticipated to be suitable for most flooring finishes that can accommodate some vapor emissions. However, this system may emit more than 4 pounds of water per 1000 sq. ft. and therefore, may not be suitable for all flooring finishes. Additional steps should be taken if such vapor emission levels are too high for anticipated flooring finishes.

Special consideration should be given to slabs in areas to receive ceramic tile or other rigid, crack-sensitive floor coverings. Design and construction of such areas should mitigate hairline cracking as recommended by the structural engineer.

Block-outs should be provided around interior columns to permit relative movement and mitigate distress to the floor slabs due to differential settlement that will occur between column footings and adjacent floor subgrade soils as loads are applied.

Prior to placing concrete, subgrade soils below slab-on-grade areas should be thoroughly moistened to provide a moisture content that is equal to or greater than 110% of the optimum moisture content to a depth of 12 inches.

6.3.8 Foundation Observations

Foundation excavation should be observed by the project geotechnical consultant to verify that they have been excavated into competent bearing soils and to the minimum embedment recommended above. These observations should be performed prior to placement of forms or reinforcement. The excavations should be trimmed neat, level and square. Loose, sloughed or moisture-softened materials and debris should be removed prior to placing concrete.

6.4 RETAINING AND SCREENING WALLS

6.4.1 General

The following preliminary design and construction recommendations are provided for general retaining and screen walls supported by engineered compacted fill or competent native soils. Final wall designs specific to the site development should be provided for review once completed. The structural engineer and architect should provide appropriate recommendations for sealing at all joints and applying moisture-proofing material on the back of the walls.

6.4.2 Allowable Bearing Value and Lateral Resistance

Design of retaining and screen walls may utilize the bearing and lateral resistance values provided in Sections 6.3.4 and **Error! Reference source not found.**.

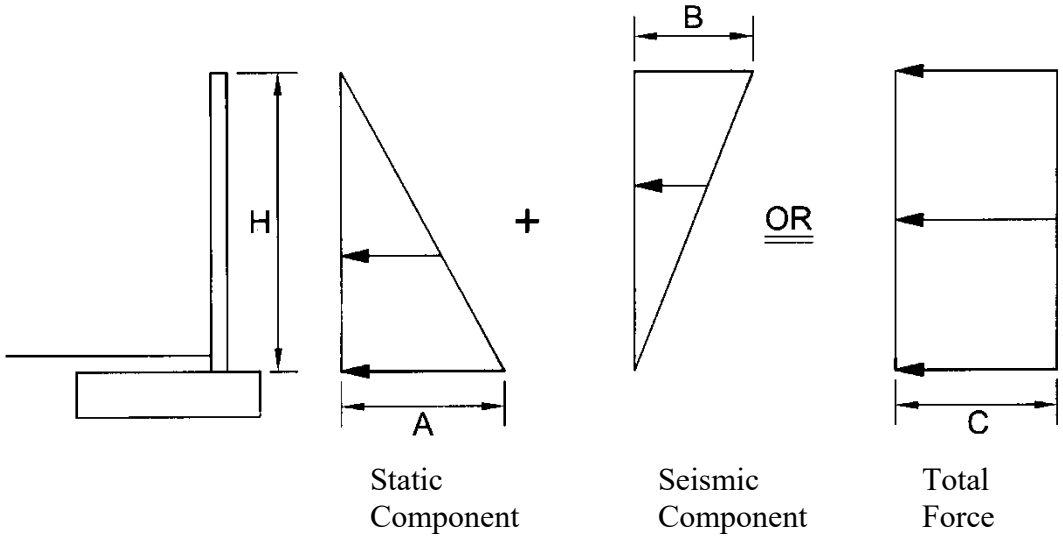
6.4.3 Active Earth Pressures

Static and seismic earth pressures for level and 2:1 (H:V) backfill conditions are provided in Table 6.3. Seismic earth pressures provided herein are based on the method provided by Seed & Whitman (1970) using a peak ground acceleration (PGA) of 0.42 g for 10% probability of exceedance in 50 years. As indicated in Section 1803.5.12 of the 2019 CBC, retaining walls supporting 10 feet of

backfill or less are not required to be designed for seismic earth pressures. The values provided in the following table do not consider hydrostatic pressure. Retaining walls should also be designed to support adjacent surcharge loads imposed by other nearby footings or traffic loads in addition to the earth pressure.

TABLE 6.3

SEISMIC EARTH PRESSURES
Pressure Diagram



Pressure Values
Walls Up To 10 Feet High

Value	Backfill Condition	
	Level	2H:1V Slope
A	33H	54H
B	12.5H	12.5H
C	23H	33.5H

Note:
H is in feet and resulting pressure is in psf. Design may utilize either the sum of the static component and the seismic component force diagrams or the total force diagram above. SEAOSC has suggested using a load factor of 1.7 for the static component and 1.0 for the seismic component. The actual load factors should be determined by the structural engineer.

6.4.4 Drainage and Moisture-Proofing

Retaining walls should be constructed with a perforated pipe and gravel subdrain to prevent entrapment of water in the backfill. The perforated pipe should consist of 4-inch-diameter, ABS SDR-

35 or PVC Schedule 40 with the perforations laid down. The pipe should be embedded in ¾- to 1½-inch open-graded gravel wrapped in filter fabric. The gravel should be at least one foot wide and extend at least one foot up the wall above the footing and drainage outlet. Drainage gravel and piping should not be placed below outlets and weepholes. Filter fabric should consist of Mirafi 140N, or equal. Outlet pipes should be directed to positive drainage devices.

The use of weepholes may be considered in locations where aesthetic issues from potential nuisance water are not a concern. Weepholes should be 2 inches in diameter and provided at least every 6 feet on center. Where weepholes are used, perforated pipe may be omitted from the gravel subdrain.

Retaining walls supporting backfill should also be coated with a moisture-proofing compound or covered with such material to inhibit infiltration of moisture through the walls. Moisture-proofing material should cover any portion of the back of wall that will be in contact with soil and should lap over and onto the top of footing. A drainage panel should be provided between the soil backfill and water proofing. The panel should extend from the top of the backdrain gravel up to within 12 inches of finish grade. The top of footing should be finished smooth with a trowel where moisture proofing-materials are applied to inhibit the infiltration of water through the wall. The project structural engineer should provide specific recommendations for moisture-proofing, water stops, and joint details.

6.4.5 Footing Reinforcement and Wall Jointing

All continuous footings should be reinforced with a minimum of two No. 4 bars, one top and one bottom. Walls should be provided with cold joints spaced no more than 20 feet apart. Wall finishes and capping materials should not extend across the cold joint. The structural engineer may require different reinforcement or jointing and should dictate if greater than the recommendations provided herein. Where recommended removals are limited due to space restrictions, greater reinforcement and closer jointing may be recommended. Specific recommendations should be provided by the geotechnical consultant during grading based on as-built conditions exposed in the field.

6.4.6 Foundation Observations

Footing excavations should be observed by the project geotechnical consultant to verify that they have been excavated into competent bearing soils and to the minimum embedment recommended herein. These observations should be performed prior to placement of forms or reinforcement. The excavations should be trimmed neat, level and square. Loose, sloughed or moisture-softened materials and debris should be removed prior to placing concrete.

6.5 EXTERIOR FLATWORK

Exterior flatwork should be a minimum 4 inches thick. Cold joints or saw cuts should be provided at least every 7 feet in each direction. Flatwork having a minimum dimension more than 7 feet should be reinforced with No. 3 bars spaced 18 inches center to center each way or 6-inch by 6-inch, W4 by W4 welded wire mesh. Special jointing detail should be provided in areas of block-outs, notches, or other irregularities to avoid cracking at points of high stress. Subgrade soils below flatwork should be thoroughly moistened to at least 110 percent of the optimum moisture content to a depth of 12 inches. Moistening should be accomplished by lightly spraying the area over a period of a few days just prior to pouring concrete. The geotechnical consultant should observe and verify the density and moisture

content of subgrade soils prior to pouring concrete to ensure that the required compaction and pre-moistening recommendations have been met.

Drainage from flatwork areas should be directed to local area drains and/or other appropriate collection devices designed to carry runoff water to the street or other approved drainage structures. The concrete flatwork should also be sloped at a minimum gradient of 0.5 percent away from building foundations and retaining walls.

6.6 CONCRETE MIX DESIGN

Laboratory testing of near-surface soils for soluble sulfate content indicates soluble sulfate concentration of 0.002%. We recommend following the procedures provided in ACI 318, Section 19.3.1, Table 19.3.1.1 for **S0** sulfate exposure. Upon completion of rough grading, an evaluation of as-graded conditions and further laboratory testing should be completed for the site to confirm or modify the recommendations provided in this section.

6.7 CORROSION

Results of preliminary testing of soils for pH, chloride, and minimum resistivity indicate the site is potentially **Highly Corrosive** to metals that are in contact or close proximity to onsite soils. As such, specific recommendations should be obtained from a corrosion specialist if construction will include metals that will be near or in direct contact with site soils.

6.8 PRELIMINARY PAVEMENT DESIGN

6.8.1 Preliminary Pavement Structural Sections

Based on the soil conditions present at the site and an estimated traffic index, preliminary pavement sections are provided in the table below. A laboratory tested "R-value" of 33 was used for the near-surface soil in this preliminary pavement design. The sections provided below are for planning purposes only and should be re-evaluated subsequent to site grading. Final pavement sections should be based on actual R-value testing of in-place soils and analysis of anticipated traffic.

6.8.2 Subgrade Preparation

Prior to placement of paving elements, subgrade soils should be scarified 6 inches, moisture-conditioned to above the optimum moisture content then compacted to at least 90 percent of the maximum dry density determined in accordance with ASTM D1557. Areas observed to pump or yield under vehicle traffic should be removed and replaced with firm and unyielding engineered compacted soil or aggregate base materials.

6.8.3 Aggregate Base

Aggregate base materials should be Crushed Aggregate Base or Crushed Miscellaneous Base conforming to Section 200-2 of the Standard Specification for Public Works Construction (Greenbook) or Class 2 Aggregate Base conforming to the Caltrans' Standard Specifications. The materials should be moisture conditioned to slightly over the optimum moisture content then compacted to at least 95 percent of ASTM D 1557.

TABLE 6.4
PRELIMINARY PAVEMENT STRUCTURAL SECTIONS

Location	Traffic Index	AC (inches)	PCC (inches)	AB (inches)
Truck Drive Areas	7.5	4.0	--	11.0
		--	8.0	--
Parking Drives	5.0	3.0	--	5.0
		--	5.0	--
Parking Stalls	--	3.0	--	5.0

6.8.4 Asphaltic Concrete

Paving asphalt should be PG 64-10 conforming to the requirements of Section 203-1 of the Greenbook. Asphalt concrete materials should conform to Section 203-6 and construction should conform to Section 302 of the Greenbook.

6.8.5 Portland Cement Concrete

Portland cement concrete used to construct concrete paving should conform to Section 201 of the Greenbook and should have a minimum compressive strength of 3,250 pounds per square inch (psi) at 28 days. Reinforcement and jointing of concrete pavement sections should be designed according to the minimum recommendations provided by the Portland Cement Association (PCA). For rigid pavement, transverse and longitudinal contraction joints should be provided at spacing no greater than 15 feet. Score joints may be constructed by saw cutting to a depth of ¼ of the slab thickness. Expansion/cold joints may be used in lieu of score joints. Such joints should be properly sealed. Where traffic will traverse over cold joints without keyways or dowels or edges of concrete paving, the edges should be thickened by 20% of the design thickness toward the edge over a horizontal distance of 5 feet.

6.9 POST GRADING CONSIDERATIONS

6.9.1 Site Drainage and Irrigation

The ground immediately adjacent to foundations should be provided with positive drainage away from the structures in accordance with 2019 CBC, Section 1804.4. Based on soil and climatic conditions, the ground slope within 10 feet of the buildings may be reduced to 2%. No rain or excess water should be allowed to pond against structures such as walls, foundations, flatwork, etc.

Excessive irrigation water can be detrimental to the performance of the proposed site development. Water applied in excess of the needs of vegetation will tend to percolate into the ground. Such percolation can lead to nuisance seepage and shallow perched groundwater. Seepage can form on slope faces, on the faces of retaining walls, in streets, or other low-lying areas. These conditions could lead to adverse effects such as the formation of stagnant water that breeds insects, distress or damage of trees, surface erosion, slope instability, discoloration and salt buildup on wall faces, and premature

failure of pavement. Excessive watering can also lead to elevated vapor emissions within buildings that can damage flooring finishes or lead to mold growth inside the home.

Key factors that can help mitigate the potential for adverse effects of overwatering include the judicious use of water for irrigation, use of irrigation systems that are appropriate for the type of vegetation and geometric configuration of the planted area, the use of soil amendments to enhance moisture retention, use of low-water demand vegetation, regular use of appropriate fertilizers, and seasonal adjustments of irrigation systems to match the water requirements of vegetation. Specific recommendations should be provided by a landscape architect or other knowledgeable professional.

6.9.2 Utility Trenches

Trench excavations should be constructed in accordance with the recommendations contained in Section 6.1.8 of this report. Trench excavations must also conform to the requirements of Cal/OSHA.

Trench backfill materials and compaction criteria should conform to the requirements of the local municipalities. As a minimum, utility trench backfill should be compacted to at least 90 percent of the laboratory standard. Materials placed within the pipe zone (6 inches below and 12 inches above the pipe) should consist of particles no greater than ¾ inches and have a SE of at least 30. The materials within the pipe zone should be moisture-conditioned and compacted by hand-operated compaction equipment. Above the pipe zone (>1 foot above pipe), the backfill may consist of general fill materials. Trench backfill should be moisture-conditioned to slightly over the optimum moisture content, placed in lifts no greater than 12 inches in thickness, and then mechanically compacted with appropriate equipment to at least 90 percent of the laboratory standard. For trenches with sloped walls, backfill material should be placed in lifts no greater than 8 inches in loose thickness, and then compacted by rolling with a sheepsfoot roller or similar equipment. The project geotechnical consultant should perform density testing along with probing to verify that adequate compaction has been achieved.

Within shallow trenches (less than 18 inches deep) where pipes may be damaged by heavy compaction equipment, imported clean sand having a SE of 30 or greater may be utilized. The sand should be placed in the trench, thoroughly watered, and then compacted with a vibratory compactor. For utility trenches located below a 1:1 (H:V) plane projecting downward from the outside edge of the adjacent footing base or crossing footing trenches, concrete or slurry should be used as trench backfill.

6.10 PLAN REVIEW AND CONSTRUCTION SERVICES

We recommend ***Albus & Associates, Inc.*** be engaged to review any future development plans, including civil plans (grading plans), foundation plans, and proposed structural loads, prior to construction. This is to verify that the assumptions of this report are valid and that the preliminary conclusions and recommendations contained in this report have been properly interpreted and are incorporated into the project plans and specifications. If we are not provided the opportunity to review these documents, we take no responsibility for misinterpretation of our preliminary conclusions and recommendations.

We recommend that a geotechnical consultant be retained to provide soil engineering services during construction of the project. These services are to observe compliance with the design, specifications

or recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

If the project plans change significantly from the assumed development described herein, the project geotechnical consultant should review our preliminary design recommendations and their applicability to the revised construction. If conditions are encountered during construction that appear to be different than those indicated in this report or subsequent design reports, the project geotechnical consultant should be notified immediately. Design and construction revisions may be required.

7.0 LIMITATIONS

This report is based on the proposed development and geotechnical data as described herein. The materials encountered on the project site and utilized in our laboratory testing for this investigation are believed representative of the total project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil and bedrock materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observation and testing by a geotechnical consultant during the grading and construction phases of the project are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

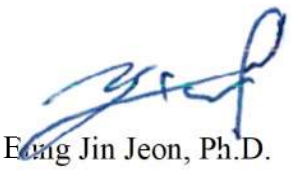
This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

This report has been prepared for the exclusive use of **G3 Urban Company** and their project consultants in the planning and design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

This report is subject to review by the controlling governmental agency.

Respectfully submitted,

ALBUS & ASSOCIATES, INC.



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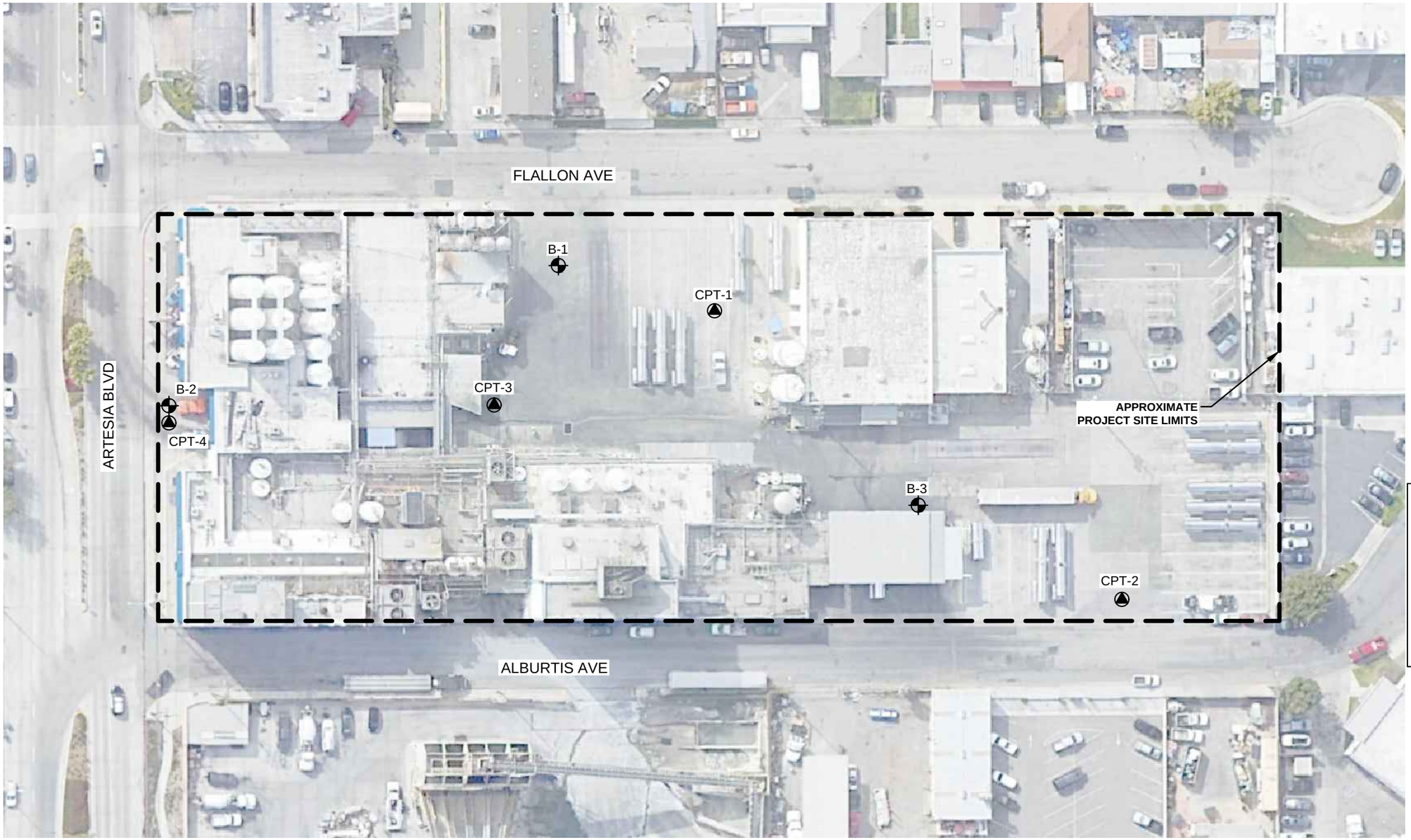


0 30 60 120

APPROX SCALE : 1" = 60'

EXPLANATION

(Locations Approximate)

- Exploratory Boring
- CPT

ALBUS ASSOCIATES

GEOTECHNICAL MAP

Job No.: 3027.00	Date: 12/07/2021	Plate: 1

APPENDIX A

EXPLORATION LOGS AND CONE PENETRATION TEST RESULTS

Field Identification Sheet

Light gray

Gray

Dark gray

Gray Brown

Light brown

Brown

Dark Brown

Olive brown

Olive

Yellow

Yellowish brown

Yellowish red

Red

Reddish Brown

Tan

Description Order:

Description, Color, Moisture, Density, Grain Size, Additional Description

Description	%	Example
	0-5	Sand
trace	5-15	Sand trace Silt
with	15-30	Sand with Silt
	30+	Silty Sand

More Examples

Sand with Silt trace Clay

Sand trace Silt and Clay

Sand with Silt and Clay

Gravelly Sand with Silt trace Clay

Silty Clay with Sand trace Gravel

Moisture

Dry	absence of water
Damp	below optimum
Moist	near optimum
Very Moist	above optimum
Wet	free water visible

Density (Navfac)

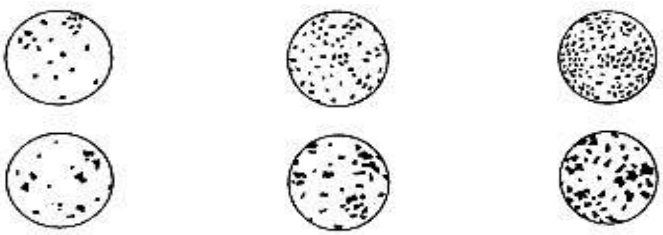
Coarse grained soils	SPT	CA
Very Loose	0-3	0-5
Loose	3-8	5-13
Medium Dense	8-14	13-22
Dense	14-25	22-40
Very Dense	25>	40>
Fine grained soils		
Very Soft	2<	0-3
Soft	2-4	3-6
Medium Stiff	4-8	6-13
Stiff	8-15	13-24
Very Stiff	15-30	24-48
Hard	30>	48>

Grain Size

Description		Sieve Size	Approx. Size
Boulders		>12"	Larger than basketball
Cobbles		3-12"	Fist to basketball
Gravel	coarse	3/4-3"	Thumb to Fist
	fine	#4-3/4"	Pea to Thumb
Sand	coarse	#10-4	Rock Salt to Pea
	medium	#40-10	Sugar to Rock Salt
	fine	#200-40	Flour to Sugar
Fines		Pass #200	Smaller than Flour

Additional Description (ie. roots, pinhole pores, debris, etc.)

Trace 5% Moderate 15% Abundant 30%



EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		EXPLANATION							
		Solid lines separate geologic units and/or material types.							
		Dashed lines indicate unknown depth of geologic unit change or material type change.							
5		**Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).							
		Double triangle in core column represents SPT sampler.							
10		**Vertical Lines** in core column represents Shelby sampler.							
		Solid black rectangle in Bulk column respresents large bag sample.							
		Other Laboratory Tests:							
15		Max = Maximum Dry Density/Optimum Moisture Content							
		EI = Expansion Index							
		SO4 = Soluble Sulfate Content							
		DSR = Direct Shear, Remolded							
		DS = Direct Shear, Undisturbed							
		SA = Sieve Analysis (1" through #200 sieve)							
		Hydro = Particle Size Analysis (SA with Hydrometer)							
20		200 = Percent Passing #200 Sieve							
		Consol = Consolidation							
		SE = Sand Equivalent							
		Rval = R-Value							
		ATT = Atterberg Limits							

EXPLORATION LOG

Project:		Location: B-1
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 54.4
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Concrete							Max EI SO4 DS RVal pH Resist Ch Consol ATT
		ARTIFICIAL FILL (Af) Sandy Silt (ML): Grayish brown, moist, fine grained sand		14	■	■	22.4	100.7	
		ALLUVIUM (Qal) Sandy Silt (ML): Grayish brown, moist, stiff, fine grained sand, moderate pinhole pores		15	■	■	19.1	104.5	
5		@ 4 ft, more fine grained sand present Sand trace Silt (SP): Light gray, moist, loose, fine to medium grained sand		9	■		11.9	100.5	
10		Sandy Silt / Silty Sand (ML/SM): Grayish brown, very moist, stiff / medium dense, fine grained sand	▽	17	■		20.1	99.8	
15		Sand trace Silt (SP): Grayish brown, wet, medium dense, fine to medium grained sand		14	⧗				
20		Sandy Silt (SM): Grayish brown, wet, medium stiff, fine grained sand		4	⧗				200
25		Sand trace Silt (SP): Light gray, wet, medium dense, fine to medium grained sand		16	⧗				
		Total Depth 26.5 feet Groundwater 14 feet Boring backfilled with bentonite and capped with concrete							

EXPLORATION LOG

Project:		Location: B-2
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 53.4
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Concrete							
		ARTIFICIAL FILL (Af)							
		Sandy Silt trace Clay (ML): Grayish brown, damp to moist, fine grained sand		17	■		24.2	97.9	Consol
		ALLUVIUM (Qal)							
		Sandy Silt trace Clay (ML): Grayish brown, damp to moist, medium dense, fine grained sand, trace pinhole pores, decayed rootlets		15	■		19.4	100.5	
5		Silty Sand / Sandy Silt (SM/ML): Grayish brown, moist, medium dense / stiff, fine grained sand		12	■		15.7	90.7	
		Silty Sand (SM): Light grayish brown, very moist, loose, fine grained sand							
10		Sandy Silt trace Clay (ML): Grayish brown, very moist, stiff, fine grained sand		18	■		12.6	98.8	Consol
		Silty Sand (SM): Grayish brown, very moist, medium dense, fine grained sand							
		Sand trace Silt (SP): Grayish brown, very moist, medium dense, fine to medium grained sand	▽						
15		Silty Sand (SM): Grayish brown, wet, medium dense, fine grained sand, significant fines		12	▼				
		@ 16.3 ft, Gray							
20		Silty Sand (SM): Grayish brown, wet, loose, fine grained sand		6	▼				200
25		Sand trace Silt (SP): Light grayish brown, wet, dense, fine to medium grained sand		19	▼				

EXPLORATION LOG

Project:		Location: B-2
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 53.4
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Silty Sand trace Clay (SM): Grayish brown, wet, medium dense, fine grained sand		8					200
35		Sand trace Silt (SP): Grayish brown, wet, dense, fine to medium grained sand		25					
40		Sandy Silt (ML): Gray, wet, very stiff, fine grained sand		13					200
45		Sand (SP): Grayish brown, wet, very dense, fine to medium grained sand		35					
50		Sandy Silt (ML): Grayish brown, wet, very stiff, fine grained sand		11					
		Total Depth 51.5 feet Groundwater 14 feet Boring backfilled with bentonite and capped with concrete							

EXPLORATION LOG

Project:		Location: B-3
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 57
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		concrete with rebar							
		ARTIFICIAL FILL (Af)							
		Silty Sand / Sandy Silt (SM/ML): Grayish brown, moist, fine grained sand		15	■		20.9	102.9	
		ALLUVIUM (Qal)							
5		Silty Sand / Sandy Silt (SM/ML): Grayish brown, moist, medium dense / stiff, fine grained sand, trace pinhole pores		13	■		19.2	101.8	
		@ 4 ft, loose / stiff		11	■		15.3	97	Consol
		Silty Sand (SM): Grayish brown, moist, loose, fine grained sand							
10		@ 10 ft, very moist, medium dense		17	■		15.4	93.2	
			▽						
15		Sand trace Silt and Clay (SP): Grayish brown, wet, loose, fine grained sand		4	⧗				
		Silty Sand (SM): Gray, wet, loose, fine to medium grained sand							
20		Silty Sand with Clay (SM): Grayish brown, wet, loose, fine grained sand		4	⧗				200
25		Sand (SP): Grayish brown, wet, medium dense, fine to medium grained sand		11	⧗				
		Total Depth 26.5 feet Groundwater 14 feet Boring backfilled with bentonite and capped with concrete							

Albus & Associates, Inc.

Plate A-5

SUMMARY

OF

CONE PENETRATION TEST DATA

Project:

180 Flallon Avenue
Artesia, CA
November 2, 2021

Prepared for:

Mr. Danny Albus
Albus & Associates
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Prepared by:

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www.kehoetesting.com

TABLE OF CONTENTS

1. **INTRODUCTION**
2. **SUMMARY OF FIELD WORK**
3. **FIELD EQUIPMENT & PROCEDURES**
4. **CONE PENETRATION TEST DATA & INTERPRETATION**

APPENDIX

- CPT Plots
- CPT Classification/Soil Behavior Chart
- CPT Data Files (sent via email)

SUMMARY

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the project located at 180 Flallon Avenue in Artesia, California. The work was performed by Kehoe Testing & Engineering (KTE) on November 2, 2021. The scope of work was performed as directed by Albus & Associates personnel.

2. SUMMARY OF FIELD WORK

The fieldwork consisted of performing CPT soundings at four locations to determine the soil lithology. A summary is provided in **TABLE 2.1**.

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	50	
CPT-2	50	
CPT-3	50	
CPT-4	50	

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

The CPT soundings were carried out by **KTE** using an integrated electronic cone system manufactured by Vertek. The CPT soundings were performed in accordance with ASTM standards (D5778). The cone penetrometers were pushed using a 30-ton CPT rig. The cone used during the program was a 15 cm^2 cone with a cone net area ratio of 0.83. The following parameters were recorded at approximately 2.5 cm depth intervals:

- Cone Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed

The above parameters were recorded and viewed in real time using a laptop computer. Data is stored at the KTE office for up to 2 years for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. Monitoring base line readings ensures that the cone electronics are operating properly.

4. CONE PENETRATION TEST DATA & INTERPRETATION

The Cone Penetration Test data is presented in graphical form in the attached Appendix. These plots were generated using the CPeT-IT program. Penetration depths are referenced to ground surface. The soil behavior type on the CPT plots is derived from the attached CPT SBT plot (Robertson, "Interpretation of Cone Penetration Test…", 2009) and presents major soil lithologic changes. The stratigraphic interpretation is based on relationships between cone resistance (qc), sleeve friction (fs), and penetration pore pressure (u). The friction ratio (Rf), which is sleeve friction divided by cone resistance, is a calculated parameter that is used along with cone resistance to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little (or negative) excess pore water pressures.

The CPT data files have also been provided. These files can be imported in CPeT-IT (software by GeoLogismiki) and other programs to calculate various geotechnical parameters.

It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. In these situations, experience, judgement and an assessment of the pore pressure data should be used to infer the soil behavior type.

If you have any questions regarding this information, please do not hesitate to call our office at (714) 901-7270.

Sincerely,

KEHOE TESTING & ENGINEERING

Steven P. Kehoe
President

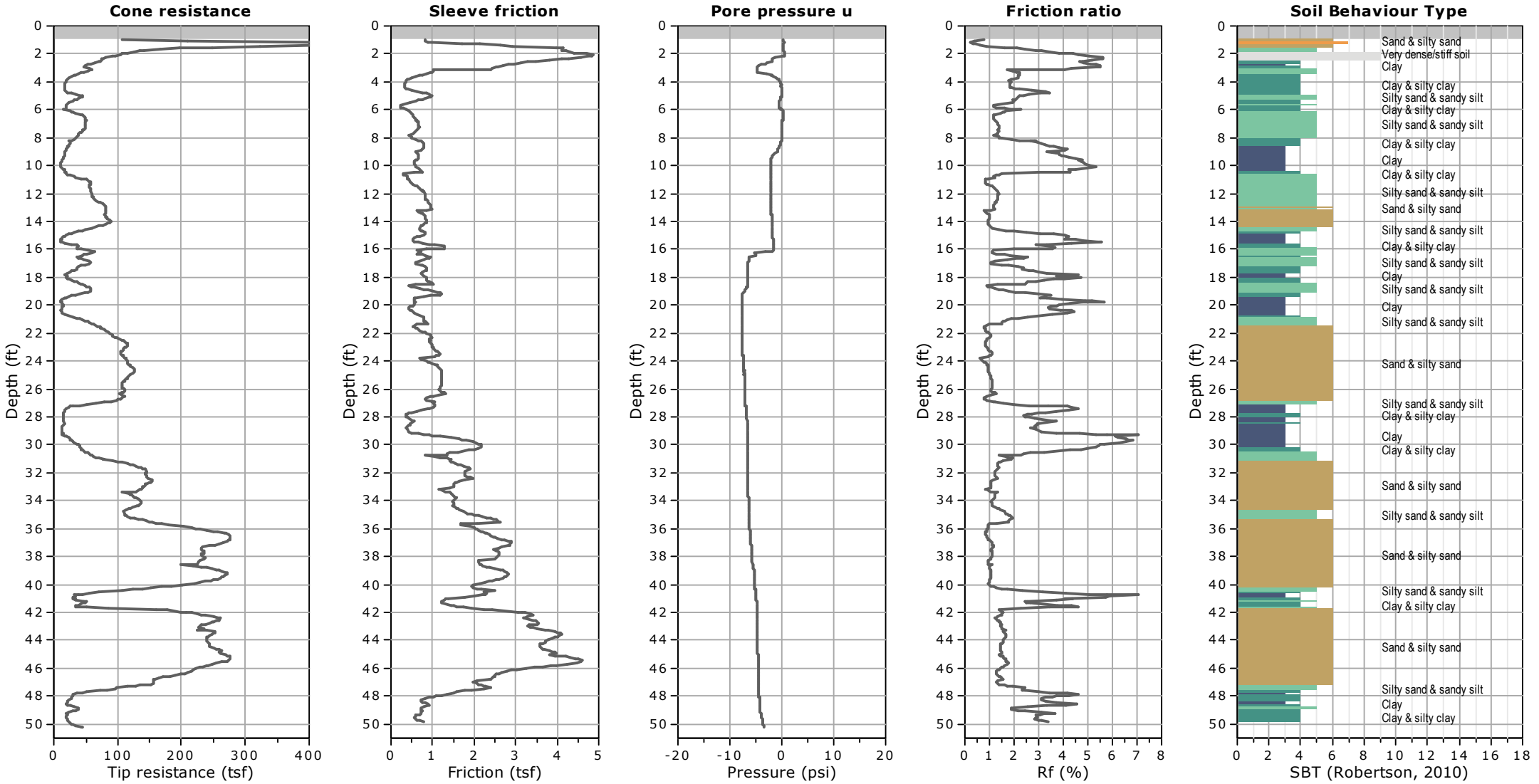
11/04/21-hh-3536

APPENDIX

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-1
Total depth: 50.20 ft, Date: 11/2/2021



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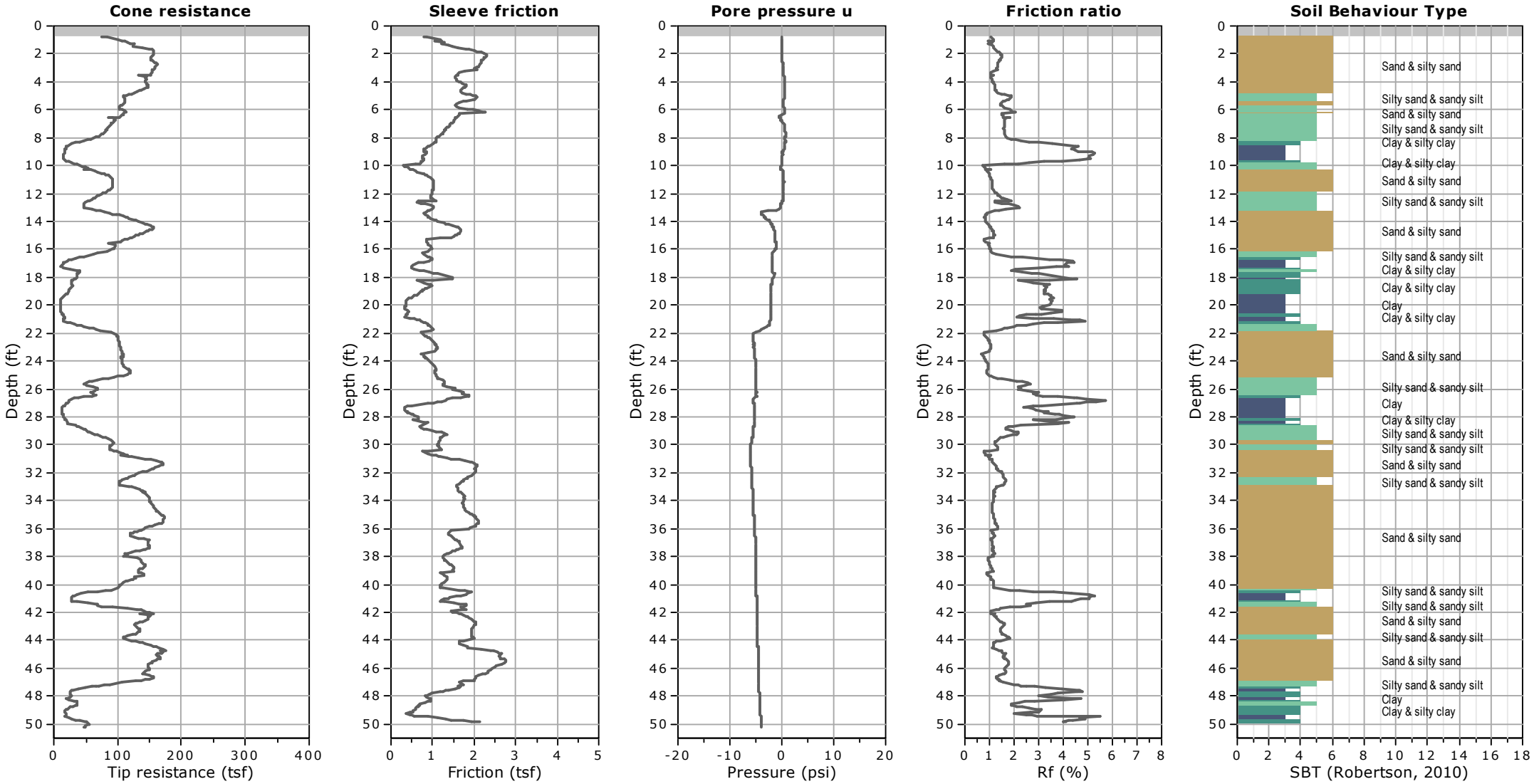
Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-2
Total depth: 50.22 ft, Date: 11/2/2021



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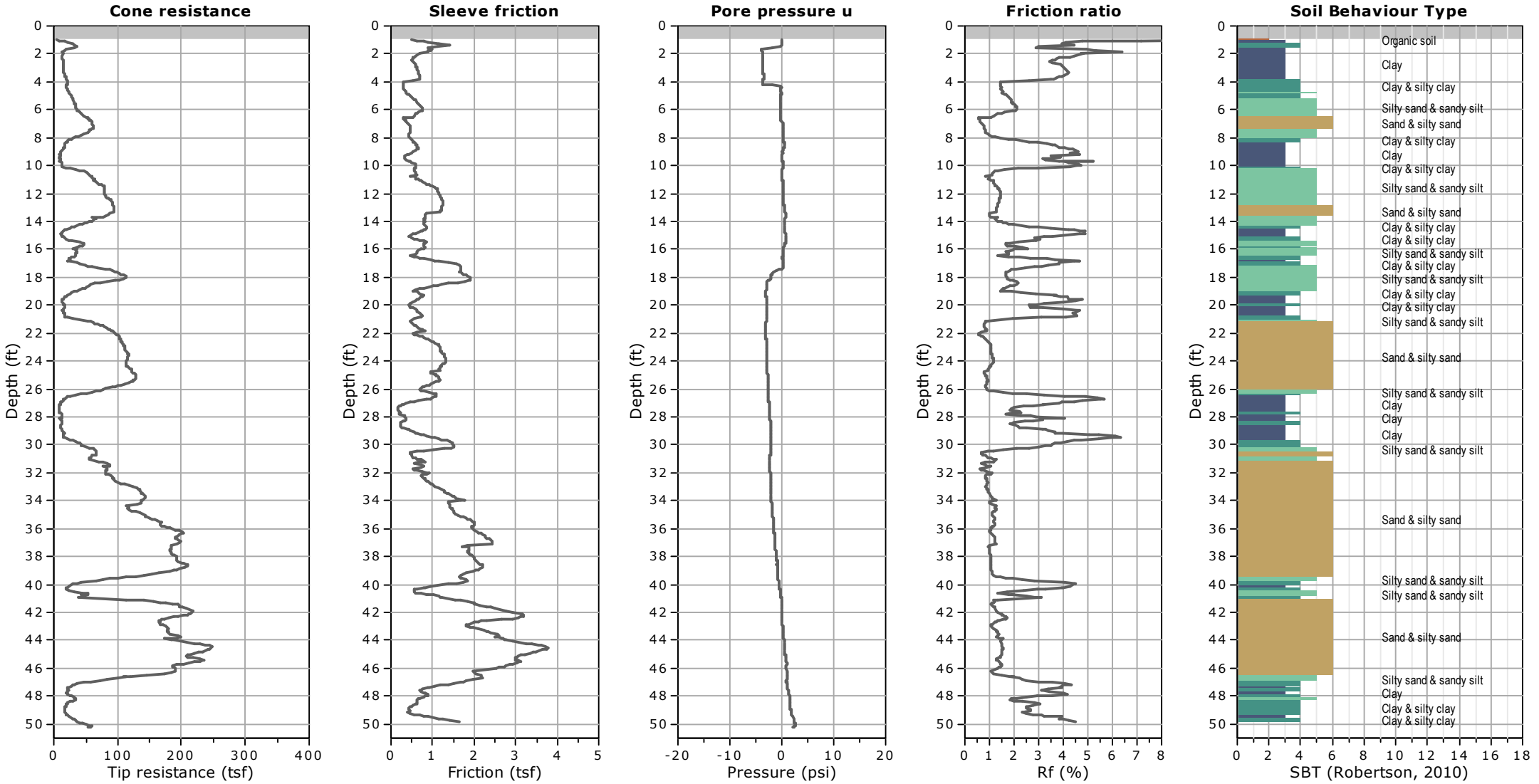
Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-3
Total depth: 50.24 ft, Date: 11/2/2021



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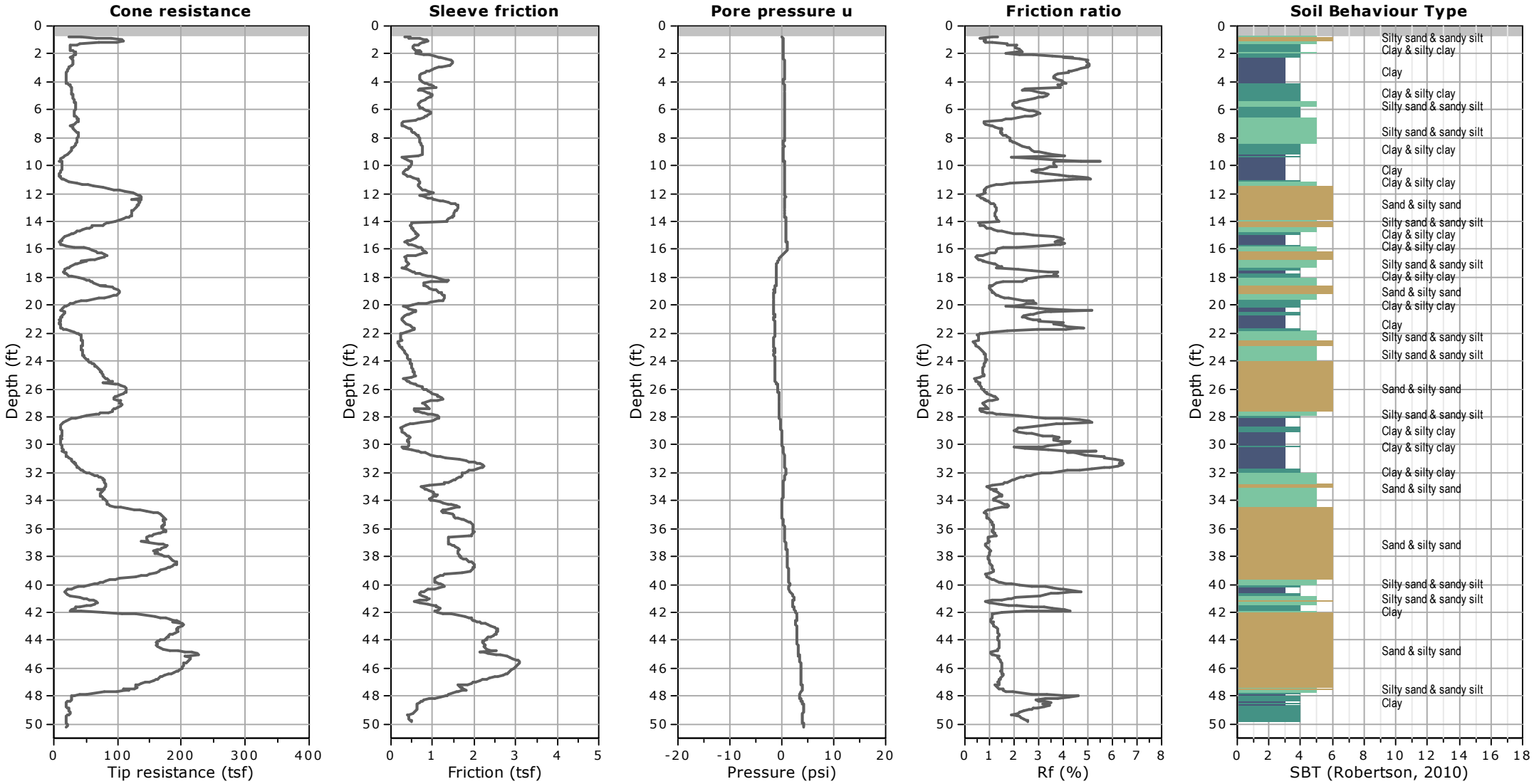
Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-4
Total depth: 50.22 ft, Date: 11/2/2021



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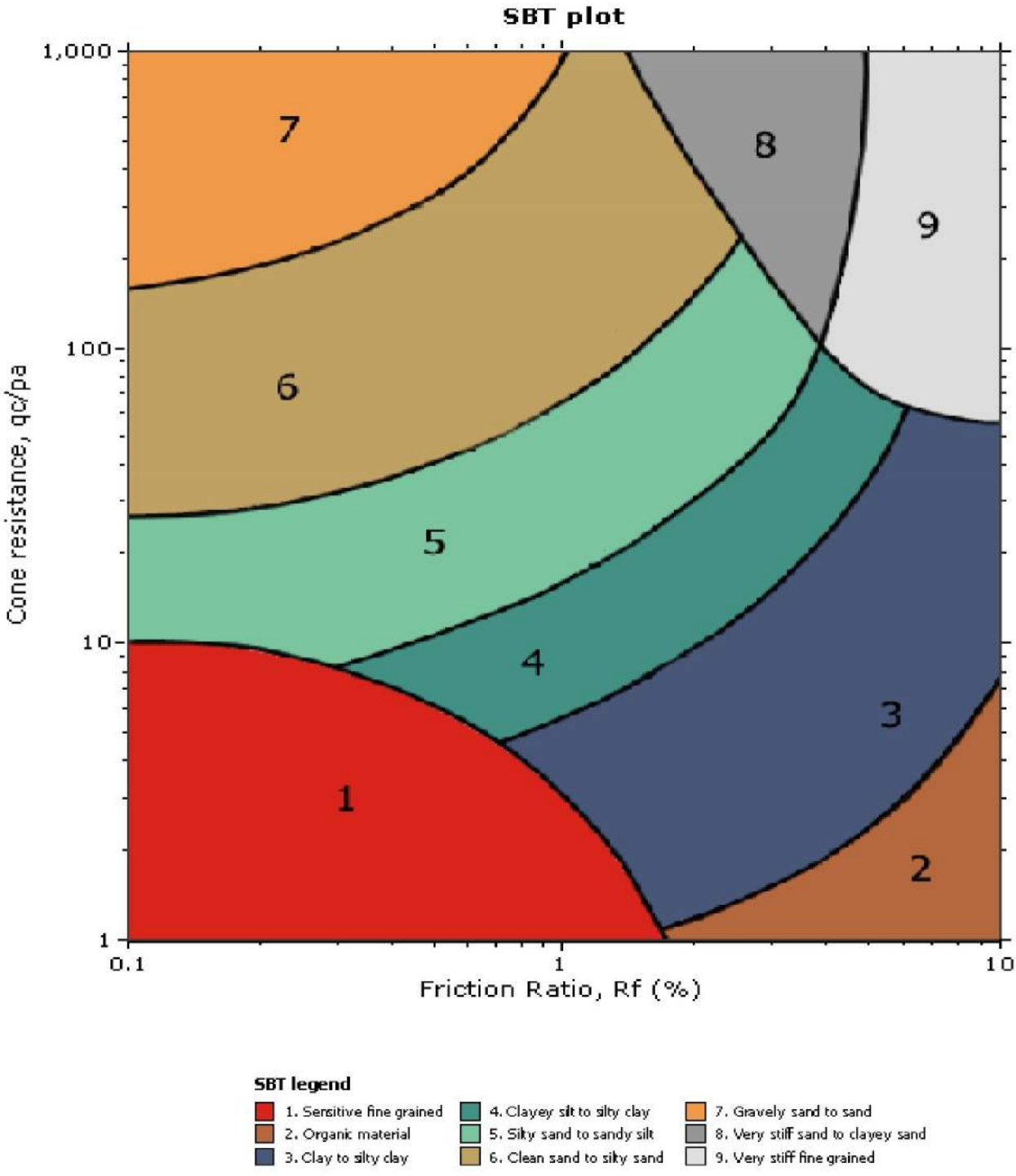


APPENDIX B

LABORATORY TEST RESULTS

LABORATORY TESTING PROGRAM

Soil Classification

Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2488). The samples were re-examined in the laboratory and classifications reviewed and then revised where appropriate. The assigned group symbols are presented on the Exploration Logs provided in Appendix A.

In-Situ Moisture Content and Dry Density

Moisture content and dry density of in-place soil materials were determined in representative strata. Test data are summarized on the Exploration Logs, Appendix A.

Atterberg Limits

Atterberg Limits (Liquid Limit, Plastic Limit, and Plasticity Index) were performed in accordance with Test Method ASTM D 4318. Pertinent test values are presented within Table B-1.

Maximum Dry Density and Optimum Moisture Content

Maximum dry density and optimum moisture content were performed on a representative sample of the site materials obtained from our field explorations. The test was performed in accordance with ASTM D 1557. Pertinent test values are given in Table B-1.

Expansion Potential

Expansion index testing was performed on a selected sample. The test was performed in accordance with ASTM D4829. The test result and expansion potential are presented in Table B-1.

Direct Shear

The Coulomb shear strength parameters, angle of internal friction and cohesion, were determined for a bulk sample and intact samples obtained from one our borings. The tests were performed in general conformance with Test Method ASTM D 3080. The bulk sample was remolded to 90 percent of maximum dry density and at the optimum moisture content. Three specimens were prepared for each test, artificially saturated, and then sheared under varied loads at an appropriate constant rate of strain. Results are graphically presented on Plate B-5.

Consolidation

Consolidation tests were performed for selected soil samples in general conformance with ASTM D 2435. Axial loads were applied in several increments to a laterally restrained 1-inch-high sample. Loads were applied in geometric progression by doubling the previous load, and the resulting deformations were recorded at selected time intervals. The specific test samples were inundated at selected loads to evaluate the effects of a sudden increase in moisture content (hydro-consolidation potential). Results of the tests are graphically presented on Plates B-1 to B-4.

Soluble Sulfate Content

A chemical analysis was performed on a selected sample to determine soluble sulfate content. This test was performed in our soil laboratory in accordance with California Test Method No 417. The test result is included on Table B-1.

Corrosion

Select samples were tested for minimum resistivity, chloride, pH in accordance with California Test Method 643. Results of these tests are provided in Table B-1.

R-Value

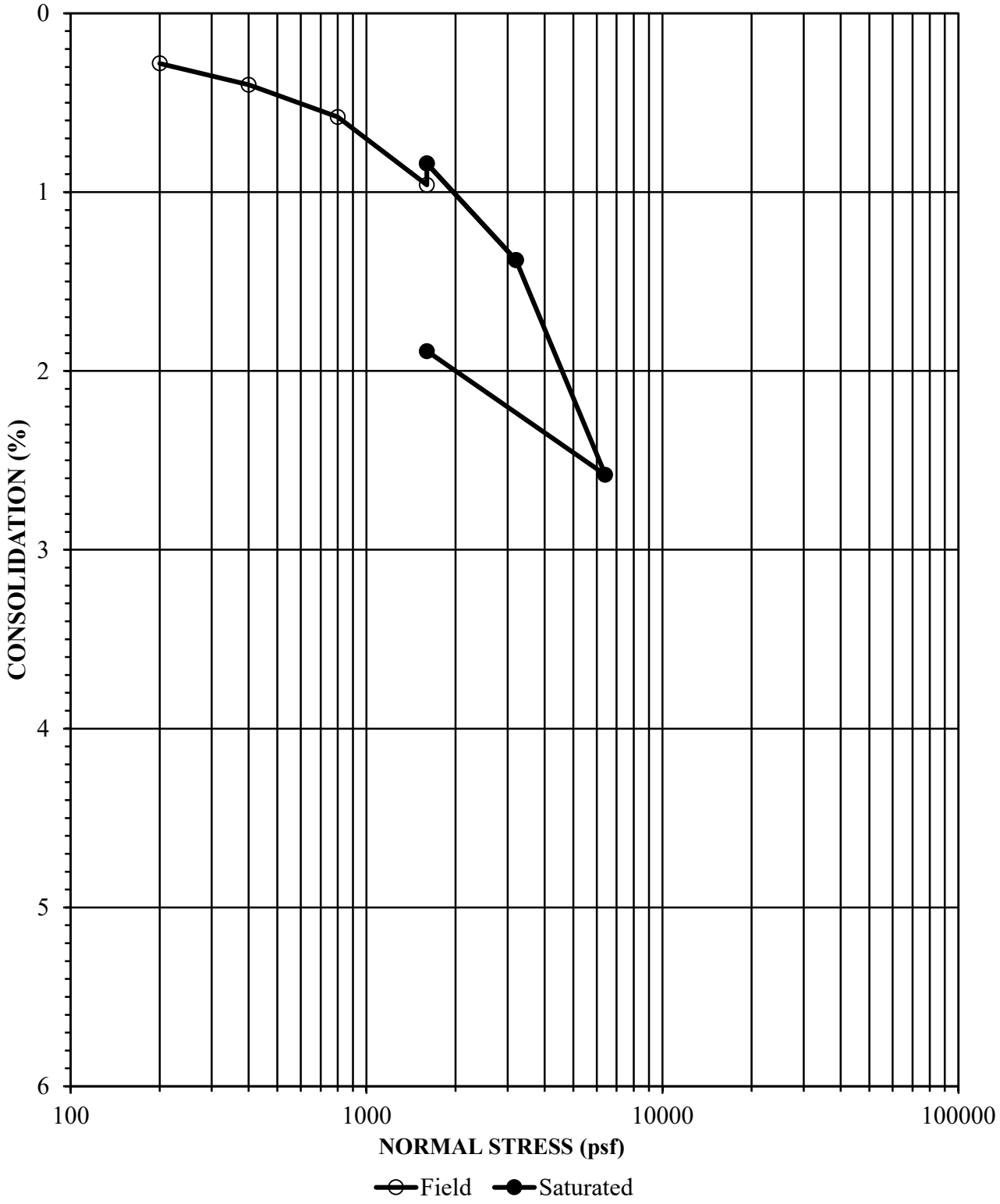
A sample of soil was tested for R-value in accordance with California Test Method (CTM) 301. The results are summarized in Plate B-6.

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

Boring No.	Sample Depth (ft.)	Soil Description	Test Results	
B-1	0-5	Sandy Silt trace Clay	Maximum Dry Density (pcf): Optimum Moisture (%): Expansion Index: Expansion Potential: Soluble Sulfate Content (%): Sulfate Exposure: R-Value (By Exudation): Resistivity (ohm-cm): Chloride (ppm): pH:	113.5 15.5 23 Low 0.002 Negligible 43 2500 160 9.45
B-1	2	Sandy Silt	Liquid Limit (%): Plasticity Index (%):	32.7 9
B-1	20	Sandy Silt	Passing No. 200 Sieve (%):	53.4
B-2	20	Silty Sand	Passing No. 200 Sieve (%):	46.6
B-2	30	Silty Sand	Passing No. 200 Sieve (%):	38.5
B-2	40	Sand trace Silt	Passing No. 200 Sieve (%):	7.2
B-3	20	Silty Sand with Clay	Passing No. 200 Sieve (%):	53.2

Note: Additional laboratory test results are provided on the boring logs provided in Appendix A.

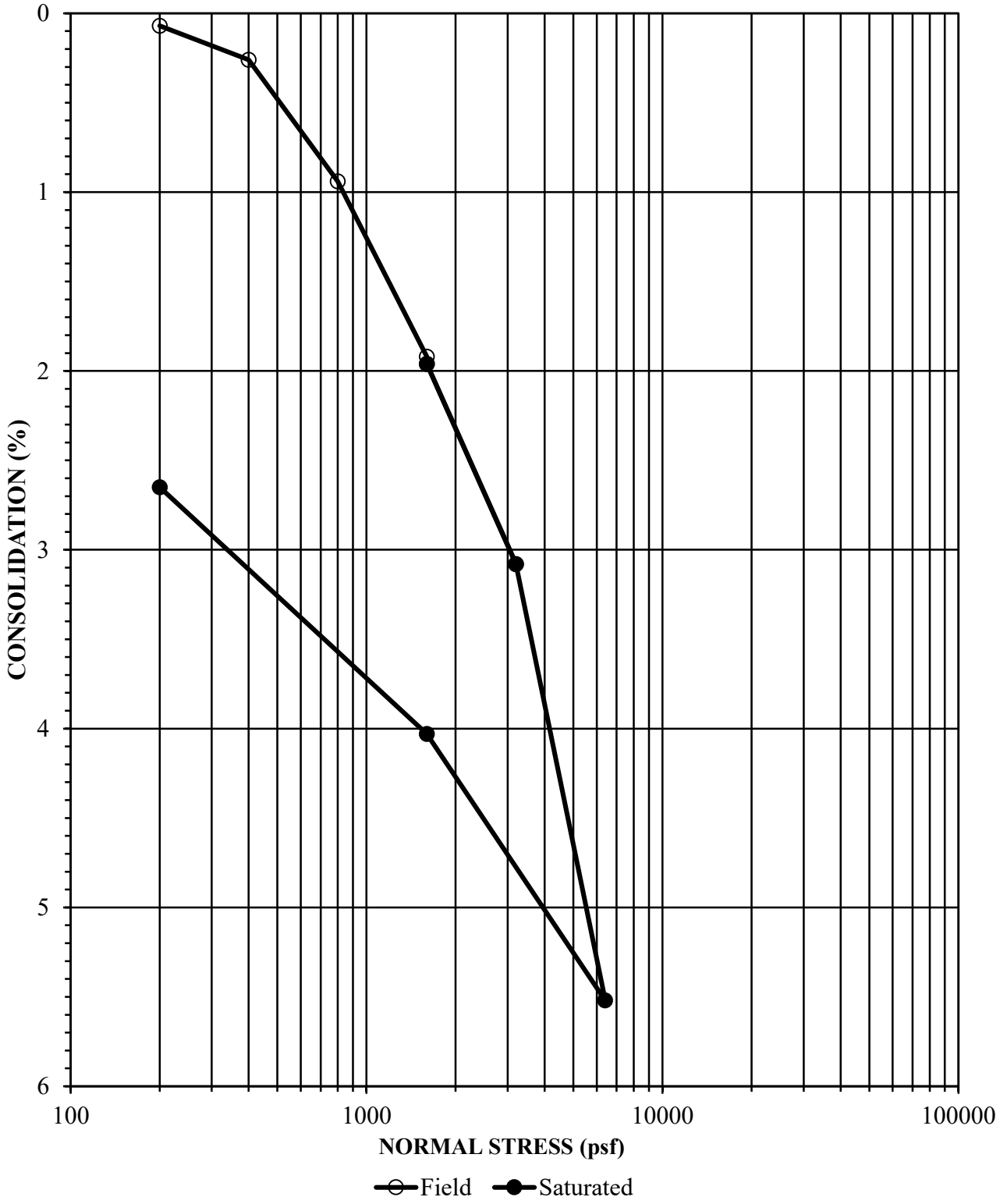
CONSOLIDATION



Job Number	Location	Depth	Description
3027.00	B-1	2	Sandy Silt (ML)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)
99	23.4	24.8

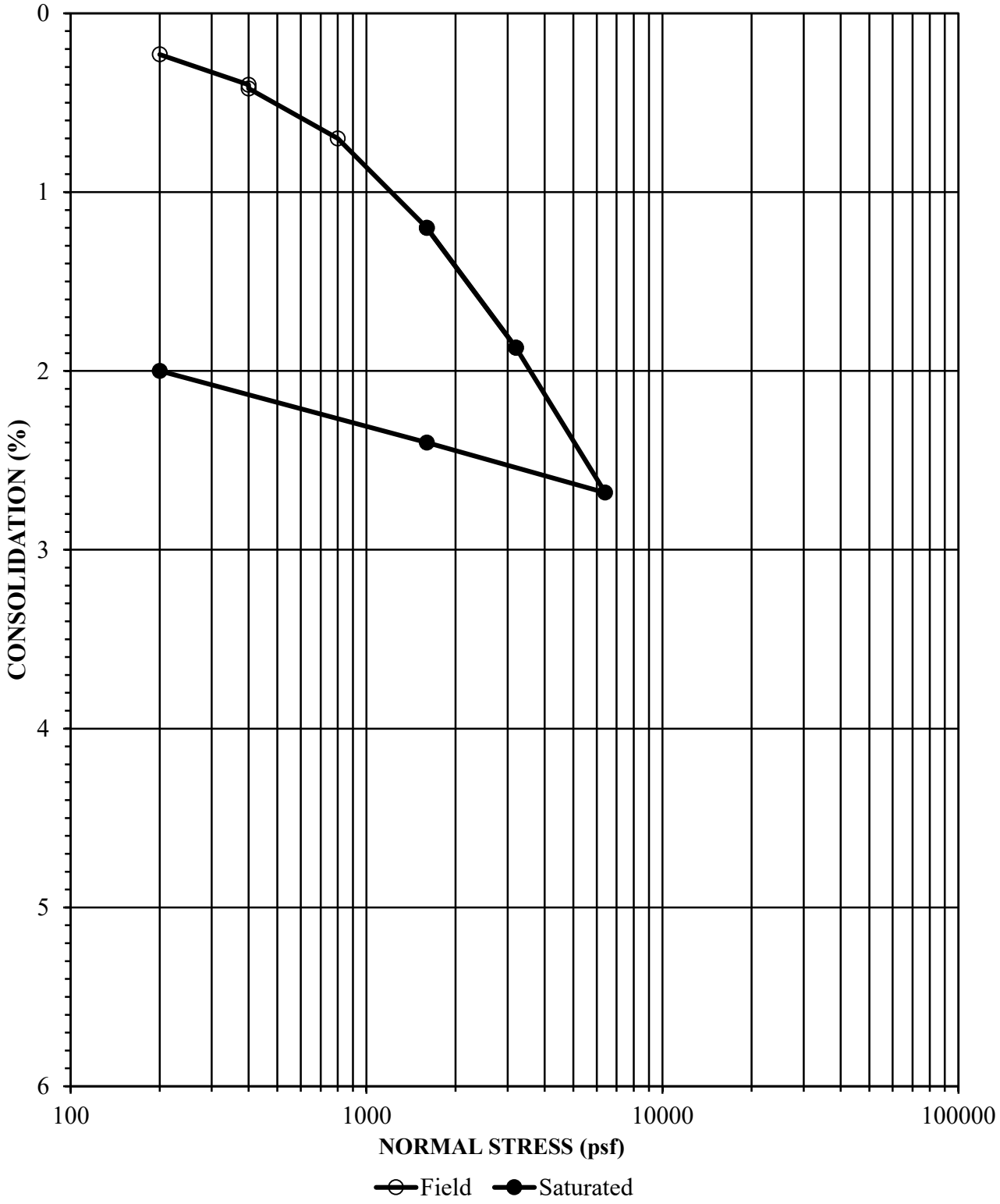
CONSOLIDATION



Job Number	Location	Depth	Description
3027.00	B-2	2	Sandy Silt (ML)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)
100.1	22.3	25.5

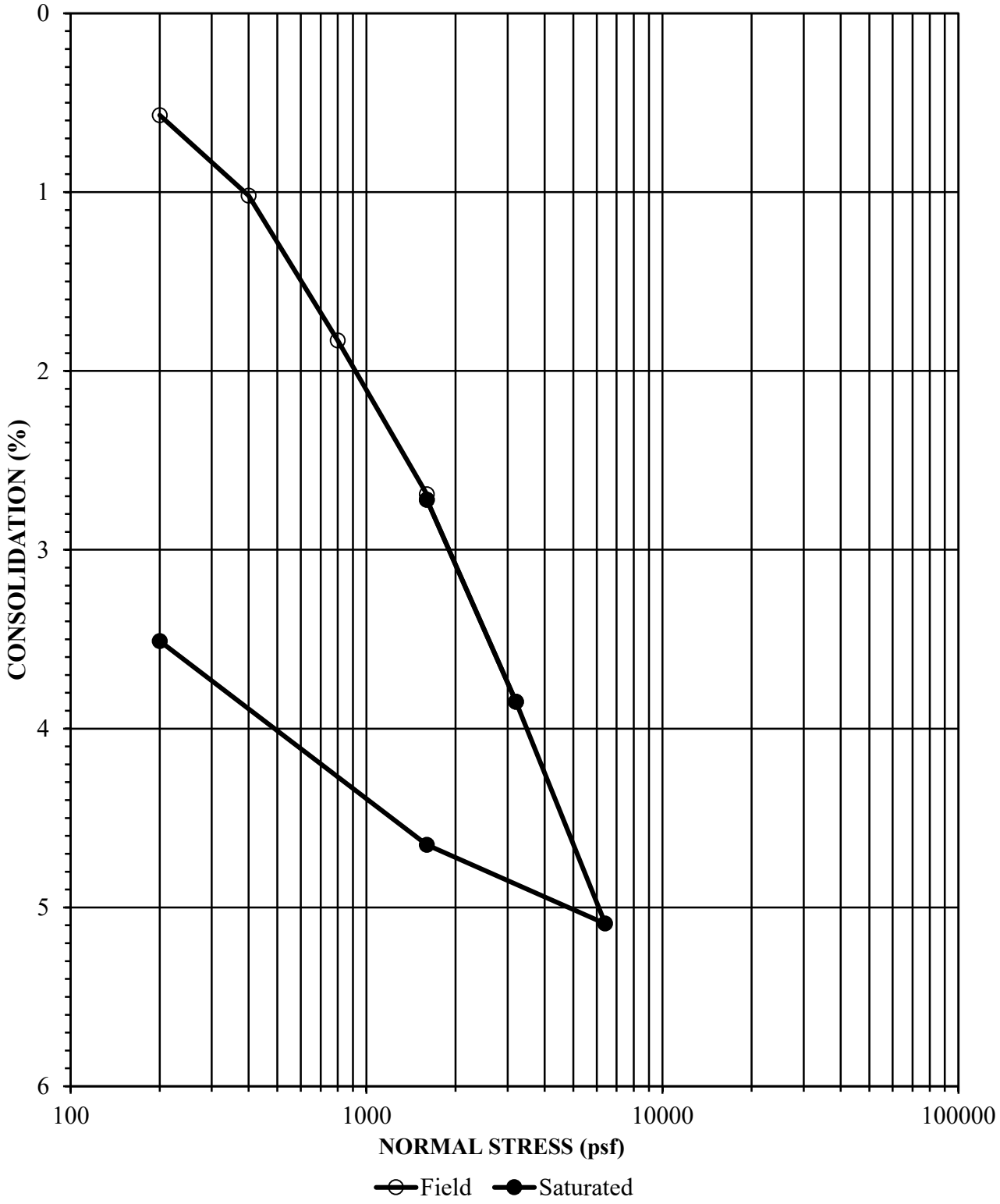
CONSOLIDATION



Job Number	Location	Depth	Description
3027.00	B-2	10	Sandy Silt (ML)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)
94.7	17.1	28.3

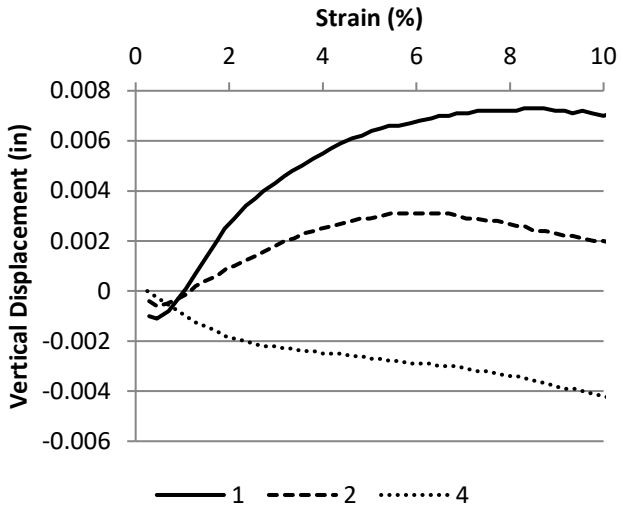
CONSOLIDATION

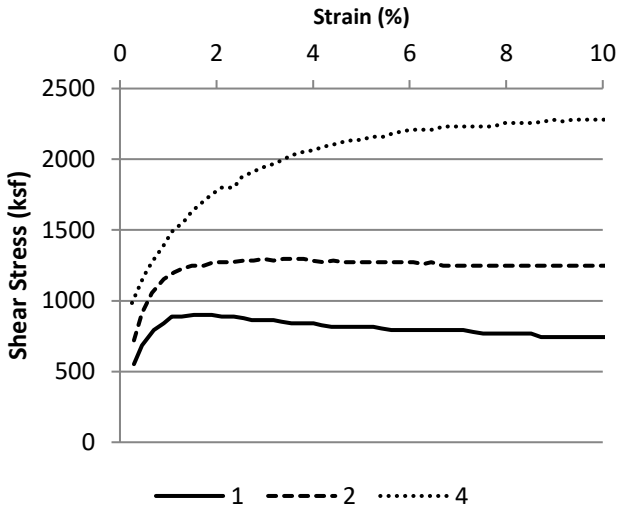


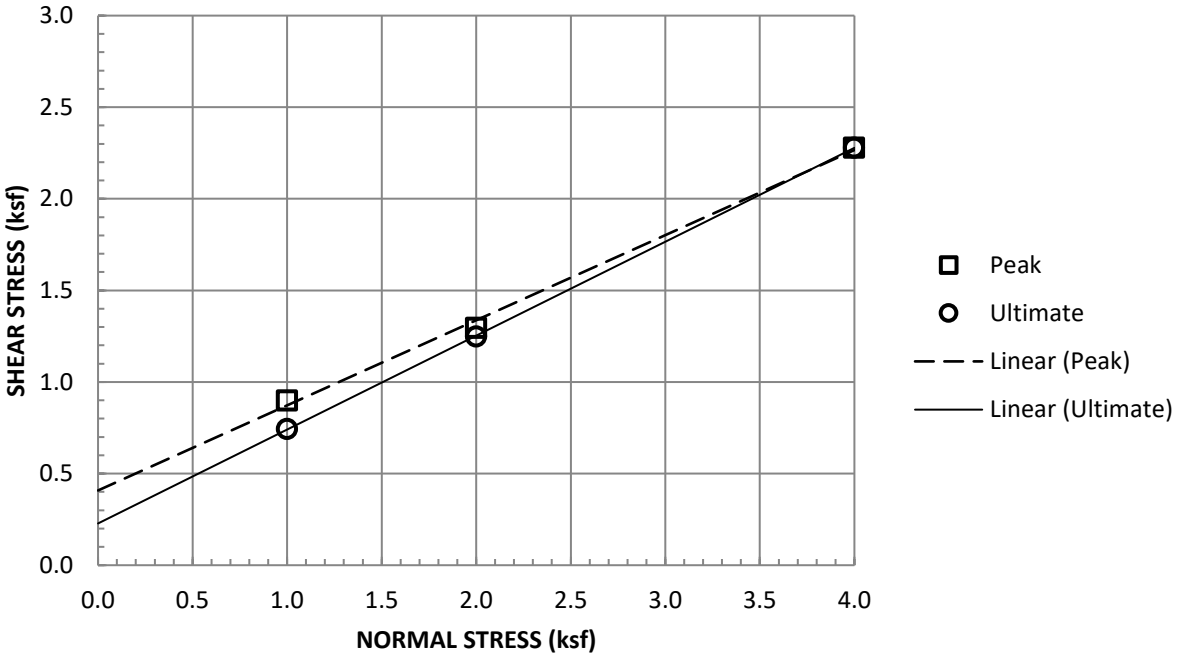
Job Number	Location	Depth	Description
3027.00	B-3	6	Silty Sand (SM)

Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Concent (%)
98.9	9	18.3

DIRECT SHEAR







Sample Type:	Remolded, Saturated		
Normal Stress (ksf)	1	2	4
Peak Shear Stress (ksf)	0.9	1.296	2.28
Peak Displacement (in)	0.007	0.003	0.004
Ultimate Shear Stress (ksf)	0.744	1.248	2.28
Ultimate Displacement (in)	0.25	0.25	0.25
Initial Dry Density (pcf)	95.9	95.5	95.5
Initial Moisture Content (%)	23.2	23.2	23.2
Final Moisture Content (%)	32	32	32.7
Strain Rate (in/min)	0.05		

Job Number	Location	Depth	Description
3027.00	B-1	0-5	Sandy Silt

'R' VALUE CA 301

Client: Albus | Date: 11/9/21 | By: LD

Client's Job No.: 3027.00 | Sample : B-1 @ 0 - 5'

GLA Reference: 2005-011 | Soil Type: Brown, Sandy Clay

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	**200**	**300**	**250**	
Initial Moisture Content	%	**17.3**	**17.3**	**17.3**	
Water Added	ml	**0**	**-15**	**-8**	
Moisture at Compaction	%	17.3	15.9	16.5	
Sample & Mold Weight	gms	**3174**	**3192**	**3163**	
Mold Weight	gms	**2103**	**2098**	**2099**	
Net Sample Weight	gms	1071	1094	1064	
Sample Height	in.	**2.5**	**2.511**	**2.466**	
Dry Density	pcf	110.6	113.9	112.2	
Pressure	lbs	**2835**	**7550**	**4620**	
Exudation Pressure	psi	226	601	368	
Expansion Dial	x 0.0001	**27**	**115**	**70**	
Expansion Pressure	psf	117	498	303	
Ph at 1000lbs	psi	**38**	**22**	**30**	
Ph at 2000lbs	psi	**82**	**48**	**60**	
Displacement	turns	**4.69**	**4.05**	**4.29**	
R' Value		34	59	49	
Corrected 'R' Value		**34**	**59**	**49**	

FINAL 'R' VALUE	
By Exudation Pressure (@ 300 psi):	**43**
By Epansion Pressure :	**33**
TI = 5	

Geo-Logic ASSOCIATES

APPENDIX C

LIQUEFACTION ANALYSIS

Albus & Associates, Inc.
Geotechnical Consultants
1011 N. Armando Street, Anaheim, CA
albus-keefe.net

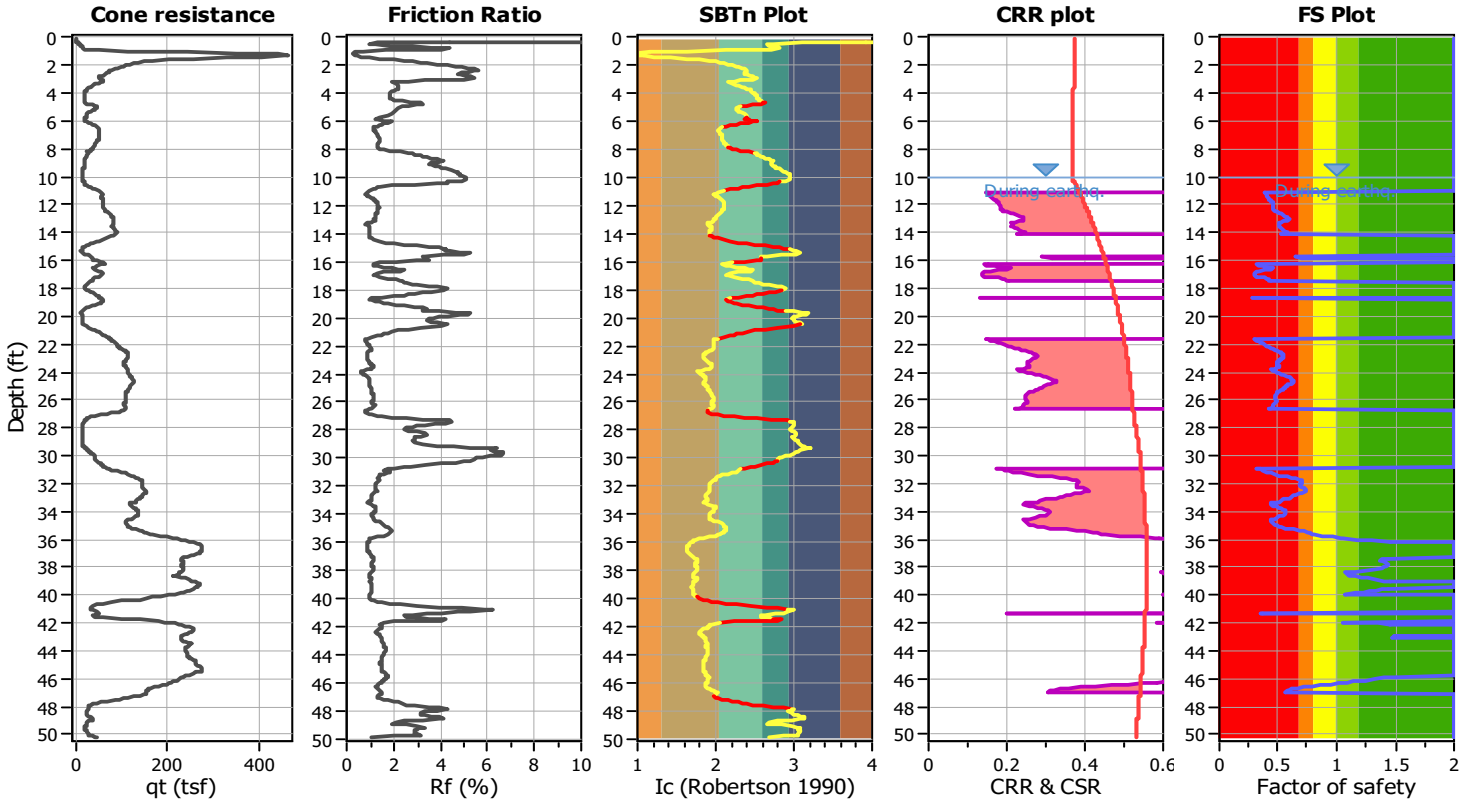
LIQUEFACTION ANALYSIS REPORT

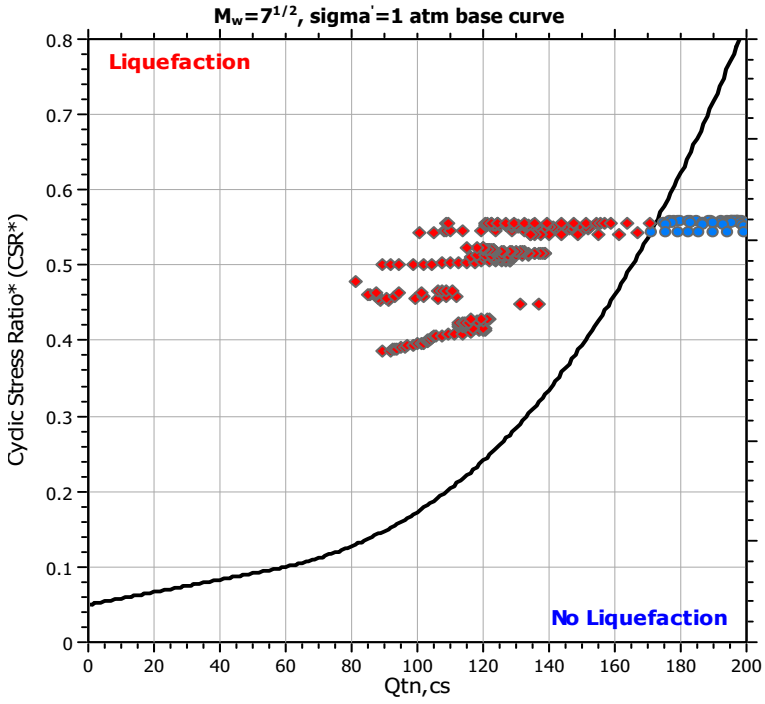
Project title : 3027.00 **Location : Artesia, CA**

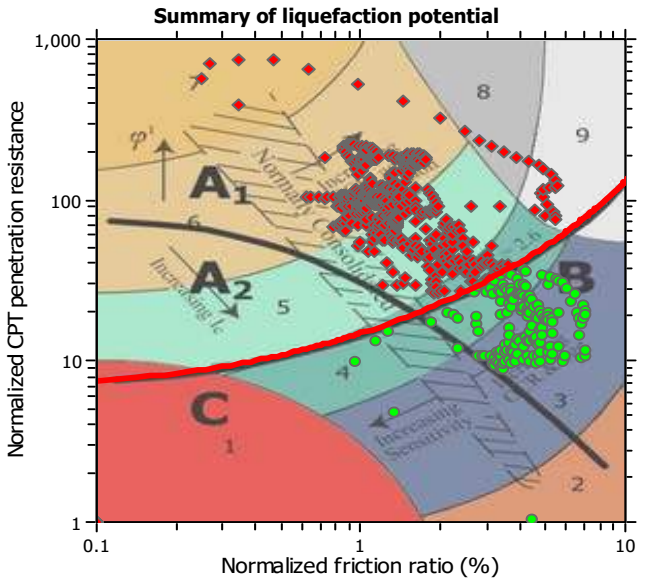
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.83	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.73	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
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Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
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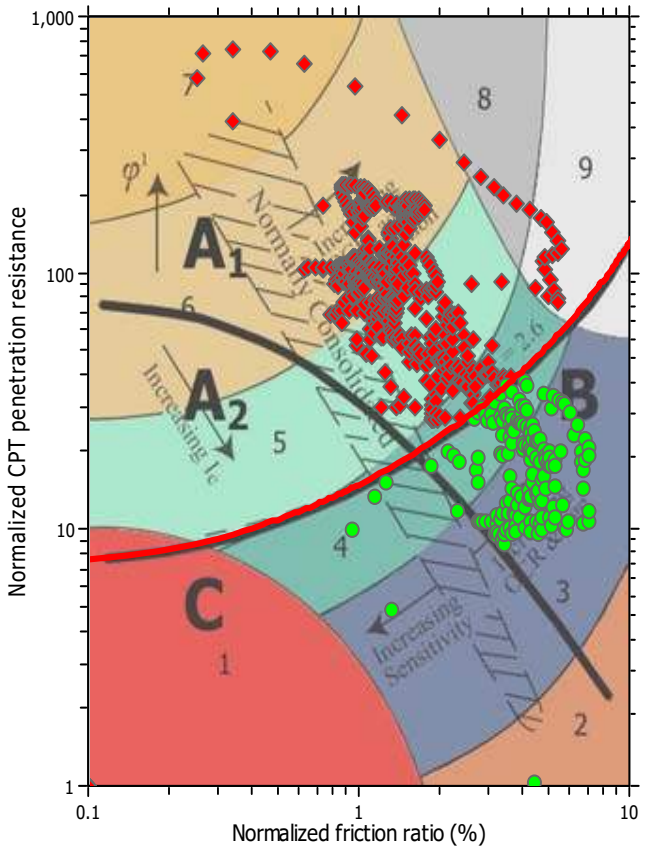
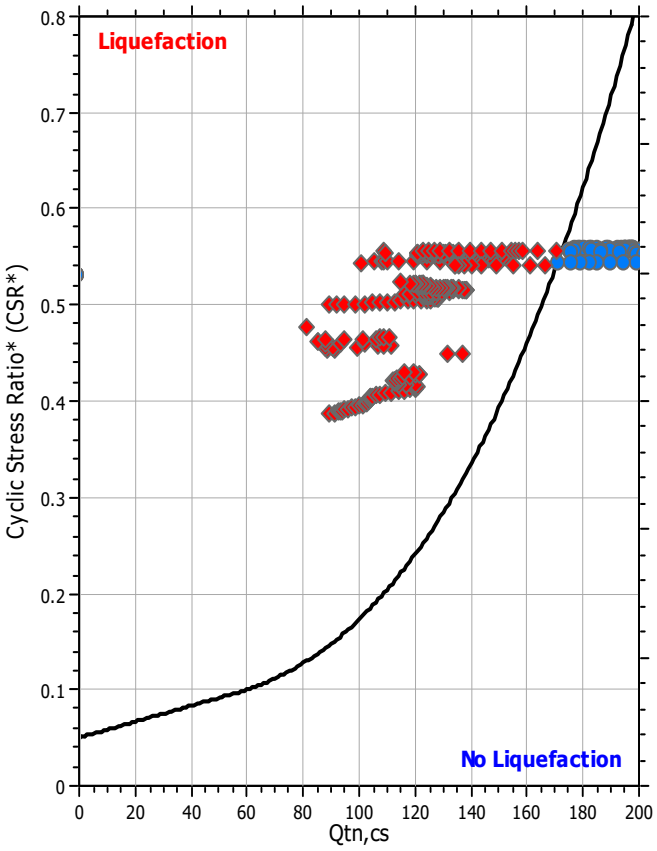
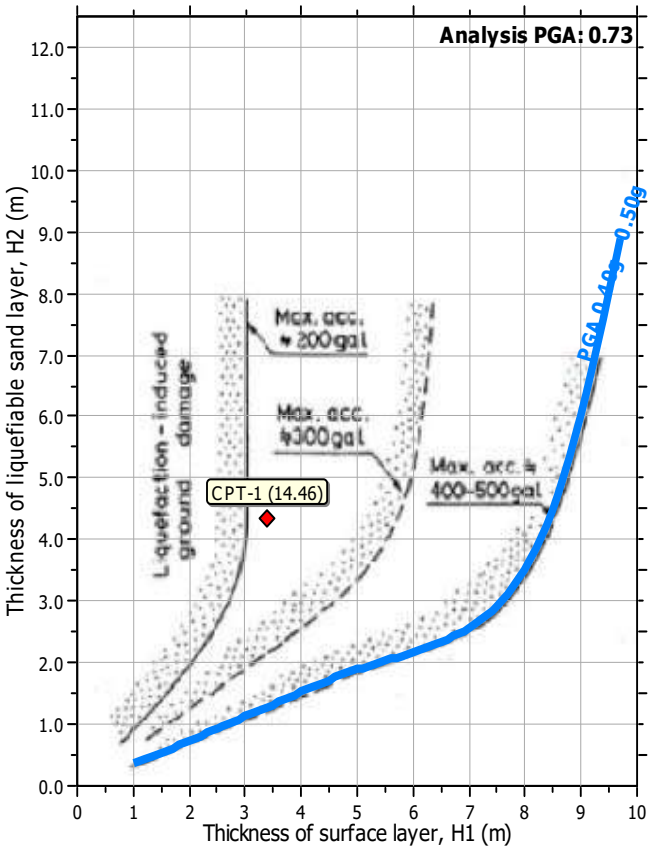
Liquefaction analysis summary plots



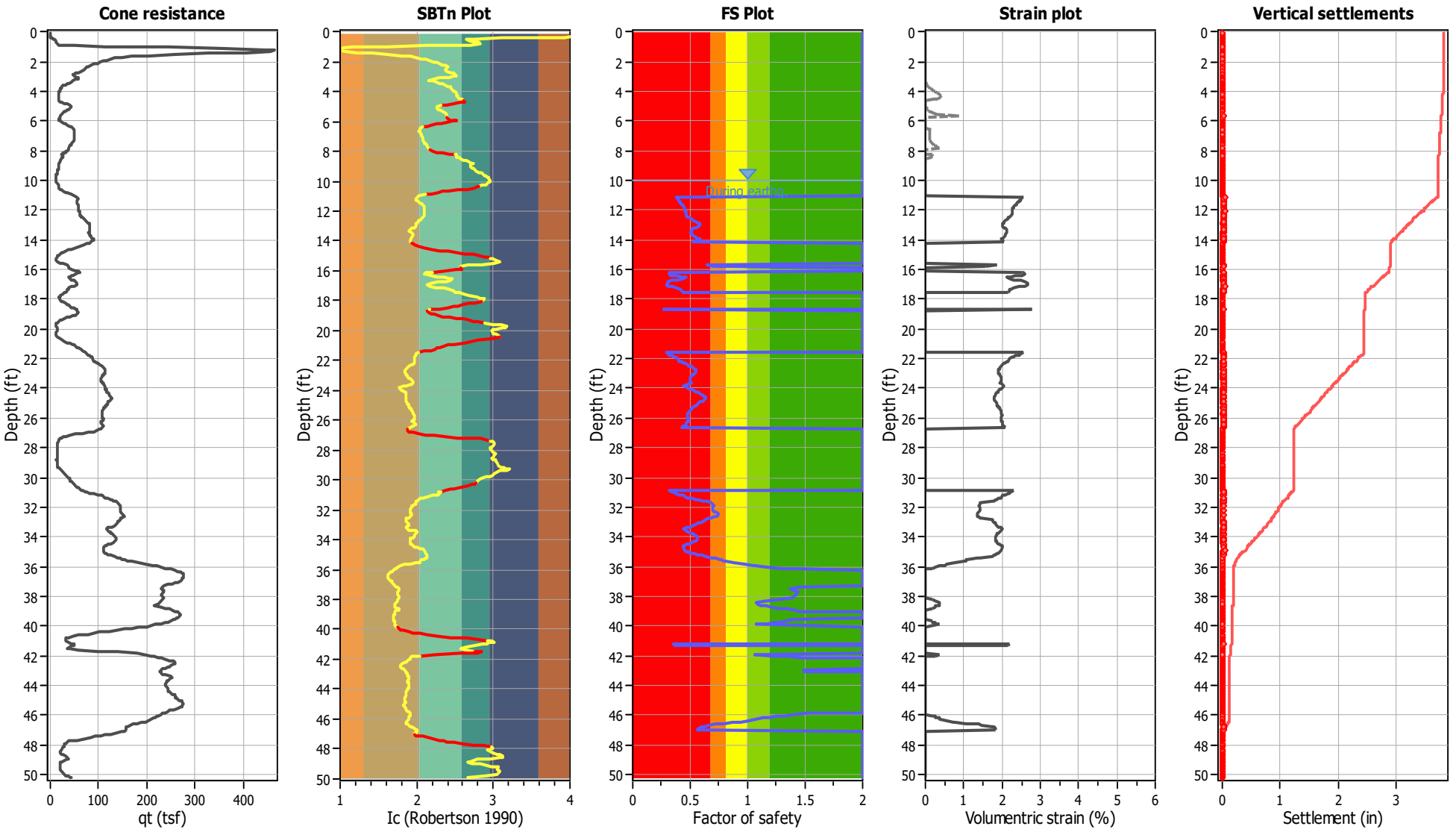




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.73	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	14.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Albus & Associates, Inc.
Geotechnical Consultants
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LIQUEFACTION ANALYSIS REPORT

Project title : 3027.00 **Location : Artesia, CA**

CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
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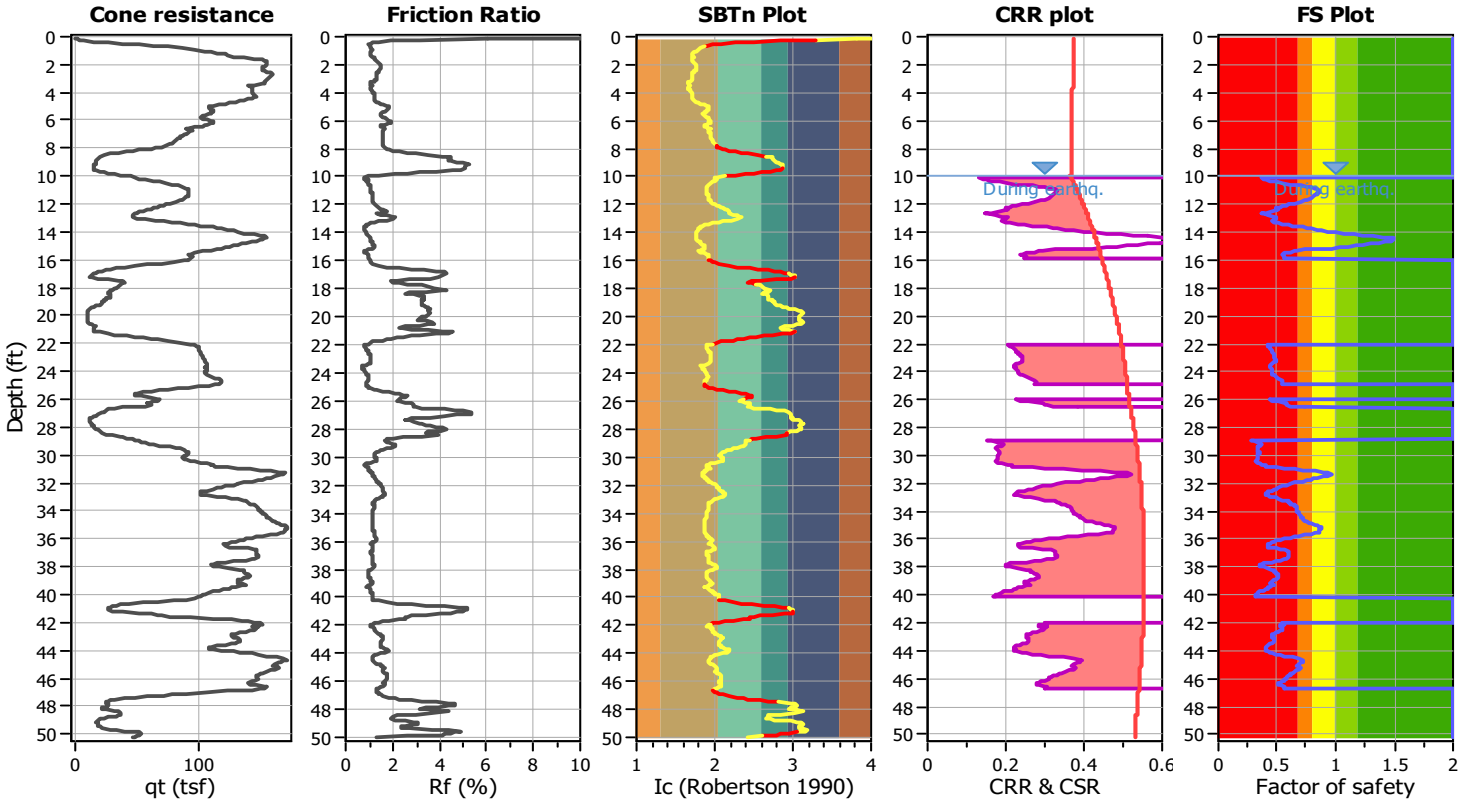
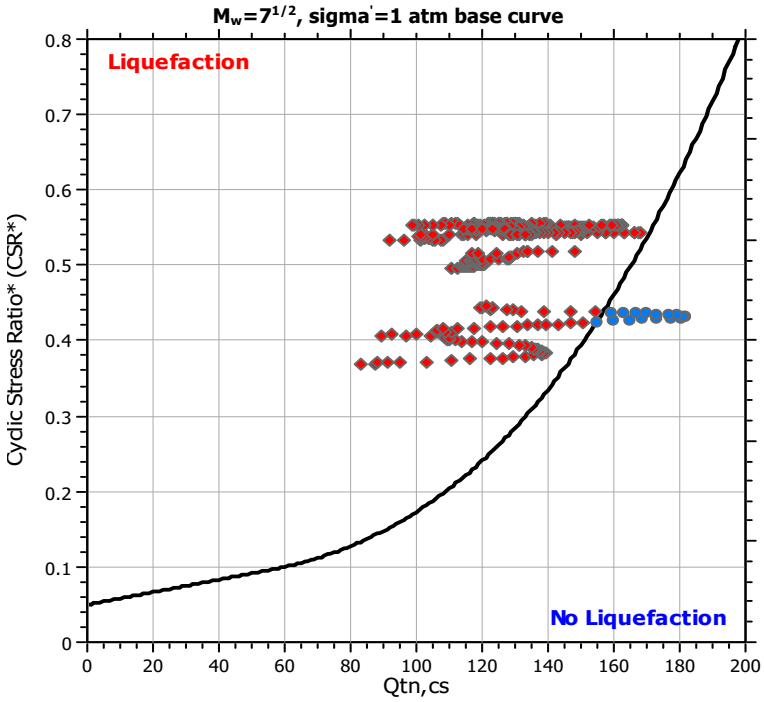
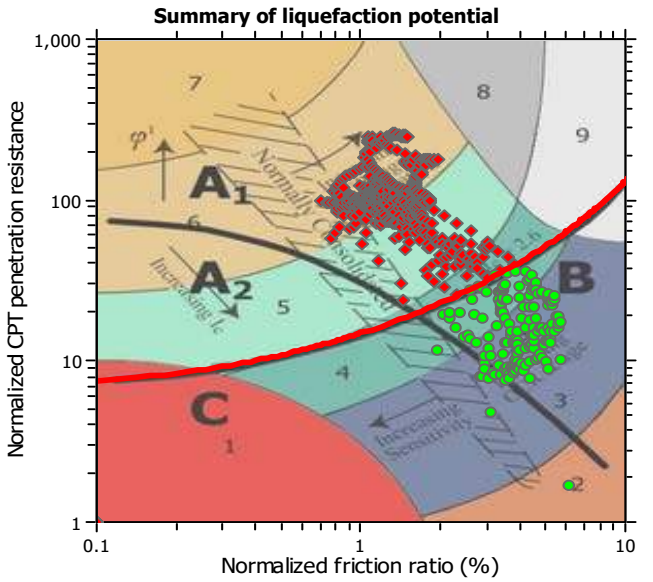
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.83	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.73	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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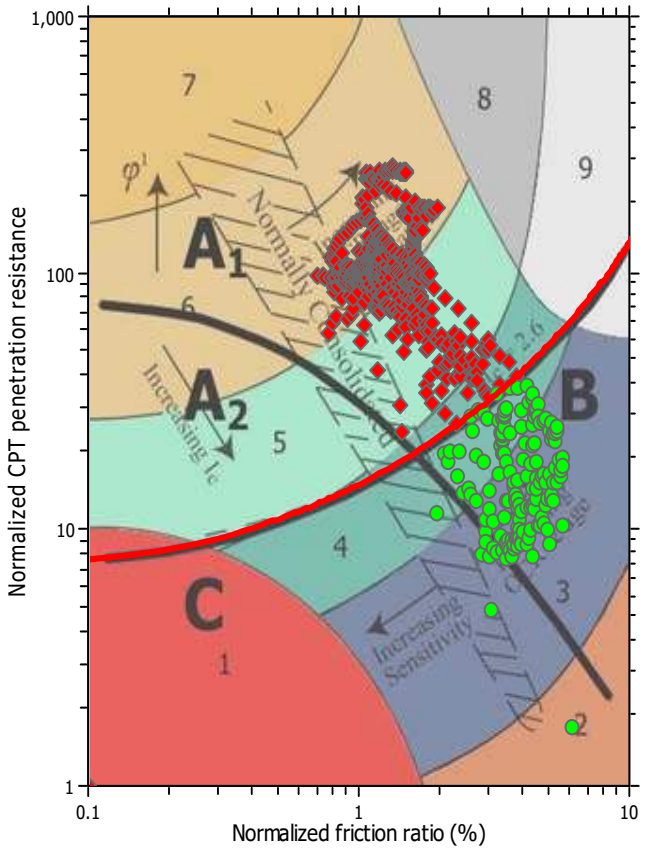
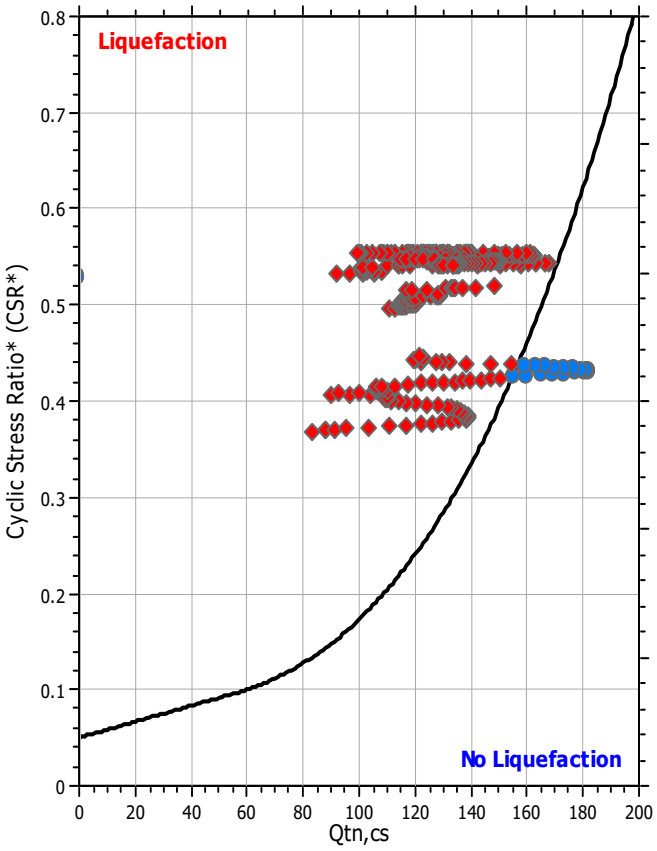
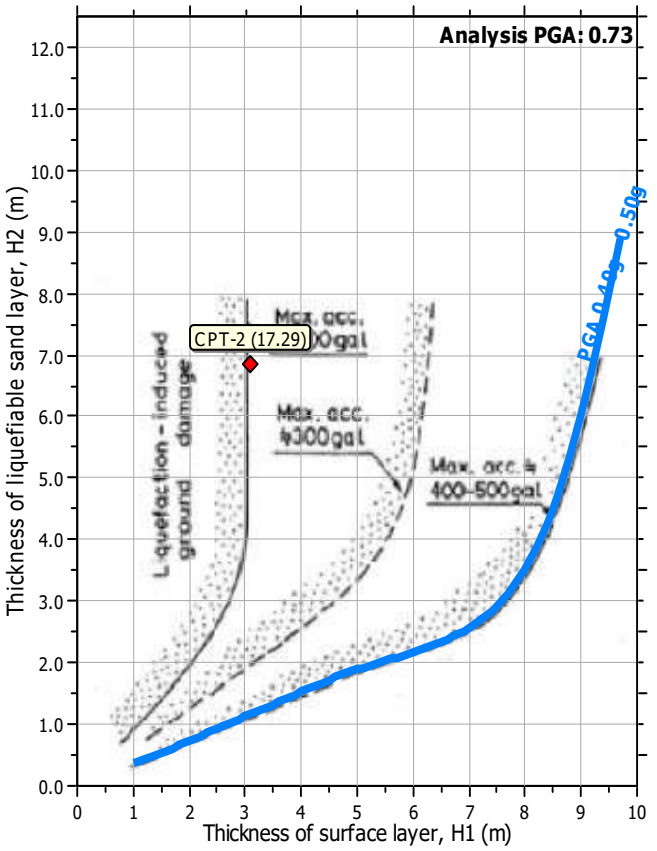
Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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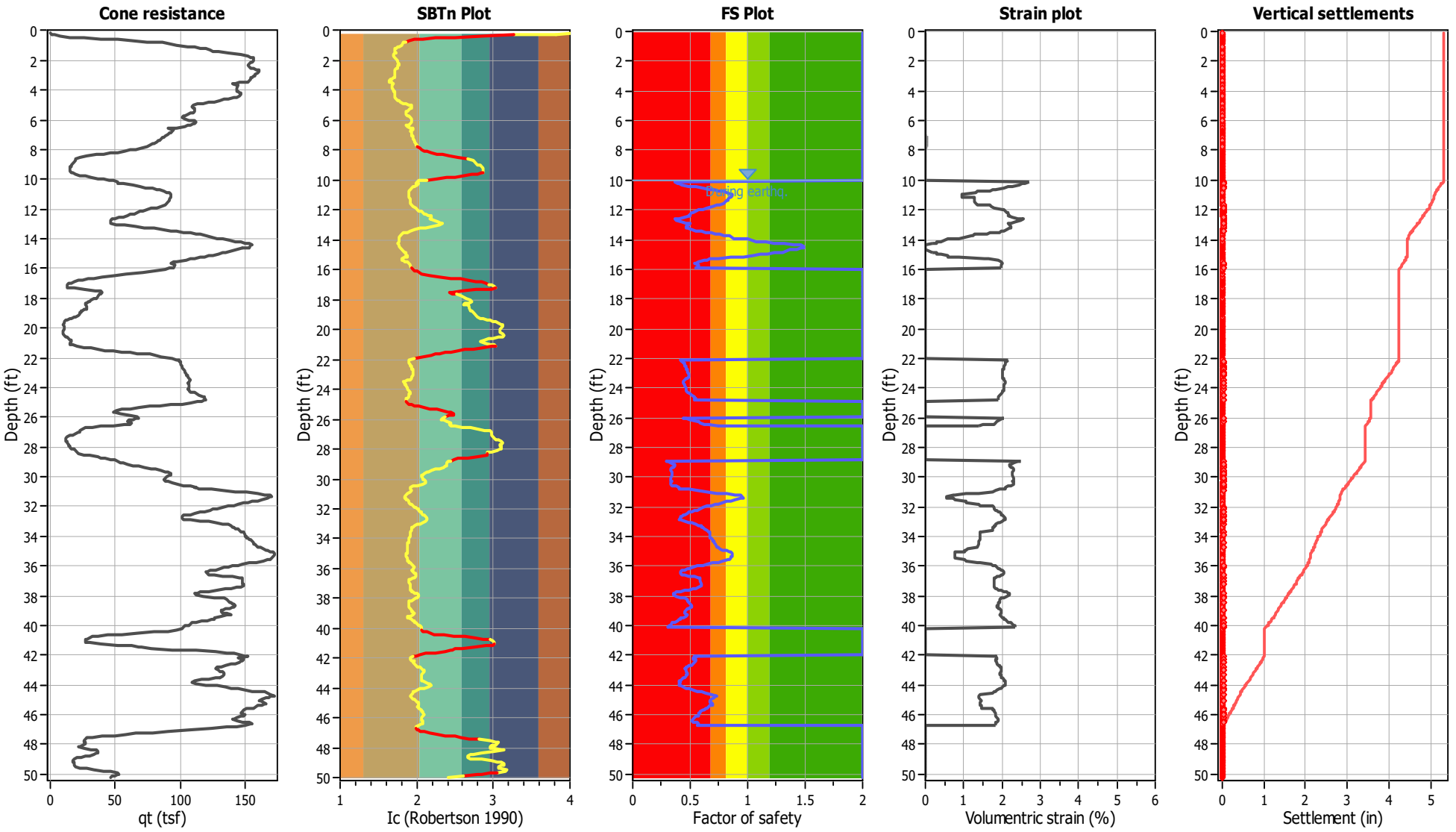
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.73	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	14.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
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Volumentric strain:	Post-liquefaction volumentric strain

Albus & Associates, Inc.
Geotechnical Consultants
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LIQUEFACTION ANALYSIS REPORT

Project title : 3027.00 **Location : Artesia, CA**

CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
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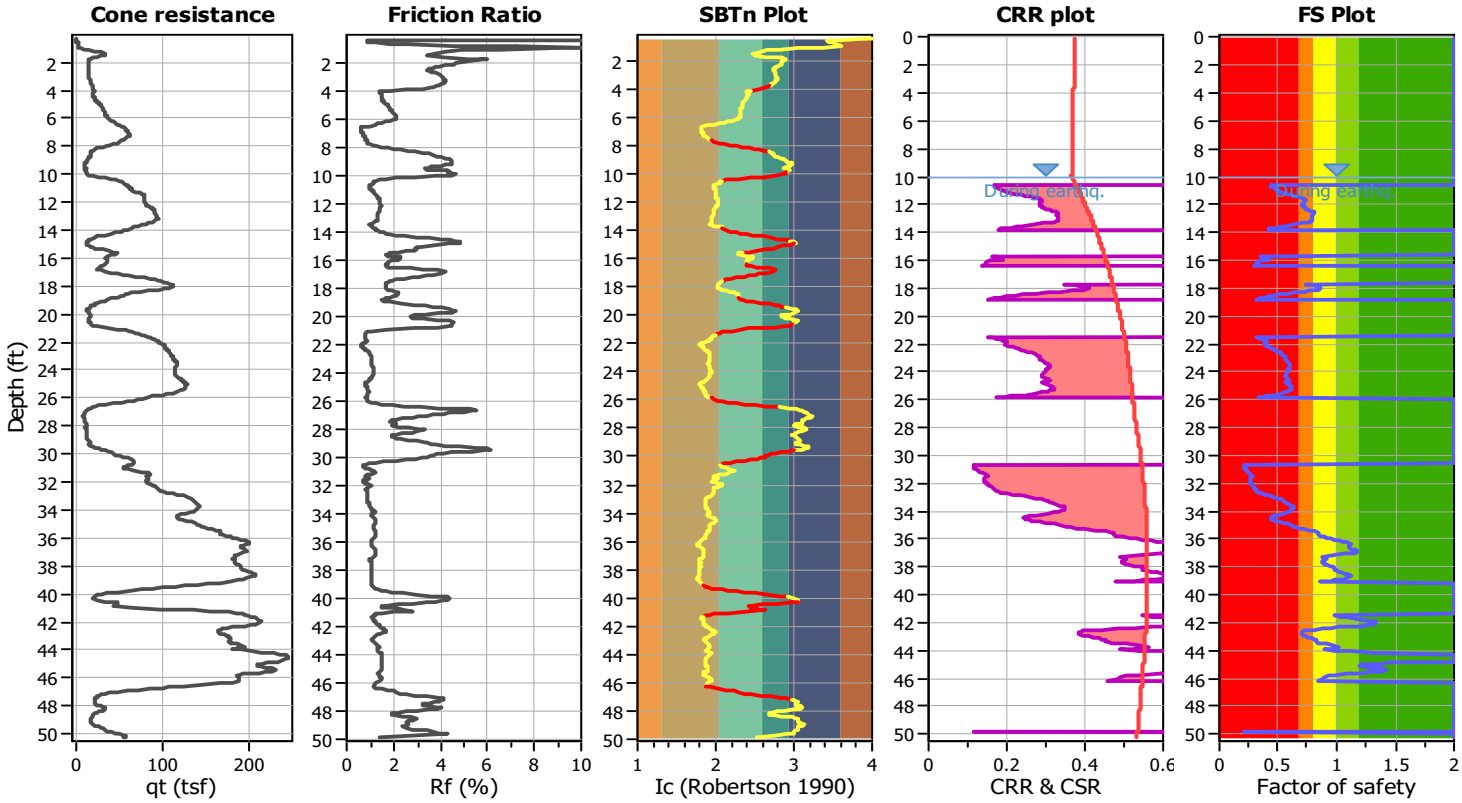
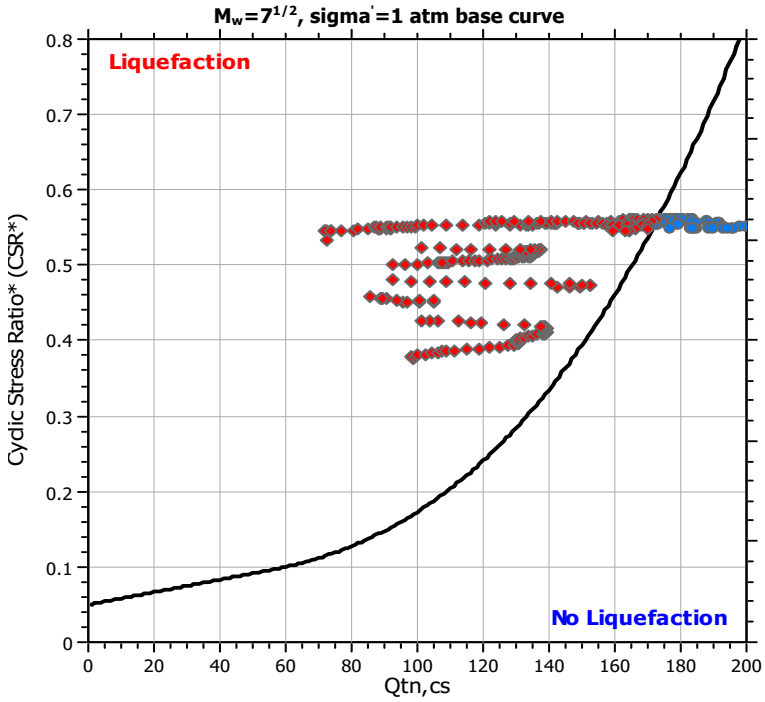
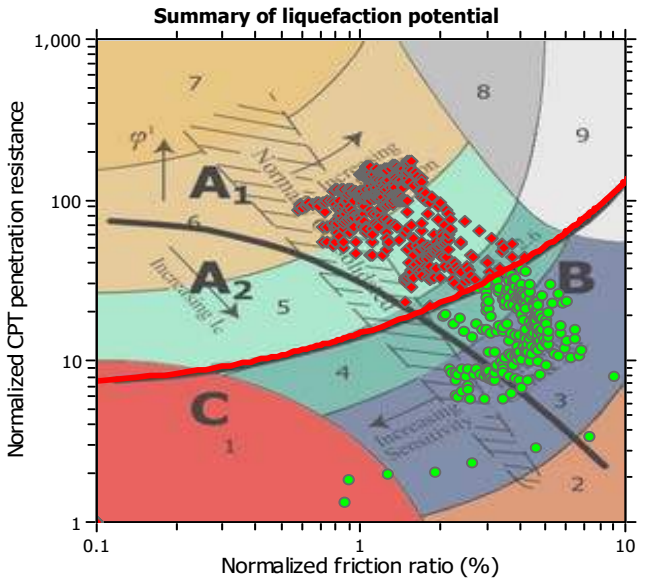
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.83	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.73	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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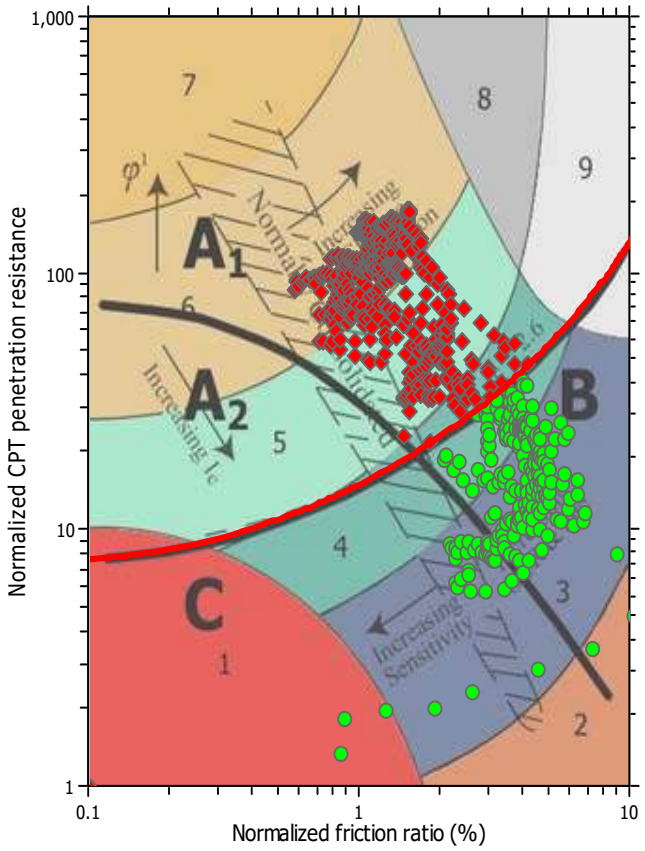
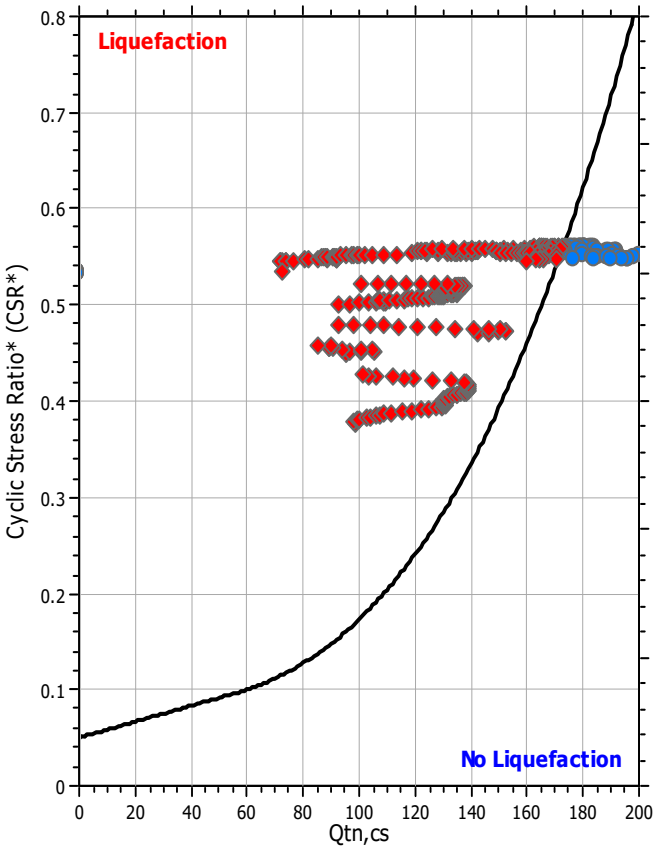
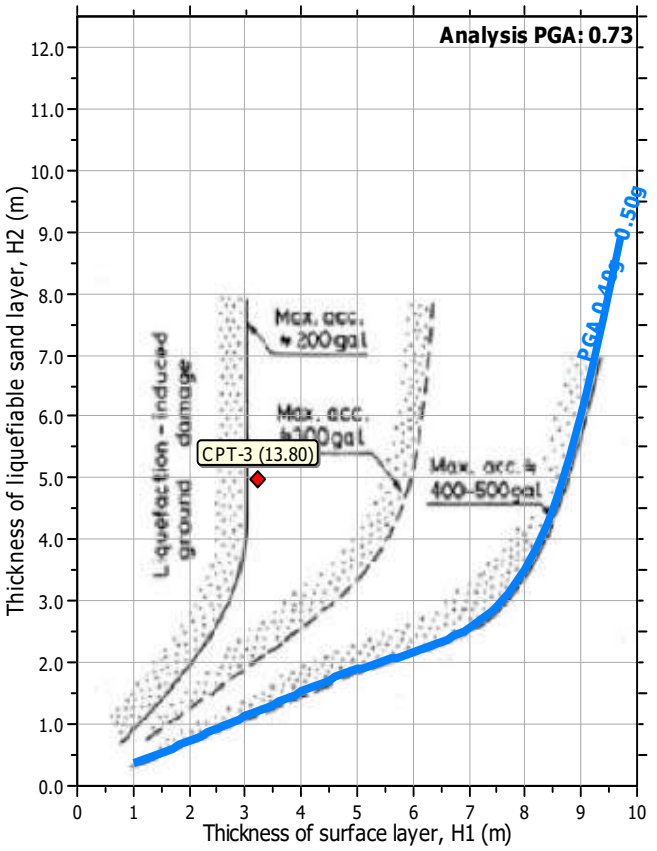
Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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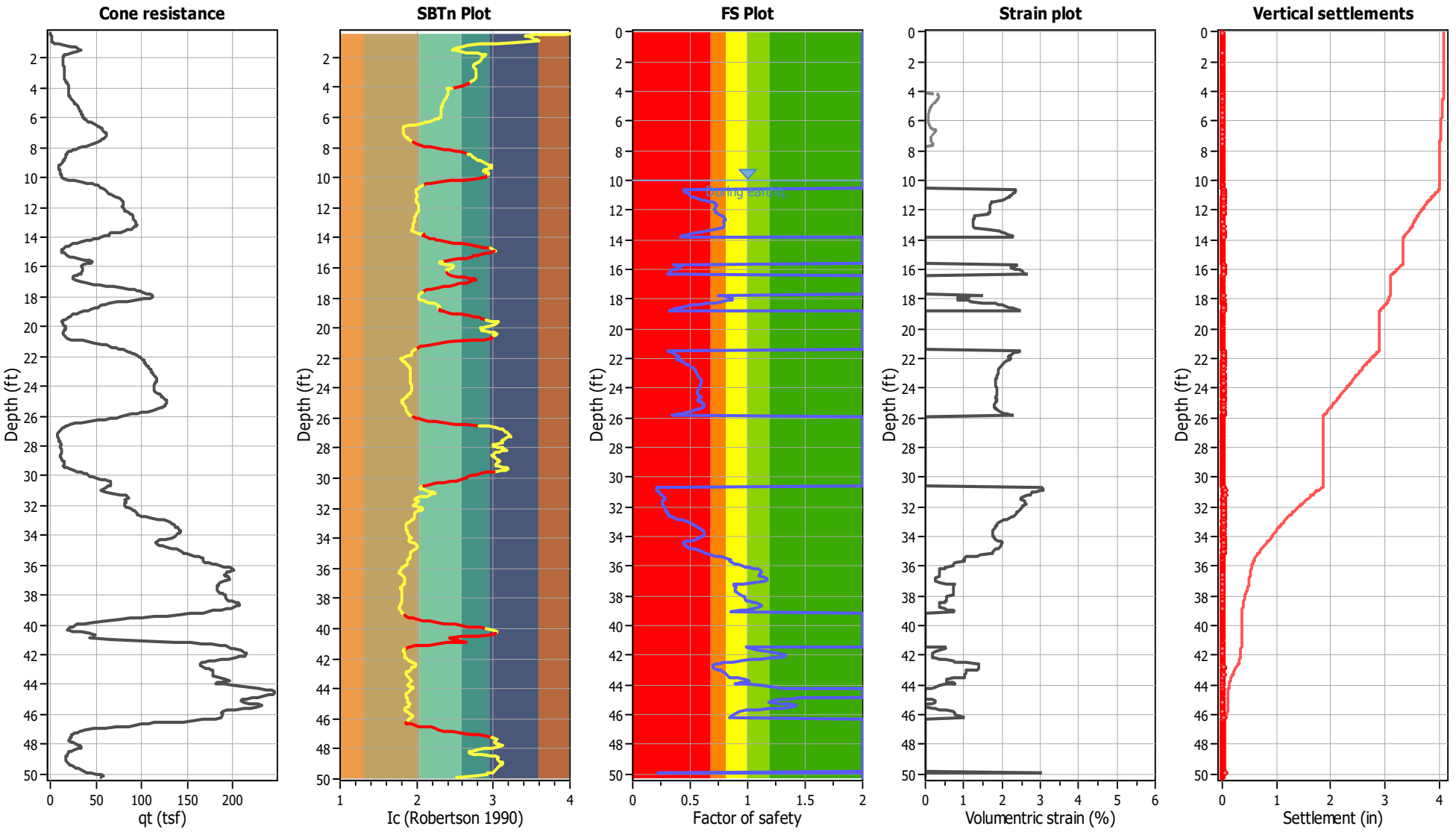
Estimation of post-earthquake settlements



Abbreviations

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Albus & Associates, Inc.
Geotechnical Consultants
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albus-keefe.net

LIQUEFACTION ANALYSIS REPORT

Project title : 3027.00 **Location : Artesia, CA**

CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
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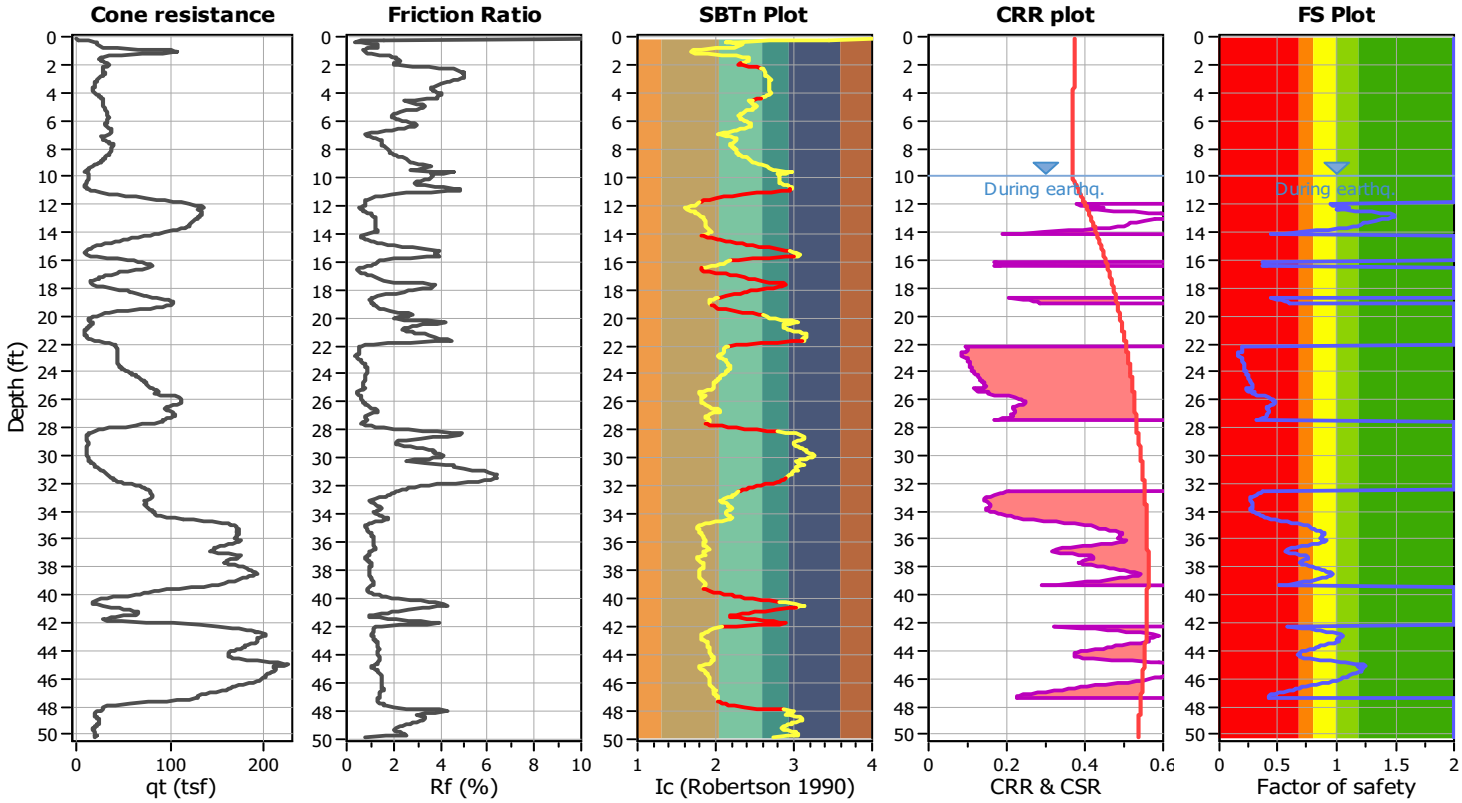
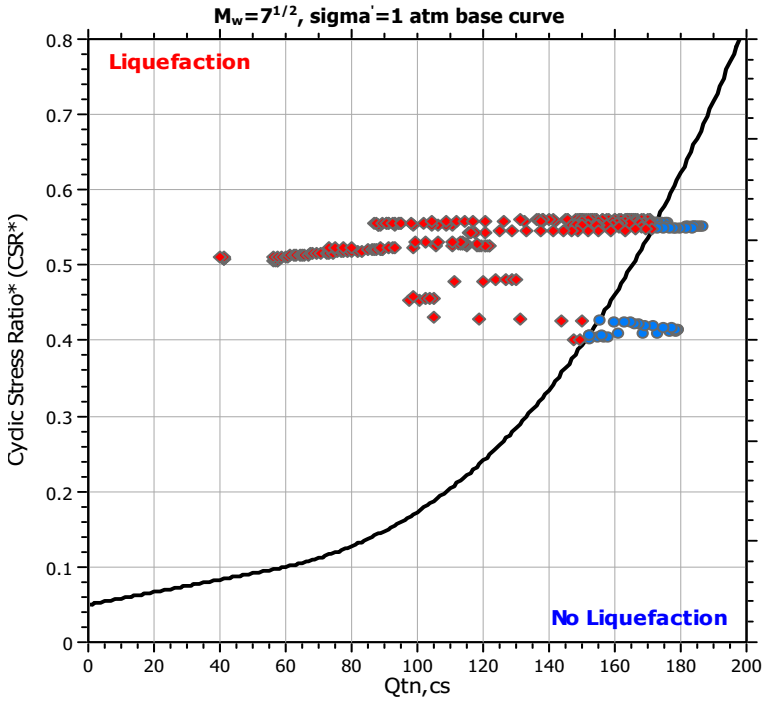
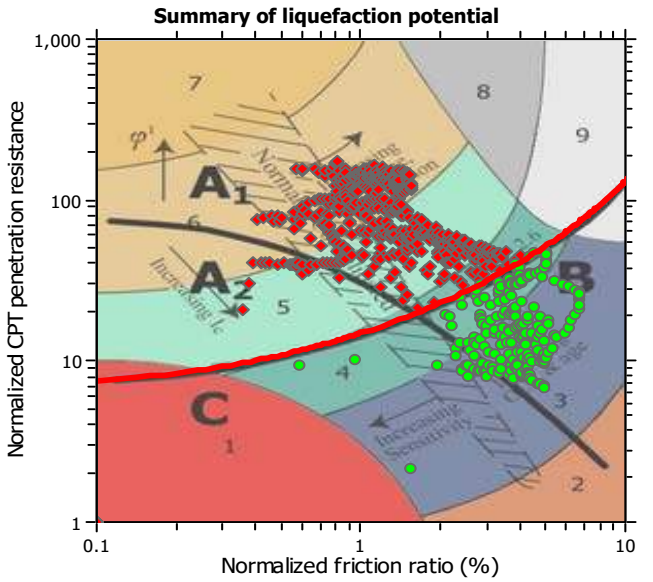
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.83	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.73	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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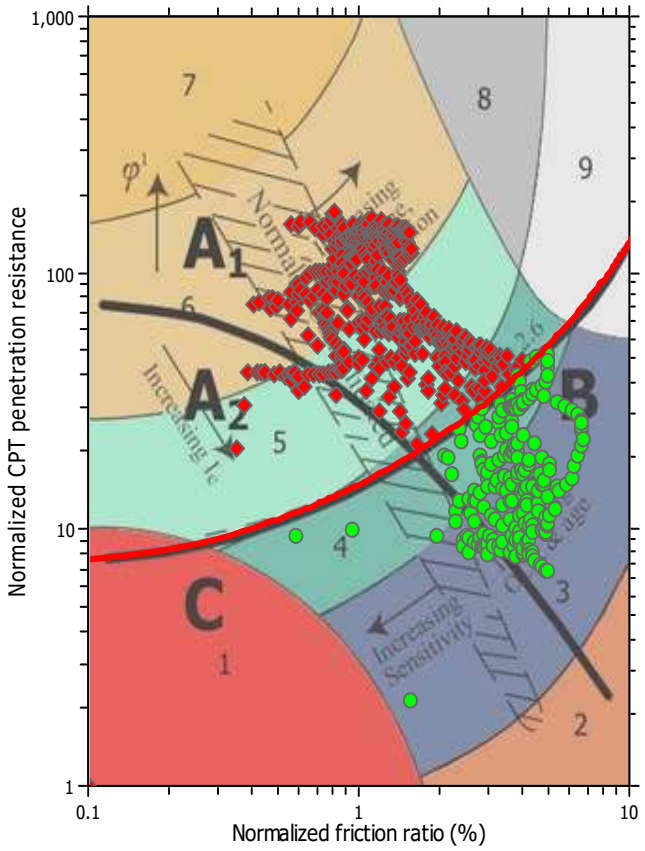
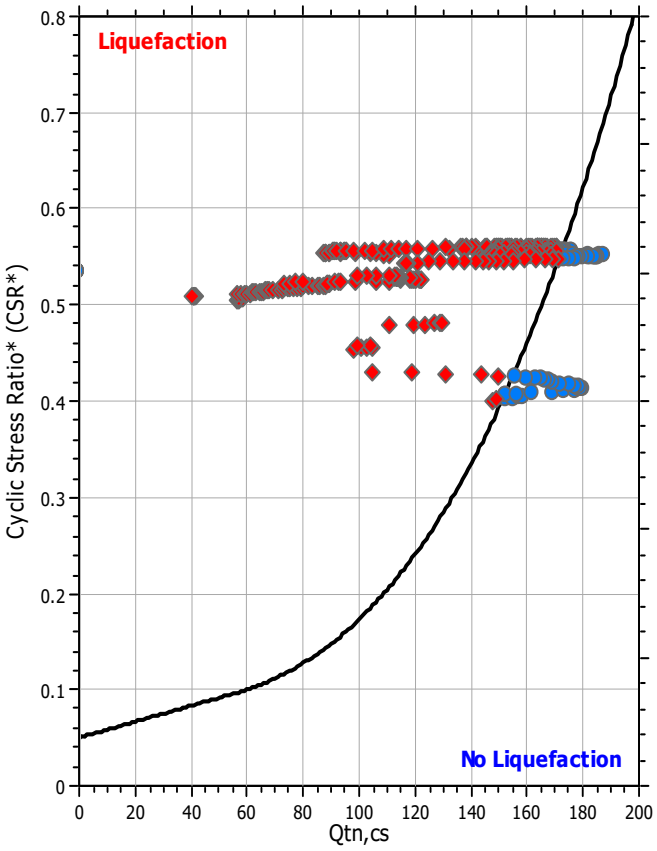
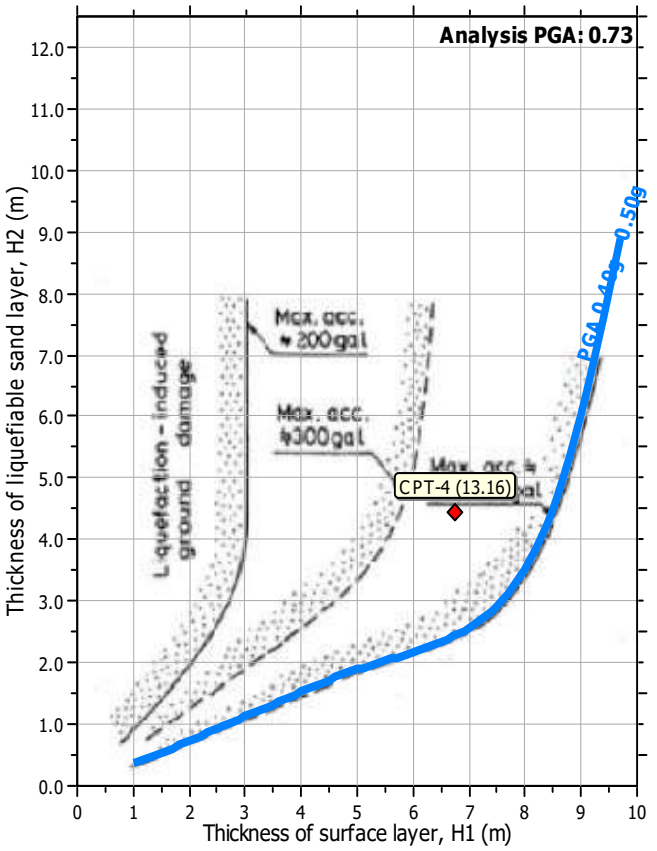
Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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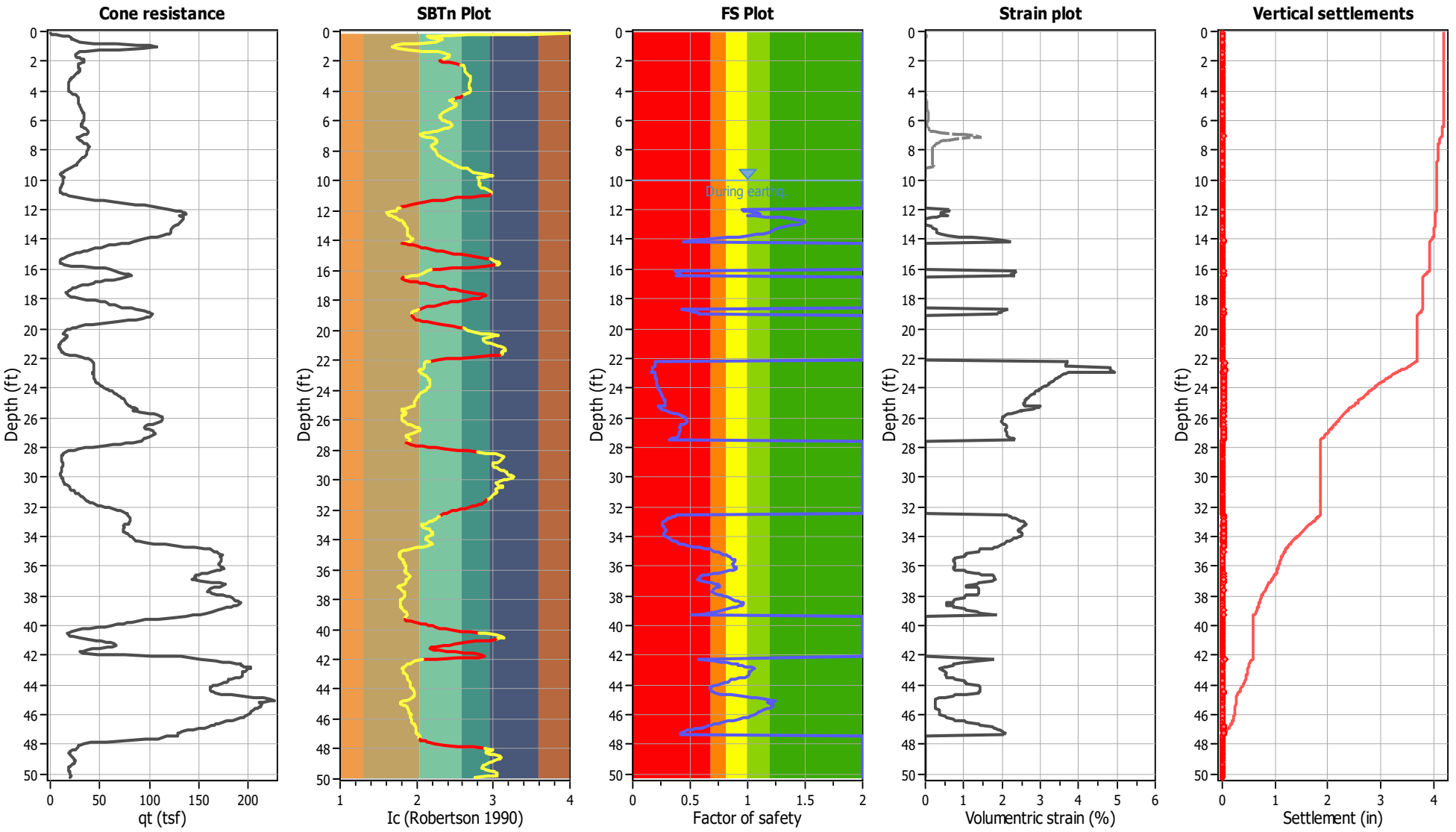
Estimation of post-earthquake settlements



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Volumentric strain:	Post-liquefaction volumentric strain

formerly Albus-Keefe & Associates, Inc.

May 5, 2022
J.N.: 3027.00

Mr. Mitchell Gardner
G3 Urban
15235 S. Western Avenue
Gardena, California 90249

Subject: **Preliminary Geotechnical Investigation for Proposed Water Quality Improvements, Proposed Industrial Development, 11709 Artesia Blvd., Artesia, California**

Dear Mr. Gardner,

Albus & Associates, Inc. has completed a preliminary geotechnical investigation of the site for evaluation of the percolation characteristics of the site soils. The scope of this investigation consisted of the following:

- Exploratory drilling and soil sampling
- Laboratory testing of selected soil samples
- Engineering analysis of the data
- Preparation of this report

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Site Location and Description

The site is located at the address of 11709 Artesia Boulevard within the city of Artesia, California. The site is bordered by Artesia Boulevard to the south, Fallon Avenue to the west, Alburtis Avenue to the east, and a commercial building and surface parking lots to the north. The location of the site and its relationship to the surrounding areas are shown in Figure 1, Site Location Map.

The site consists of approximately 3.33 acres of land with several industrial buildings, above-ground tanks, processing equipment, and above-ground piping. The remainder of the site consists of asphalt- and concrete-covered paving.

N

FIGURE 1-SITE LOCATION MAP

Proposed Industrial Development
11709 Artesia Boulevard,
Artesia, California

NOT TO SCALE

Proposed Development

Based on the project brochure prepared by Colliers, we understand that the proposed development will likely consist of one or two new industrial buildings at-grade parking as well as associated interior driveways, parking, underground utilities, and decorative hardscape and landscape areas.

No grading or structural plans were available in preparing this report. However, we anticipate that minor rough grading of the site will be required to achieve future surface configuration. Structural loads are anticipated to typically consist of 250 kips for columns and 6 kips/ft for walls.

SUMMARY OF FIELD AND LABORATORY WORK

Subsurface Investigation

Subsurface exploration for this investigation was conducted on November 2, 2021 and consisted of drilling three (3) soil borings to depths ranging from approximately 11.5 to 51.5 feet below the existing ground surface (bgs) and advancing four (4) Cone Penetration Test (CPT) soundings to a depth of 50 feet bgs. The borings were drilled using a truck-mounted, continuous flight, hollow-stem-auger drill rig. A representative of Albus & Associates, Inc. logged the exploratory borings. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented in the Exploration Logs in Appendix A. The CPT soundings were advanced using a 30-ton CPT truck. As the cone is advanced through the soil, direct measurements are obtained and recorded for tip resistance, side resistance and porewater measurements. The relationship between the tip resistance and the side resistance allows a determination of the general soil type. Following completion of the CPT soundings, a log is generated that provides a continuous profile of the tip resistance, side resistance and porewater measurements. The approximate locations of the exploratory excavations and CPT soundings completed by this firm are shown on the enclosed Geotechnical Map, Plate 1.

Bulk, relatively undisturbed, and Standard Penetration Test (SPT) samples were obtained at selected depths within the exploratory borings for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with brass rings. SPT samples were obtained from the boring using a standard, unlined SPT soil sampler. During each sampling interval, the sampler was driven 18 inches with successive drops of a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the sampler was recorded for each six inches of advancement. The total blow count for the lower 12 inches of advancement per soil sample is recorded on the exploration log. Samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses. The borings were backfilled with bentonite and capped with concrete.

Laboratory Testing

Selected soil samples of representative earth materials were tested to assist in the formulation of conclusions presented in this report. Tests consisted of in-situ moisture contents and dry densities. Results of laboratory testing relevant to percolation characteristics are presented on the Exploration Logs in Appendix A.

ANALYSIS OF DATA

Subsurface Conditions

Descriptions of the earth materials encountered during our investigation are summarized below and are presented in detail on the Exploration Logs presented in Appendix A.

Soil materials encountered at the subject site consisted of approximately 2 feet of artificial fill over alluvial soils. The artificial fill is predominately comprised of interlayered grayish brown sandy silt and silty sand. These fill materials typically were observed to be damp to moist and medium dense.

Underlying the artificial fills are native soils consisting of young alluvial fan deposits (Qyf_a). The alluvial fan deposit materials were encountered to the maximum depth explored of 51.5 feet and are comprised of grayish brown to light gray, interlayered silty sand and sand that are damp to wet and loose to very dense. Occasional lenses and layers of sandy silt are also present that are generally very moist to wet and firm to very stiff.

Groundwater

Groundwater was encountered during this firm's subsurface exploration at a depth of 14 feet. The CDMG Special Report 019 suggests that historic high groundwater for the subject site is less than 10 feet below the ground surface.

CONCLUSIONS

Results of our work indicate a storm water disposal system is **not** feasible at the site. As discussed above, the historic groundwater level in this area is approximately 10 feet. Additionally, during our site investigation, groundwater was encountered at a depth of 14 feet below ground surface. In accordance with the County of Los Angeles GS200.1 guidelines, the invert of the stormwater infiltration shall be at least 10 feet above the design groundwater elevation. Additionally, the upper 6 feet of materials encountered at the site included artificial fills and inter-layers of fine-grained alluvium. Such materials would create geotechnical hazards such as ponding under foundations. It would also introduce water to subsurface soils that are potentially susceptible to liquefaction. As such, the site is **not** feasible for infiltration.

LIMITATIONS

This report is based on the geotechnical data as described herein. The materials encountered in our boring excavations and utilized in our laboratory testing for this investigation are believed representative of the project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil and bedrock materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observations by a geotechnical consultant during the construction phase of the storm water infiltration systems are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

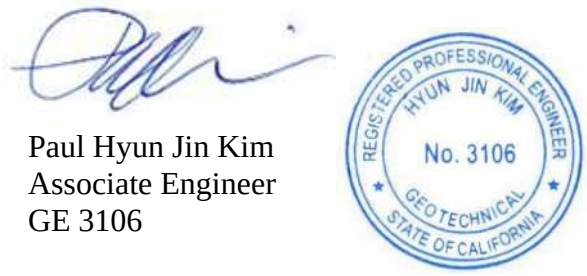
This report has been prepared for the exclusive use of **G3 Urban** to assist the project consultants in the design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

This report is subject to review by the controlling governmental agency.

We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS & ASSOCIATES, INC



Paul Hyun Jin Kim
Associate Engineer
GE 3106

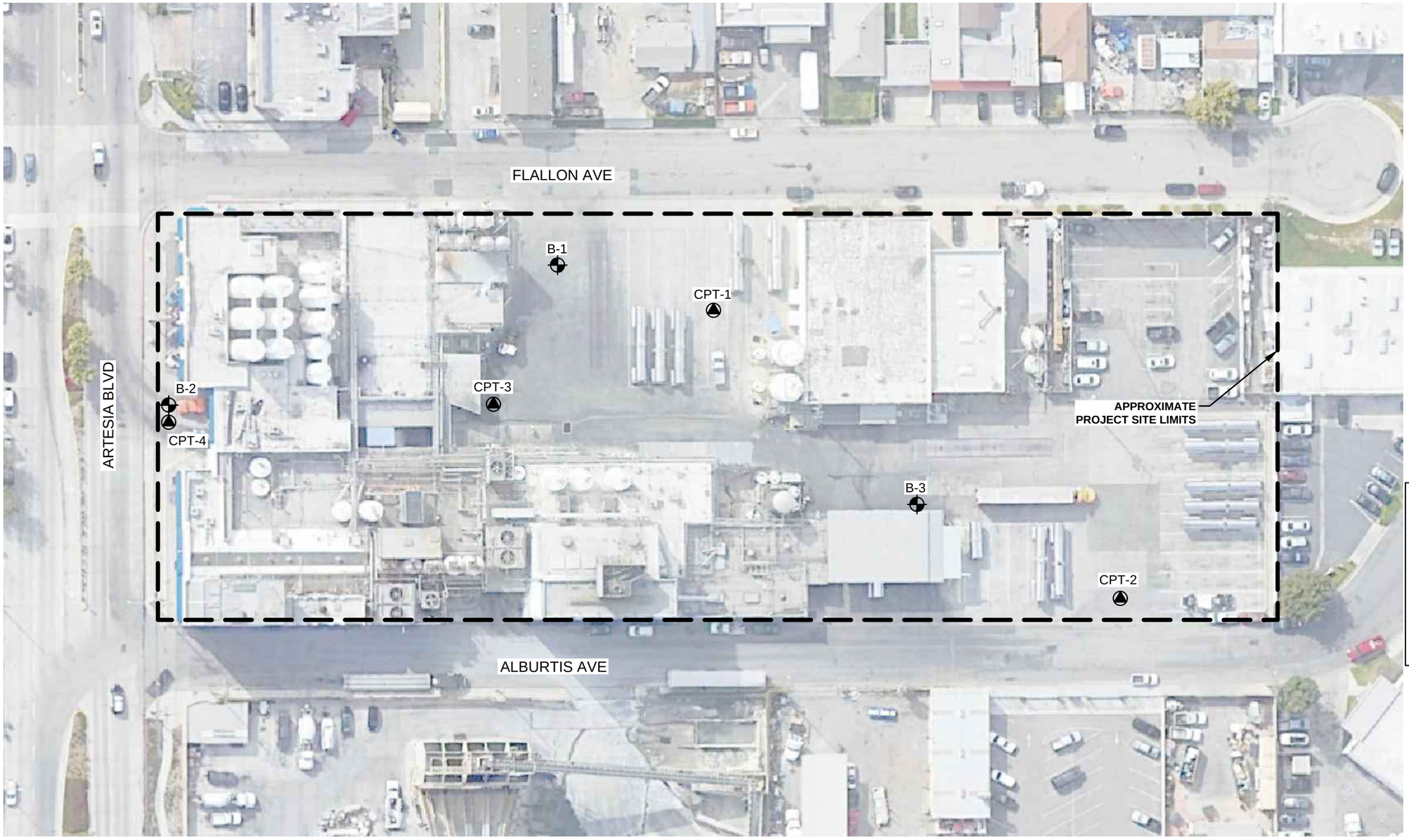
Enclosures: Plate 1- Geotechnical Map
Appendix A - Exploratory Logs

REFERENCES

Publications and Reports

California Department of Conservation, Division of Mines and Geology, Seismic Hazard Report 029, "Seismic Hazard Zone Report for the Los Angeles 7.5-Minute Quadrangle, Los Angeles County, California", 1998.

Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration, by County of Los Angeles, Department of Public Works, Geotechnical and Materials Engineering Division (GS200.1), dated 6/30/2021.



0 30 60 120

APPROX SCALE : 1" = 60'

EXPLANATION

(Locations Approximate)

- Exploratory Boring
- CPT

Google 2021

ALBUS ASSOCIATES

GEOTECHNICAL MAP

Job No.: 3027.00	Date: XX/XX/2021	Plate: 1

APPENDIX A

EXPLORATORY LOGS

Field Identification Sheet

Light gray

Gray

Dark gray

Gray Brown

Light brown

Brown

Dark Brown

Olive brown

Olive

Yellow

Yellowish brown

Yellowish red

Red

Reddish Brown

Tan

Description Order:

Description, Color, Moisture, Density, Grain Size, Additional Description

Description	%	Example
	0-5	Sand
trace	5-15	Sand trace Silt
with	15-30	Sand with Silt
	30+	Silty Sand

More Examples

Sand with Silt trace Clay

Sand trace Silt and Clay

Sand with Silt and Clay

Gravelly Sand with Silt trace Clay

Silty Clay with Sand trace Gravel

Moisture

Dry	absence of water
Damp	below optimum
Moist	near optimum
Very Moist	above optimum
Wet	free water visible

Density (Navfac)

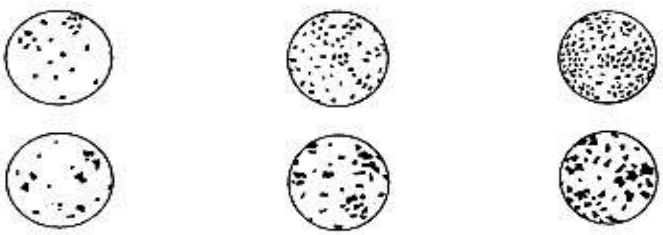
Coarse grained soils	SPT	CA
Very Loose	0-3	0-5
Loose	3-8	5-13
Medium Dense	8-14	13-22
Dense	14-25	22-40
Very Dense	25>	40>
Fine grained soils		
Very Soft	2<	0-3
Soft	2-4	3-6
Medium Stiff	4-8	6-13
Stiff	8-15	13-24
Very Stiff	15-30	24-48
Hard	30>	48>

Grain Size

Description		Sieve Size	Approx. Size
Boulders		>12"	Larger than basketball
Cobbles		3-12"	Fist to basketball
Gravel	coarse	3/4-3"	Thumb to Fist
	fine	#4-3/4"	Pea to Thumb
Sand	coarse	#10-4	Rock Salt to Pea
	medium	#40-10	Sugar to Rock Salt
	fine	#200-40	Flour to Sugar
Fines		Pass #200	Smaller than Flour

Additional Description (ie. roots, pinhole pores, debris, etc.)

Trace 5% Moderate 15% Abundant 30%



EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		EXPLANATION							
		Solid lines separate geologic units and/or material types.							
		Dashed lines indicate unknown depth of geologic unit change or material type change.							
5		**Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).							
		Double triangle in core column represents SPT sampler.							
10		**Vertical Lines** in core column represents Shelby sampler.							
		Solid black rectangle in Bulk column respresents large bag sample.							
		Other Laboratory Tests:							
15		Max = Maximum Dry Density/Optimum Moisture Content							
		EI = Expansion Index							
		SO4 = Soluble Sulfate Content							
		DSR = Direct Shear, Remolded							
		DS = Direct Shear, Undisturbed							
		SA = Sieve Analysis (1" through #200 sieve)							
		Hydro = Particle Size Analysis (SA with Hydrometer)							
20		200 = Percent Passing #200 Sieve							
		Consol = Consolidation							
		SE = Sand Equivalent							
		Rval = R-Value							
		ATT = Atterberg Limits							

EXPLORATION LOG

Project:		Location: B-1
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 54.4
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Concrete							Max EI SO4 DS RVal pH Resist Ch Consol ATT
		ARTIFICIAL FILL (Af) Sandy Silt (ML): Grayish brown, moist, fine grained sand		14	■	■	22.4	100.7	
		ALLUVIUM (Qal) Sandy Silt (ML): Grayish brown, moist, stiff, fine grained sand, moderate pinhole pores		15	■	■	19.1	104.5	
5		@ 4 ft, more fine grained sand present Sand trace Silt (SP): Light gray, moist, loose, fine to medium grained sand		9	■		11.9	100.5	
10		Sandy Silt / Silty Sand (ML/SM): Grayish brown, very moist, stiff / medium dense, fine grained sand	▽	17	■		20.1	99.8	
15		Sand trace Silt (SP): Grayish brown, wet, medium dense, fine to medium grained sand		14	⧗				
20		Sandy Silt (SM): Grayish brown, wet, medium stiff, fine grained sand		4	⧗				200
25		Sand trace Silt (SP): Light gray, wet, medium dense, fine to medium grained sand		16	⧗				
		Total Depth 26.5 feet Groundwater 14 feet Boring backfilled with bentonite and capped with concrete							

EXPLORATION LOG

Project:		Location: B-2
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 53.4
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Concrete							
		ARTIFICIAL FILL (Af)							
		Sandy Silt trace Clay (ML): Grayish brown, damp to moist, fine grained sand		17	■		24.2	97.9	Consol
		ALLUVIUM (Qal)							
		Sandy Silt trace Clay (ML): Grayish brown, damp to moist, medium dense, fine grained sand, trace pinhole pores, decayed rootlets		15	■		19.4	100.5	
5		Silty Sand / Sandy Silt (SM/ML): Grayish brown, moist, medium dense / stiff, fine grained sand		12	■		15.7	90.7	
		Silty Sand (SM): Light grayish brown, very moist, loose, fine grained sand							
10		Sandy Silt trace Clay (ML): Grayish brown, very moist, stiff, fine grained sand		18	■		12.6	98.8	Consol
		Silty Sand (SM): Grayish brown, very moist, medium dense, fine grained sand							
		Sand trace Silt (SP): Grayish brown, very moist, medium dense, fine to medium grained sand	▽						
15		Silty Sand (SM): Grayish brown, wet, medium dense, fine grained sand, significant fines		12	▼				
		@ 16.3 ft, Gray							
20		Silty Sand (SM): Grayish brown, wet, loose, fine grained sand		6	▼				200
25		Sand trace Silt (SP): Light grayish brown, wet, dense, fine to medium grained sand		19	▼				

EXPLORATION LOG

Project:		Location: B-2
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 53.4
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Silty Sand trace Clay (SM): Grayish brown, wet, medium dense, fine grained sand		8					200
35		Sand trace Silt (SP): Grayish brown, wet, dense, fine to medium grained sand		25					
40		Sandy Silt (ML): Gray, wet, very stiff, fine grained sand		13					200
45		Sand (SP): Grayish brown, wet, very dense, fine to medium grained sand		35					
50		Sandy Silt (ML): Grayish brown, wet, very stiff, fine grained sand		11					
		Total Depth 51.5 feet Groundwater 14 feet Boring backfilled with bentonite and capped with concrete							

EXPLORATION LOG

Project:		Location: B-3
Address: 180 Flallon Avenue, Artesia, CA 90701		Elevation: 57
Job Number: 3027.00	Client: G3 Urban	Date: 11/2/2021
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: ddalbus

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		concrete with rebar							
		ARTIFICIAL FILL (Af)							
		Silty Sand / Sandy Silt (SM/ML): Grayish brown, moist, fine grained sand		15	■		20.9	102.9	
		ALLUVIUM (Qal)							
5		Silty Sand / Sandy Silt (SM/ML): Grayish brown, moist, medium dense / stiff, fine grained sand, trace pinhole pores		13	■		19.2	101.8	
		@ 4 ft, loose / stiff		11	■		15.3	97	Consol
		Silty Sand (SM): Grayish brown, moist, loose, fine grained sand							
10		@ 10 ft, very moist, medium dense		17	■		15.4	93.2	
			▽						
15		Sand trace Silt and Clay (SP): Grayish brown, wet, loose, fine grained sand		4	⧗				
		Silty Sand (SM): Gray, wet, loose, fine to medium grained sand							
20		Silty Sand with Clay (SM): Grayish brown, wet, loose, fine grained sand		4	⧗				200
25		Sand (SP): Grayish brown, wet, medium dense, fine to medium grained sand		11	⧗				
		Total Depth 26.5 feet Groundwater 14 feet Boring backfilled with bentonite and capped with concrete							

Albus & Associates, Inc.

Plate A-5

SUMMARY

OF

CONE PENETRATION TEST DATA

Project:

180 Flallon Avenue
Artesia, CA
November 2, 2021

Prepared for:

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Albus & Associates
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www.kehoetesting.com

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1. **INTRODUCTION**
2. **SUMMARY OF FIELD WORK**
3. **FIELD EQUIPMENT & PROCEDURES**
4. **CONE PENETRATION TEST DATA & INTERPRETATION**

APPENDIX

- CPT Plots
- CPT Classification/Soil Behavior Chart
- CPT Data Files (sent via email)

SUMMARY

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the project located at 180 Flallon Avenue in Artesia, California. The work was performed by Kehoe Testing & Engineering (KTE) on November 2, 2021. The scope of work was performed as directed by Albus & Associates personnel.

2. SUMMARY OF FIELD WORK

The fieldwork consisted of performing CPT soundings at four locations to determine the soil lithology. A summary is provided in **TABLE 2.1**.

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	50	
CPT-2	50	
CPT-3	50	
CPT-4	50	

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

The CPT soundings were carried out by **KTE** using an integrated electronic cone system manufactured by Vertek. The CPT soundings were performed in accordance with ASTM standards (D5778). The cone penetrometers were pushed using a 30-ton CPT rig. The cone used during the program was a 15 cm^2 cone with a cone net area ratio of 0.83. The following parameters were recorded at approximately 2.5 cm depth intervals:

- Cone Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed

The above parameters were recorded and viewed in real time using a laptop computer. Data is stored at the KTE office for up to 2 years for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. Monitoring base line readings ensures that the cone electronics are operating properly.

4. CONE PENETRATION TEST DATA & INTERPRETATION

The Cone Penetration Test data is presented in graphical form in the attached Appendix. These plots were generated using the CPeT-IT program. Penetration depths are referenced to ground surface. The soil behavior type on the CPT plots is derived from the attached CPT SBT plot (Robertson, "Interpretation of Cone Penetration Test…", 2009) and presents major soil lithologic changes. The stratigraphic interpretation is based on relationships between cone resistance (qc), sleeve friction (fs), and penetration pore pressure (u). The friction ratio (Rf), which is sleeve friction divided by cone resistance, is a calculated parameter that is used along with cone resistance to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little (or negative) excess pore water pressures.

The CPT data files have also been provided. These files can be imported in CPeT-IT (software by GeoLogismiki) and other programs to calculate various geotechnical parameters.

It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. In these situations, experience, judgement and an assessment of the pore pressure data should be used to infer the soil behavior type.

If you have any questions regarding this information, please do not hesitate to call our office at (714) 901-7270.

Sincerely,

KEHOE TESTING & ENGINEERING

Steven P. Kehoe
President

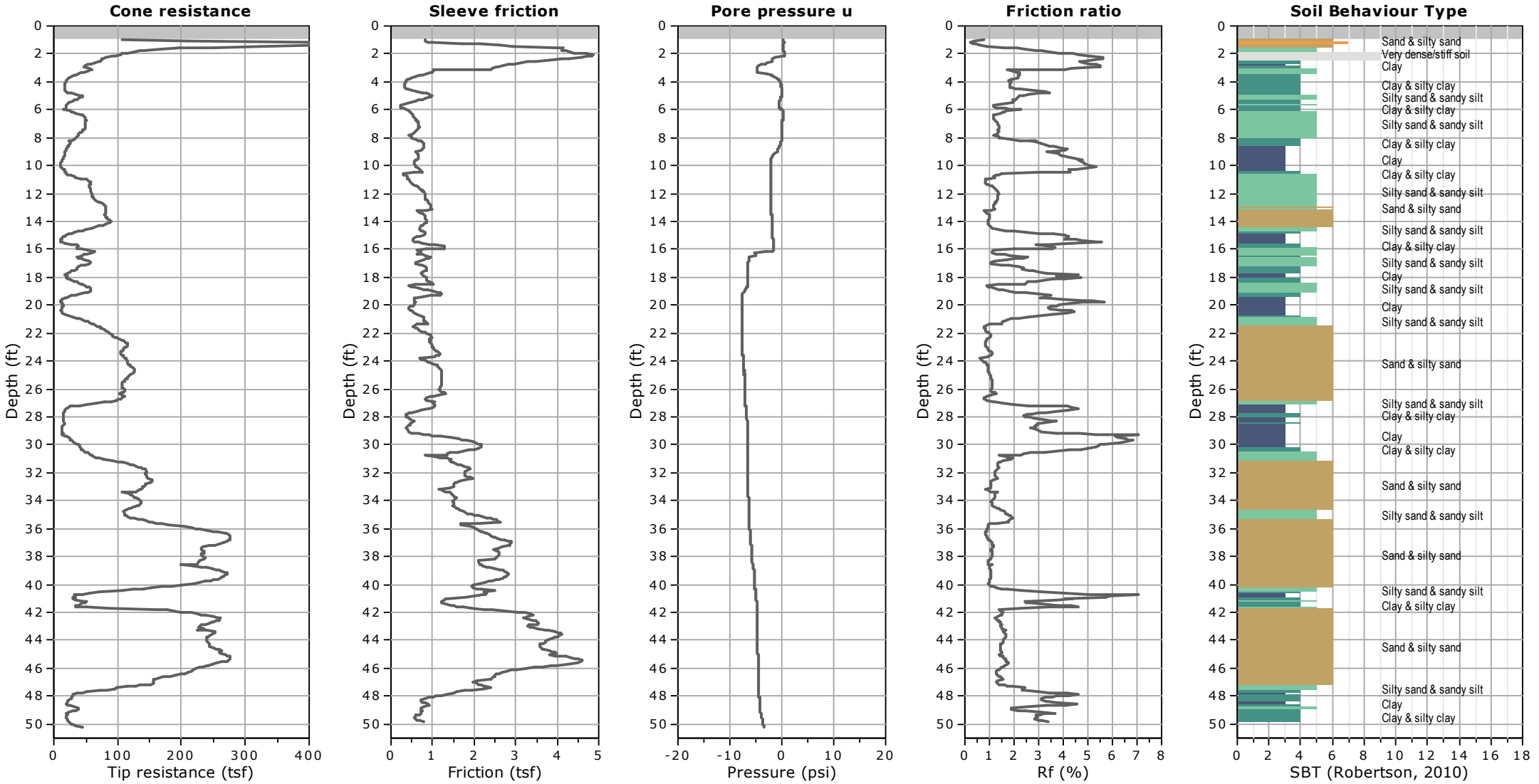
11/04/21-hh-3536

APPENDIX

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-1
Total depth: 50.20 ft, Date: 11/2/2021



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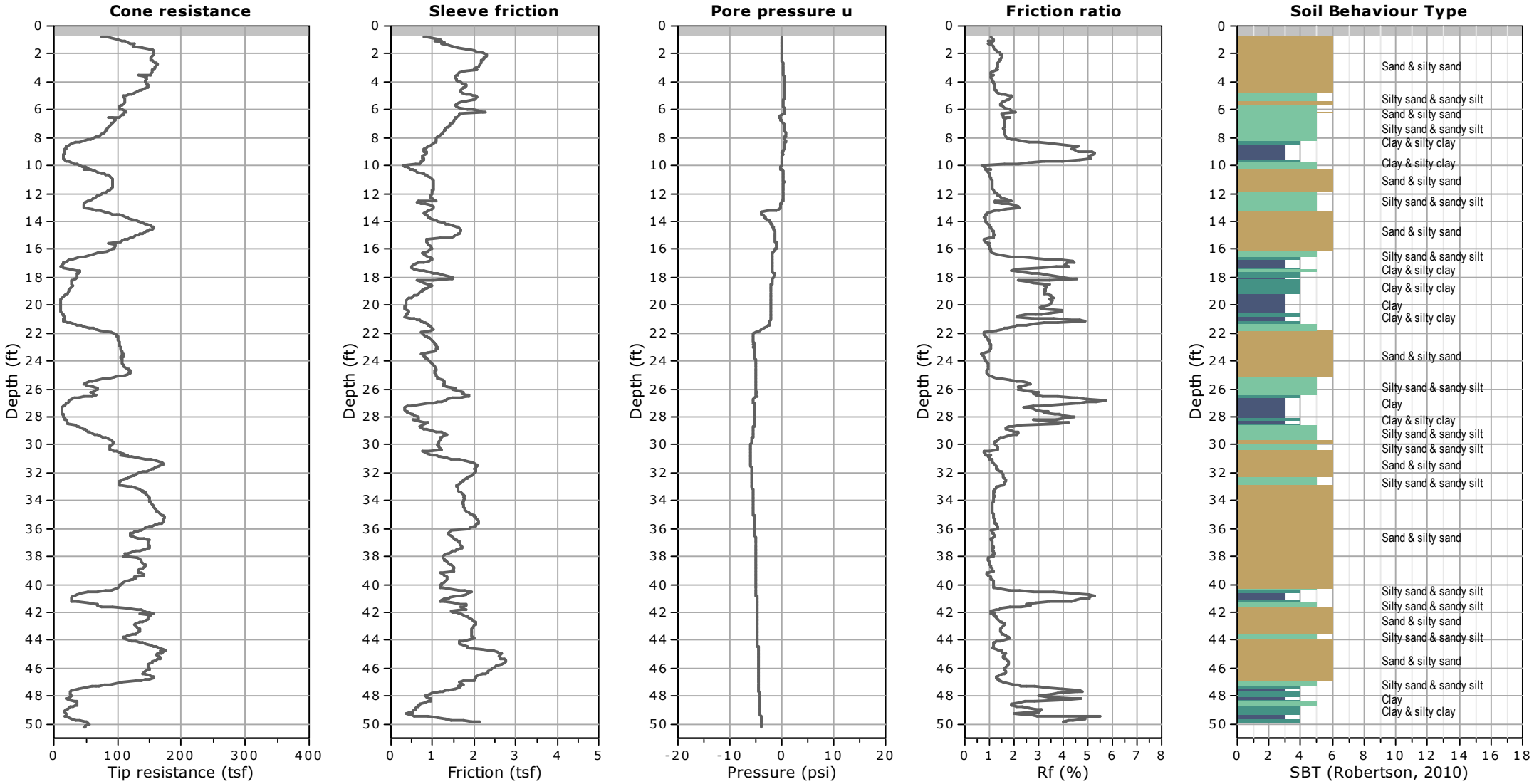
Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-2
Total depth: 50.22 ft, Date: 11/2/2021



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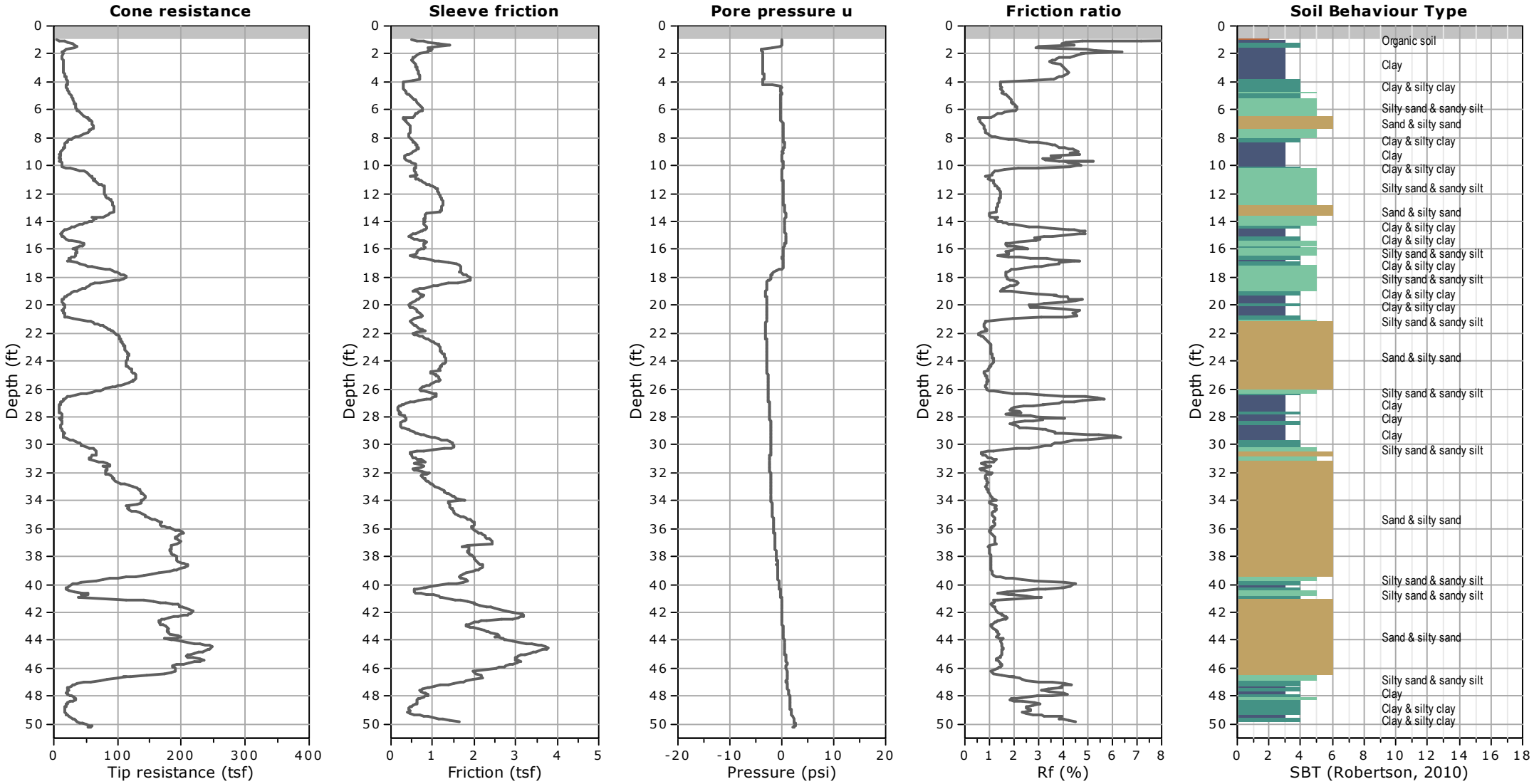
Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-3
Total depth: 50.24 ft, Date: 11/2/2021



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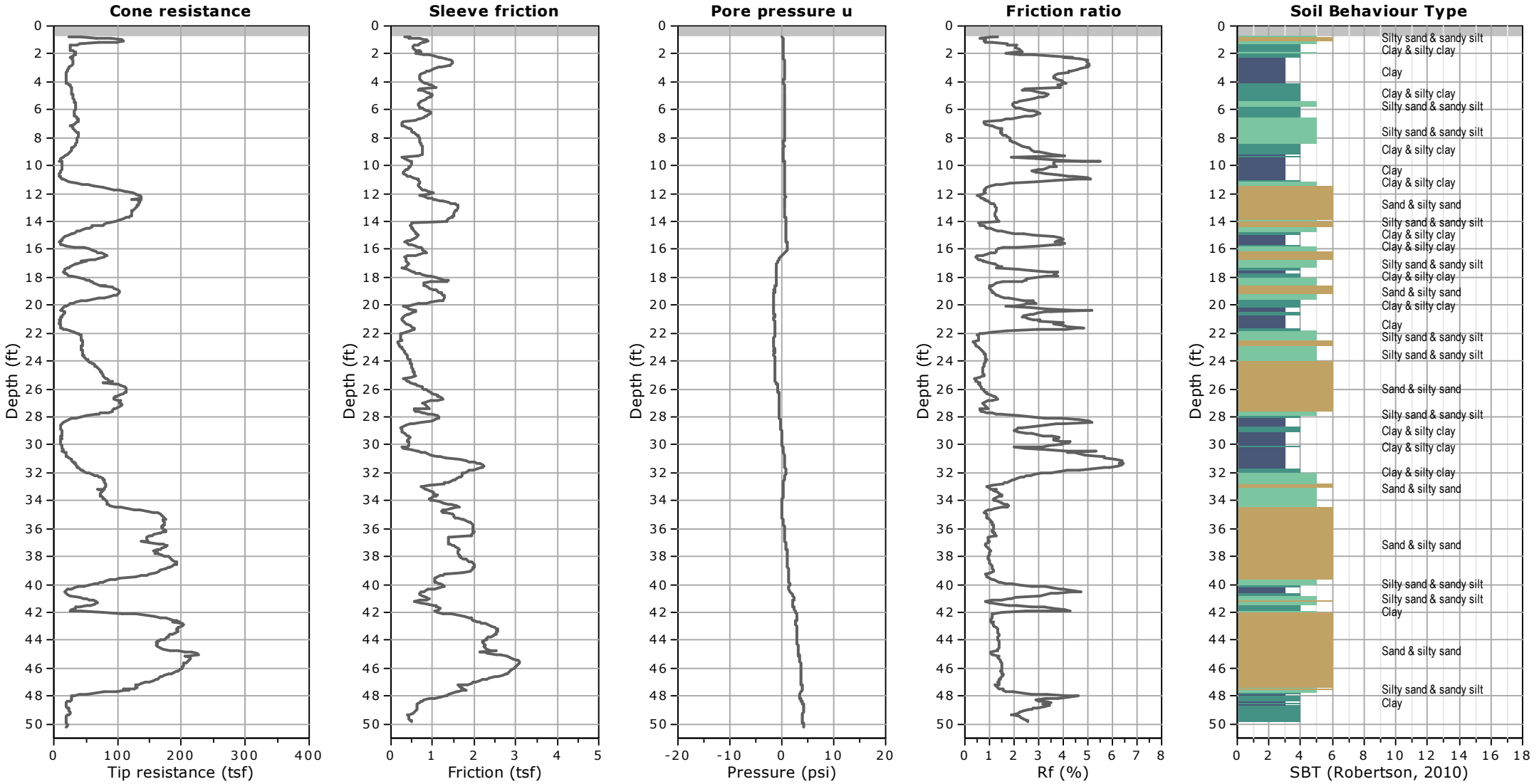
Project: **Albus & Associates**
Location: **180 Flallon Ave, Artesia, CA**

CPT-4
Total depth: 50.22 ft, Date: 11/2/2021



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