Low Impact Development Plan
(LID Plan)

For:

COMMERCIAL CENTER

Project Site Location/Address:

NW Corner of 190TH St. & Western Avenue
Torrance, CA 90501

Prepared for:

Calbay Development, LLC
3770 Highland Avenue, Suite 208
Manhattan Beach, CA 90266
Contact: Ryan Shea
Tel: (310) 545-8360

Prepared by:

DRC Engineering Inc.
160 South Old Springs Road #210
Anaheim Hills, CA 92808
Tel: (714) 685-6860
Contact: Jeptha Brander, P.E.

Prepared: January 27, 2020
Revised October 24, 2020
Updated: September 13, 2021

DRC Project No. 18-935

Project Owner's Certification

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:	Ryan Shea		
Owner's Title:	Developer		
Company:	Calbay Development, LLC.		
Address:	3770 Highland Avenue, Suite 208, Manhattan Beach, CA 90266		
Email:	ryan@calbaycorp.com		
Telephone No:	310-545-8360		
Signature:		Date:	

Preparer (Engineer) Certification

Engineer's Name:	Jeptha Brander		
Engineer's Title:	Project Manager		
Company:	DRC Engineering		
Address:	160 South Old Springs Rd., Anaheim Hills, CA 92808		
Email:	jbrander@drc-eng.com		
Telephone No:	714-685-6860 x376		
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 as amended by State Water Board Order WQ 2015-0075 NPDES Permit NO. CAS004001, of the Los Angeles Regional Water Quality Control Board.			
Engineer's Signature		Date	
Place Stamp Here			

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1. Project Description

1.1. Project Category

Category	YES	NO
1. Development [a] of a new project equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious area [b]	☒	☐
2. Development [a] of a new industrial park with 10,000 square feet or more of surface area [c]	☐	☒
3. Development [a] of a new commercial mall with 10,000 square feet or more surface area [c]	☐	☒
4. Development [a] of a new retail gasoline outlet with 5,000 square feet or more of surface area [c]	☐	☒
5. Development [a] of a new restaurant (SIC 5812) with 5,000 square feet or more of surface area [c]	☒	☐
6. Development [a] of a new parking lot with either 5,000 ft^2 or more of impervious area [b] or with 25 or more parking spaces	☒	☐
7. Development [a] of a new automotive service facility (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) with 5,000 square feet or more of surface area [c]	☐	☒
8. Projects located in or directly adjacent to, or discharging directly to a Significant Ecological Area (SEA),[d] where the development will: a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and b. Create 2,500 square feet or more of impervious area [b]	☐	☒
9. Redevelopment [e] of 5,000 square feet or more in one of the categories listed above **If yes, list redevelopment category here:**	☐	☒
10. Redevelopment [e] of 10,000 square feet or more to a Single Family Home, without a change in land use.	☐	☒

a Development includes any construction or demolition activity, clearing, grading, grubbing, or excavation or any other activity that results in land disturbance.

b Surfaces that do not allow stormwater runoff to percolate into the ground. Typical impervious surfaces include: concrete, asphalt, roofing materials, etc.

c The surface area is the total footprint of an area. Not to include the cumulative area above or below the ground surface.

d An area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and would be disturbed or degraded by human activities and developments. Also, an area designated by the City as approved by the Regional Water Quality Control Board.

e Land-disturbing activities that result in the creation, addition, or replacement of a certain amount of impervious surface area on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain the original line and grade, hydraulic capacity, or original purpose of facility, nor does it include modifications to existing single family structures, or emergency construction activities required to immediately protect public health and safety.

1.2. PROJECT DESCRIPTION

Total Project Area (ft^2): 216,929±

Total Project Area (Ac): 4.98±

EXISTING CONDITIONS

Condition	Area (AC)	Percentage (%)
Pervious Area:	1.85	37.1%
Impervious Area:	3.13	62.9%

PROPOSED CONDITIONS

Condition	Area (AC)	Percentage (%)
Pervious Area:	0.89	17.8%
Impervious Area:	4.09	82.2%

SITE CHARACTERISTICS

DRAINAGE PATTERNS/CONNECTIONS	Existing: The existing site consists of paved and unpaved parking, drive aisles, an abandoned 3,500 square-foot building, and vacant land. The existing site was formerly developed (gas station, restaurant.) In the current partially demolished/vacant condition the site drains to the southeast with stormwater ponding over previous site drainage swales ultimately discharging at the existing driveway on 190th street. This flow is then conveyed via gutter and intercepted by the existing LACFCD catch basin near the intersection of 190th Street and Western Avenue. The runoff from the existing site flows to the Westgard Drain – Unit 2 of the LA County storm drain system which outlets to the concrete-lined Dominguez Channel and continues to the East basin of the Port of Los Angeles and to the Pacific Ocean.
	Proposed: The proposed development will be defined by 10 drainage areas consisting of paved parking, drive aisles, sidewalk, landscaping and 5 proposed commercial buildings distributed across the property. The proposed site will utilize catch basins with filter inserts in conjunction with modular wetland units. The modular wetland units have been sized to provide the required water quality treatment. Runoff from the modular wetland units will connect to proposed underground storm drain pipes and confluence into a proposed pipe connection to the existing Westgard Drain – Unit 2 along 190th Street. As shown in the site hydrology report, the proposed flows do not increase by more than 10% and are within the LACFCD allowable.
NARRATIVE PROJECT DESCRIPTION:	The proposed Commercial Center is comprised of 5 commerical buildings with parking lots, trash enclosures, drive aisles, and landscaping.

OFFSITE RUNON	There is no offsite run-on to the existing site. No change to this condition is anticipated in the proposed condition.
UTILITY AND INFRASTRUCTURE INFORMATION	An existing storm drain (Westgard Drain – Unit 2) owned by the County of Los Angeles flows east along 190th Street to the south of the site and turns north along Western Avenue to the east of the site. An existing 8" public sewer line runs east along 190th Street to the south of the site, turns north along Western Avenue to the east of the site, and ultimately discharges to the City of Torrance sewer system. A private water service is connected at Western Avenue and 2 private water services are connected at 190th Street. Proposed site improvements are to be constructed so as to minimize impact to existing utilities and the proposed development will utilize connections.
SIGNIFICANT ECOLOGICAL AREAS (SEAs)	None noted.

1.3. WATERSHED DESCRIPTION

The proposed project is located in the Dominguez Channel watershed and is conveyed to LA County Flood Control facilities. These facilities eventually discharge to the East Basin of the Port of Los Angeles with the following 303(d) TMDL listings:

Dominguez Channel (lined portion above Vermont Avenue) 303(d) TMDL required for Ammonia, Copper, Diazinon, Indicator Bacteria, Lead, Toxicity, and Zinc

Dominguez Channel (unlined portion below Vermont Avenue) 303(d) TMDL listing adds: Benthic Community Effects, Benzo(a)anthracene, Benzo(a)pyrene (3,4-Benzopyrene-7-d), Chlordane, Chrysene (C1-C4), Coliform Bacteria, DDT (tissue & sediment), Dieldrin (tissue), PCBs (Polychlorinated biphenyls), Phenanthrene, and Pyrene

Lost Angeles Harbor 303(d) TMDL listing adds Methylnaphthalene, Cadmium, Chromium, and Mercury

1.4. PROJECT POLLUTANTS OF CONCERN

Table 7-3 from County of Los Angeles Department of Public Works Standards Manual (Feb. 2014) lists the following as pollutants of concern by commercial land use:

Suspended Solids- Not expected to be generated from operations. Bioclean MWS Unit literature states 85% removal of TSS.

Total Phosphorus- Not expected to be generated from operations. Bioclean MWS Unit literature states 64% removal of total phosphorus.

Total Nitrogen- Nitrogen to be controlled and limited application by landscape professionals. Bioclean MWS Unit literature states 45% removal of nitrogen.

Total Kjeldahl Nitrogen- Not expected to be generated from operations

Total Copper- Not expected to be generated from operations. Bioclean MWS Unit literature states 50% removal of total copper.

Total Lead- Not expected to be generated from operations.

Total Zinc- Not expected to be generated from operations. Bioclean MWS Unit literature states 69% removal of zinc.

Coliform Bacteria Not expected to be generated from operations, incidental sources to be controlled through proper site trash pick-up and site maintenance.

Chloride, Chlorpyrifos, Diazinon, Iron, Toxicity, Ammonia, ChemA, and Toxaphene are not expected to be generated from operations.

1.5. HYDROMODIFICATION ANALYSIS

DOES THE PROPOSED PROJECT FALL INTO ONE OF THE FOLLOWING CATEGORIES? CHECK YES/NO.	YES	NO
1. *Project is a redevelopment that decreases the effective impervious area compared to the pre-project conditions.*	☐	☒
Describe: The existing site is comprised of approximately 63% impervious area. The proposed development will have approximately 82% impervious area.		
2. *Project is a redevelopment that increases the infiltration capacity of pervious areas compared to the pre-project conditions.*	☐	☒
Describe: Per the site geotechnical report, on-site infiltration is below the required 0.3 in/hr.		
3. *Project discharges directly or via a storm drain to a sump, lake, area under tidal influence, into a waterway that has a 100-year peak flow (Q_{100}) of 25,000 cfs or more.*	☒	☐
Describe: Project discharges via storm drain to Dominguez Channel and continues to the East basin of the Port of Los Angeles and to the Pacific Ocean.		
4. *Project discharges directly or via a storm drain into concrete or otherwise engineered (not natural) channels (e.g., channelized or armored with rip rap, shotcrete, etc.), which, in turn, discharge into receiving water that is not susceptible to hydromodification impacts.*	☒	☐
Describe: Project flows to the concrete-lined Dominguez Channel and continues to the East basin of the Port of Los Angeles and to the Pacific Ocean.		

HYDROMODIFICATION ANALYSIS

Project is exempt from Hydromodification Control Measures.

1.6. PROPERTY OWNERSHIP/MANAGEMENT

Property is owned by T.I. Commerce Center, LLC, a Delaware Limited Liability Company

2. BEST MANAGEMENT PRACTICES (BMPs)

2.1. SITE DESIGN

85TH PERCENTILE, 24-HOUR STORM DEPTH	0.9 inches per LA County Hydrology Map. see attachment A
SITE DESIGN	The proposed site consists of 5 proposed buildings, parking, drive aisles, sidewalk and landscape. Site and roof runoff will be conveyed via sheet and gutter flow to catch basins then to modular wetland system (MWS) units. The MWS units will provide treatment for run-off prior to these flows entering an on-site underground storm drain system. The MWS units have been sized to treat 1.5 times the required flow rate as on-site infiltration is not feasible. See table below for sizing information. Runoff flows in excess of the SWQDv will bypass the catch basins/MWS units to the on-site underground storm drain system.

BMP LIST

DMA	Tributary Area (sf)	Tributary Area (Ac)	Storm Water Quality Design Volume (SWQDv) (CF)	LID 85th Percentile Storm Flowrate (SWQDq) (CFS)	Design Flowrate (1.5 * SWQDq) (CFS)	BMP Type	Treatment Flow Provided (CFS)
1	20,223	0.464	986	0.090	0.134	MWS-L-4-13-V	0.144
2	19,342	0.444	1214	0.120	0.180	MWS-L-8-8-V	0.23
3	27,801	0.638	1566	0.146	0.219	MWS-L-4-19-V	0.237
4	26,337	0.605	1466	0.141	0.212	MWS-L-8-8-V	0.23
5	39,779	0.913	2189	0.225	0.338	MWS-L-8-12-V	0.35
6	15,215	0.349	801	0.080	0.120	MWS-L-4-13-V	0.144
7	13,914	0.319	896	0.103	0.154	MWS-L-4-15-V	0.175
8	15,768	0.362	923	0.084	0.126	MWS-L-6-8-V	0.147
9	22,727	0.522	1265	0.130	0.195	MWS-L-8-8-V	0.23
10	15,840	0.364	801	0.080	0.120	MWS-L-6-8-C	0.147

***NOTE** Areas may not sum up exactly due to rounding.

2.2. BMP Selection

2.2.1. Infiltration BMPs

Name	Included
Bioretention without underdrains	☐
Infiltration Trench	☐
Infiltration Basin	☐
Drywell	☐
Proprietary Subsurface Infiltration Gallery	☐
Permeable Pavement (concrete, asphalt, pavers)	☐
Other:	☐

Description	Infiltration rates for the site were determined to be less than the minimum 0.3 in/hr required for infiltration feasibility per the LA County LID Manual (See attachment B for percolation test results). We are proposing on-site flow-based alternative compliance using proprietary modular wetland untis for biofiltration.
Calculations	Not applicable

2.2.2. Rainwater Harvest and Use BMPs

Name	Included
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Description	Not used
Calculations	Not Applicable

2.2.3. ALTERNATIVE COMPLIANCE BMPS

BIOFILTRATION BMPS

(If Infiltration BMPs and Rainwater Harvest and Use BMPs are Infeasible)

NAME	INCLUDED
Bioretention with underdrains (i.e. planter box, rain garden, etc.)	☐
Constructed Wetland	☐
Vegetated Swale	☐
Vegetated Filter Strip	☐
Tree-Well Filter	☐
Other: Proprietary Biotreatment System (MWS)	☒
Other:	☐

DESCRIPTION	The modular wetlands vault type unit incorporates a pre-treatment chamber that includes separation and pre-filter cartridges. Sediments and hydrocarbons are removed from the runoff before entering biofiltration. Biofiltration media contains no organics and removes phosphorus. Pollutant removal is as follows: TSS-85%, Total Phosphorus-64%, Ortho Phosphorus-67%, Nitrogen-45%, Dissolved Zinc-66%, Dissolved Copper-38%, Total Zinc-69%, Total Copper-50% & Motor Oil-95%).
CALCULATIONS	Site will not retain on-site for infiltration, therefore the required design flow-rate is 1.5 * Storm water quality design flow (SWQDQ) resulting from the 85th percentile design storm. See BMP sizing calculation tables in Section 2.1 and LID Site Plan in Appendix A.

OFFSITE BMPS

(If Infiltration BMPs, Rainwater Harvest and Use BMPs, and Biofiltration BMPs are Infeasible)

NAME	INCLUDED
Offsite Infiltration	☐
Ground Water Replenishment Projects	☐
Offsite Project - Retrofit Existing Development	☐
Regional Storm Water Mitigation Program	☐
Other:	☐
Other:	☐

DESCRIPTION	Not used
CALCULATIONS	Not Applicable

2.2.4. TREATMENT CONTROL BMPS

NAME	INCLUDED
Media Filter	☐
Filter Insert	☐
CDS Unit	☐
Other: Vegetative Swale	☐
Other:	☐

DESCRIPTION	Not Applicable.

2.2.5. Hydromodification Control BMPs

Name	Included
Infiltration System	☐
Above-ground Cistern	☐
Above-ground Basin	☐
Underground Detention	☐
Other:	☐
Other:	☐

Description	The site is not susceptible to hydromodification.
Calculations	Not Applicable

2.2.6. NON-STRUCTURAL SOURCE CONTROL BMPS

Name	Included		If not applicable, state brief reason
	Yes	No	
Non-Stormwater Discharges	X		
Spill Prevention, Control and Cleanup	X		
Vehicle and Equipment Fueling		X	No vehicle or equipment fueling is proposed on site
Vehicle and Equipment Cleaning		X	No vehicle or equipment cleaning is proposed on site
Vehicle and Equipment Repair		X	No vehicle or equipment repair is proposed on site
Outdoor Loading/Unloading	X		
Outdoor Liquid Container Storage		X	No outdoor liquid container storage is proposed
Outdoor Equipment Operations		X	No outdoor equipment operation is proposed
Outdoor Storage of Raw Materials		X	No outdoor storage of raw materials is proposed
Waste Handling and Disposal	X		
Safer Alternative Products	X		
Contaminated or Erodible Areas		X	No contaminated or erodible area on site
Building & Grounds Maintenance	X		
Building Repair and Construction	X		
Parking/Storage Area Maintenance	X		
Drainage System Maintenance	X		

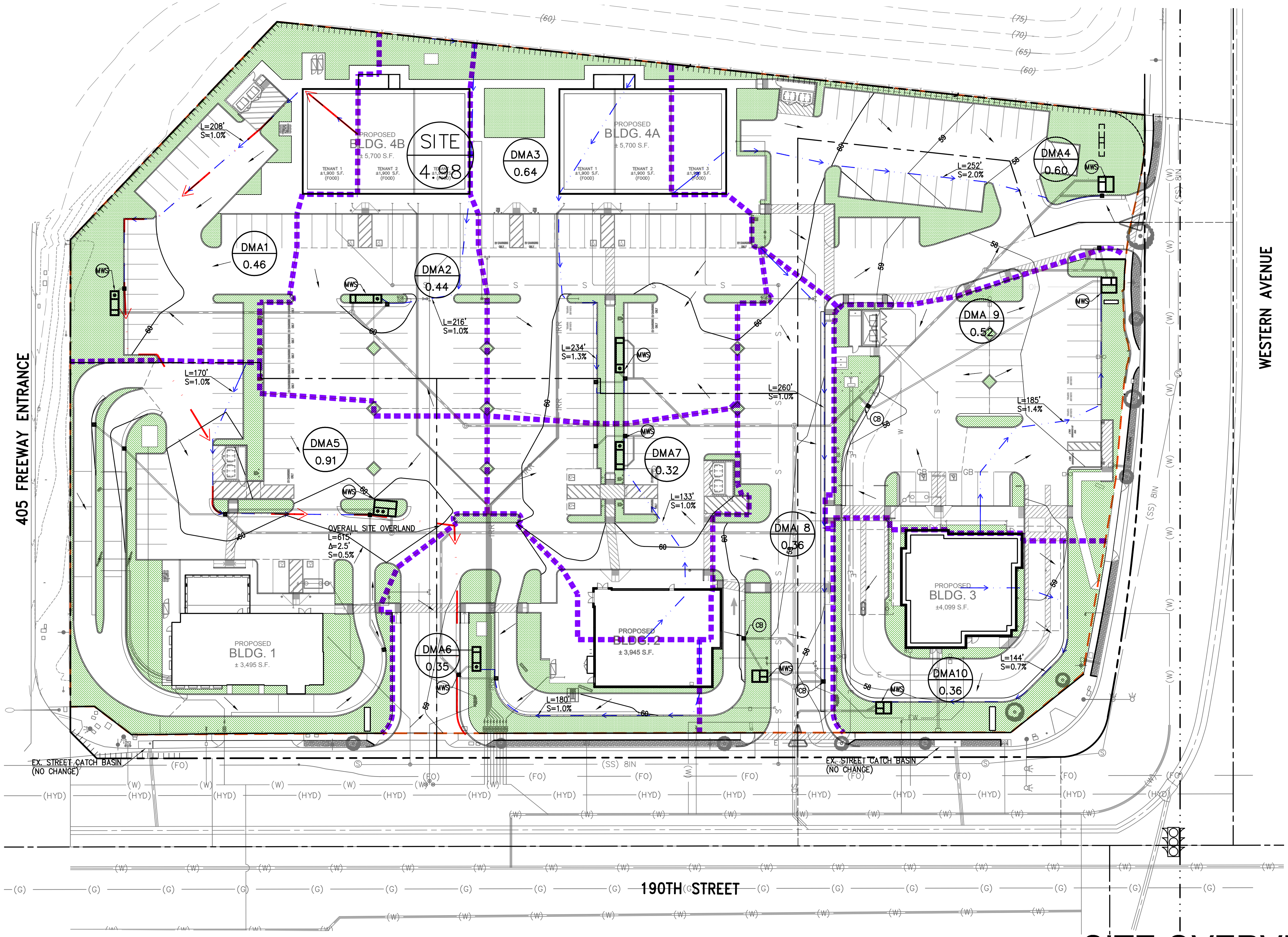
2.2.7. STRUCTURAL SOURCE CONTROL BMPS

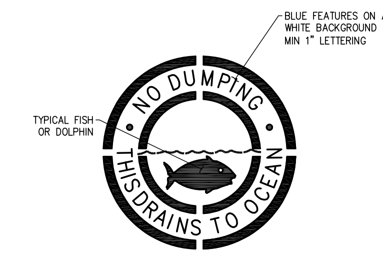
Routine Structural BMPs

BMP	Name	Included?		If not applicable, state brief reason
		Yes	No	
SD-10	Site Design and Landscape Planning	X		
SD-11	Roof Runoff Controls		X	Storm water will discharge to curb face and be treated by MWS units
SD-12	Efficient Irrigation	X		
SD-13	Storm Drain Signage	X		
SD-20	Pervious Pavements		X	No on-site infiltration system
SD-30	Fueling Areas		X	No fueling areas onsite.
SD-31	Maintenance Bays and Docks		X	Not proposed
SD-32	Trash Enclosures	X		
SD-34	Outdoor Material Storage Areas		X	Outdoor material storage areas are not proposed.
SD-35	Outdoor Work Areas		X	Outdoor work is not expected.
SD-36	Outdoor Processing Areas		X	Outdoor processing is not expected.

Attachment A

Vicinity Map & LID Plan Site Map





NOTE:
- ALL STORM DRAIN INLETS (CATCH BASINS) THAT DISCHARGE INTO AN EXISTING OR PROPOSED STORM DRAIN SHALL BE MARKED (STENCILED OR PLACARD AFFIXED) WITH THE ABOVE NOTATION TO DISCOURAGE ILLEGAL DUMPING OF POLLUTANTS.
- CURB CUTS FOR SITE DRAINAGE SHALL BE STENCILED AT OPENING WITH THE ABOVE MARKING WITH TRAFFIC RATED PAINT
- THE ABOVE MARKING MAY VARY, GC SHOULD CONFIRM ACCEPTABILITY AND/OR USE LOCAL AGENCY PREFERRED NPDES STENCIL.

NPDES STENCIL CB / -
N.T.S.

LID MWS UNIT CHART

DMA	AREA (ACRES)	PERVIOUS (%)	IMPERVIOUS (%)	LID FLOW REQUIRED	1.5 LID FLOW	MODEL	TREATMENT FLOW PROVIDED	NORTHING/ EASTING	
DMA 1	0.46	30.5	69.5	0.090	0.134	MWS-L-4-13-V	0.144		
DMA 2	0.44	7.0	93.0	0.120	0.180	MWS-L-8-8-V	0.230		
DMA 3	0.64	11.1	88.9	0.146	0.22	MWS-L-4-19-V	0.237		
DMA 4	0.60	19.0	81.0	0.141	0.21	MWS-L-8-8-V	0.230		
DMA 5	0.91	20.0	80.0	0.225	0.34	MWS-L-8-12-V	0.346		
DMA 6	0.35	23.9	76.1	0.080	0.12	MWS-L-4-13-V	0.144		
DMA 7	0.32	4.1	95.9	0.103	0.15	MWS-L-4-15-V	0.175		
DMA 8	0.36	14.1	58.9	0.084	0.13	MWS-L-6-8-V	0.147		
DMA 9	0.52	19.0	81.0	0.130	0.20	MWS-L-8-8-V	0.230		
DMA 10	0.36	27.7	72.3	0.080	0.12	MWS-L-6-8-C	0.147		

LEGEND

- DRAINAGE AREA BOUNDARY
- SUBAREA BOUNDARY
- STORM DRAIN LINE
- SITE OVERFLOW PATH
- SUBAREA FLOW PATH
- XX / X.XX — SUBAREA / ACREAGE
- APPROXIMATE OVERLAND FLOW
- MWS — MODULAR WETLAND SYSTEM
- CB — CATCH BASIN

MWS & CATCH BASINS SHALL BE STENCILED WITH APPROVED NPDES MARKING "NO DUMPING DRAINS TO OCEAN"

SITE OVERVIEW

XX / X.XX	4.98 AC	TOTAL SITE AREA	
	4.09 AC	PR. IMPERVIOUS AREA	82.2%
	0.89 AC	PERVIOUS AREA	17.8%

FULL-SIZE PLAN AT END OF REPORT

30' 0' 30' 60' 90'
GRAPHIC SCALE: 1"=30'

DRC Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning
160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860
GREGORY R. COOKE R.C.E. 39478 DATE

NOT FOR CONSTRUCTION

NO.:	REVISION:	DATE:

PROJECT: **W 190TH & WESTERN AVE COMMERCIAL RETAIL CENTER TORRANCE, CA**

DRAWING NAME: **LID SITE PLAN**

ISSUE: EXHIBIT
DATE: 2021/09/20
CHECKED: DRC DRAWN: DRC
DRAWING FILE: .
PROJECT NO.: 18-935
SHEET NUMBER: 4
OF 4 SHEETS
SCALE: AS SHOWN

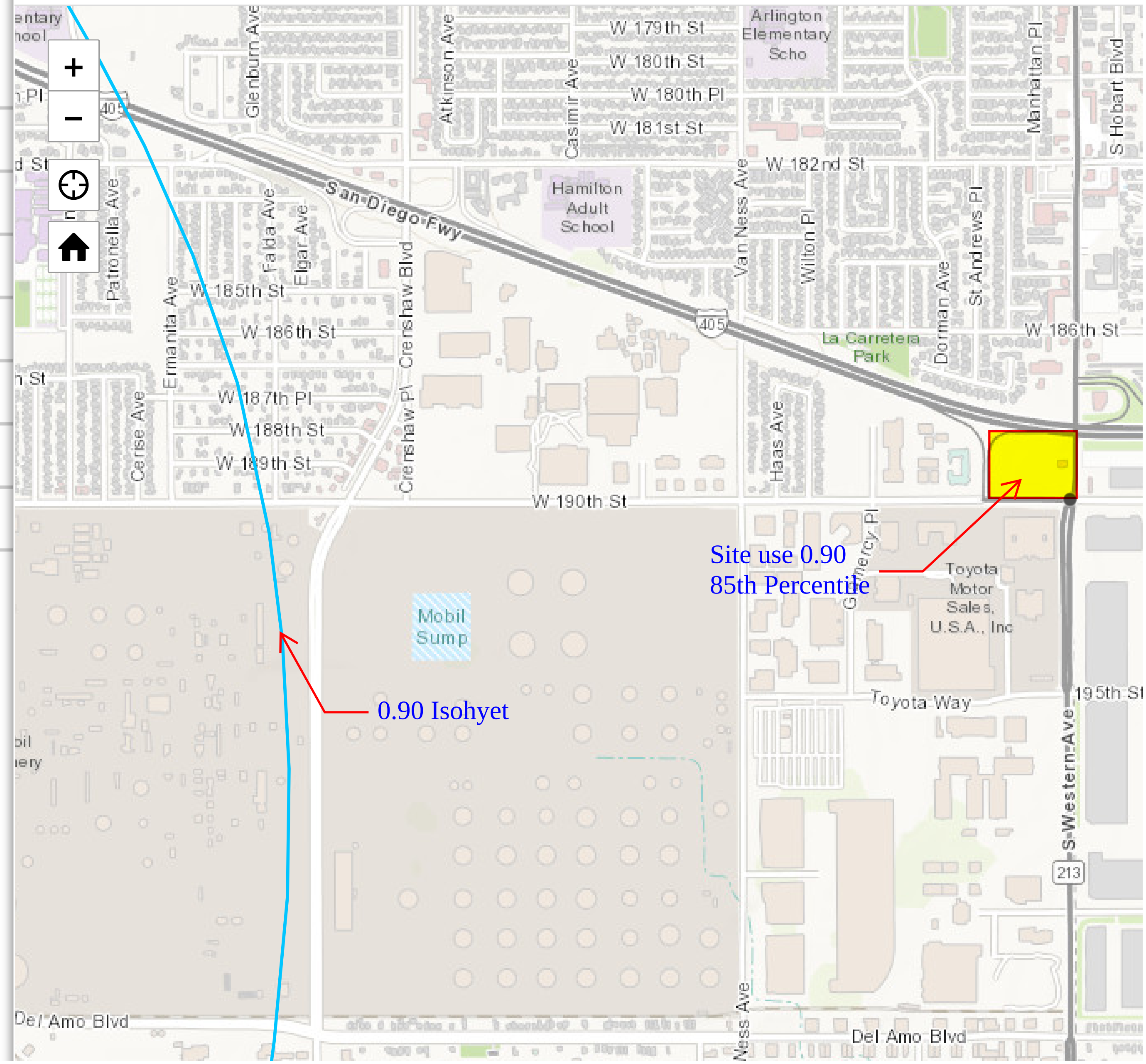
FILENAME: M:\2018\18-935 Calbay Torrance\Reports\LID\18-935 LID101 PR.dwg, LAST SAVED ON: Sep 20 2021 11:34am PLOTTED BY: JAY, ON: Sep 21 2021 11:23am, CFG:

About | Legend | Layers

Layers

- ☐ 50yr Two Tenths (Rainfall)
- ☐ DPA Zones
- ☐ Soils 2004
- ☑ Final 85th Percentile, 24-hr Rainfall
- ☐ Final 95th Percentile, 24-hr Rainfall
- ☐ 1-year, 1-hour Rainfall Intensity
- ☐ LA County Parcel

LA County Hydrology Map



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- ☐ 50yr Two Tenths (Rainfall)
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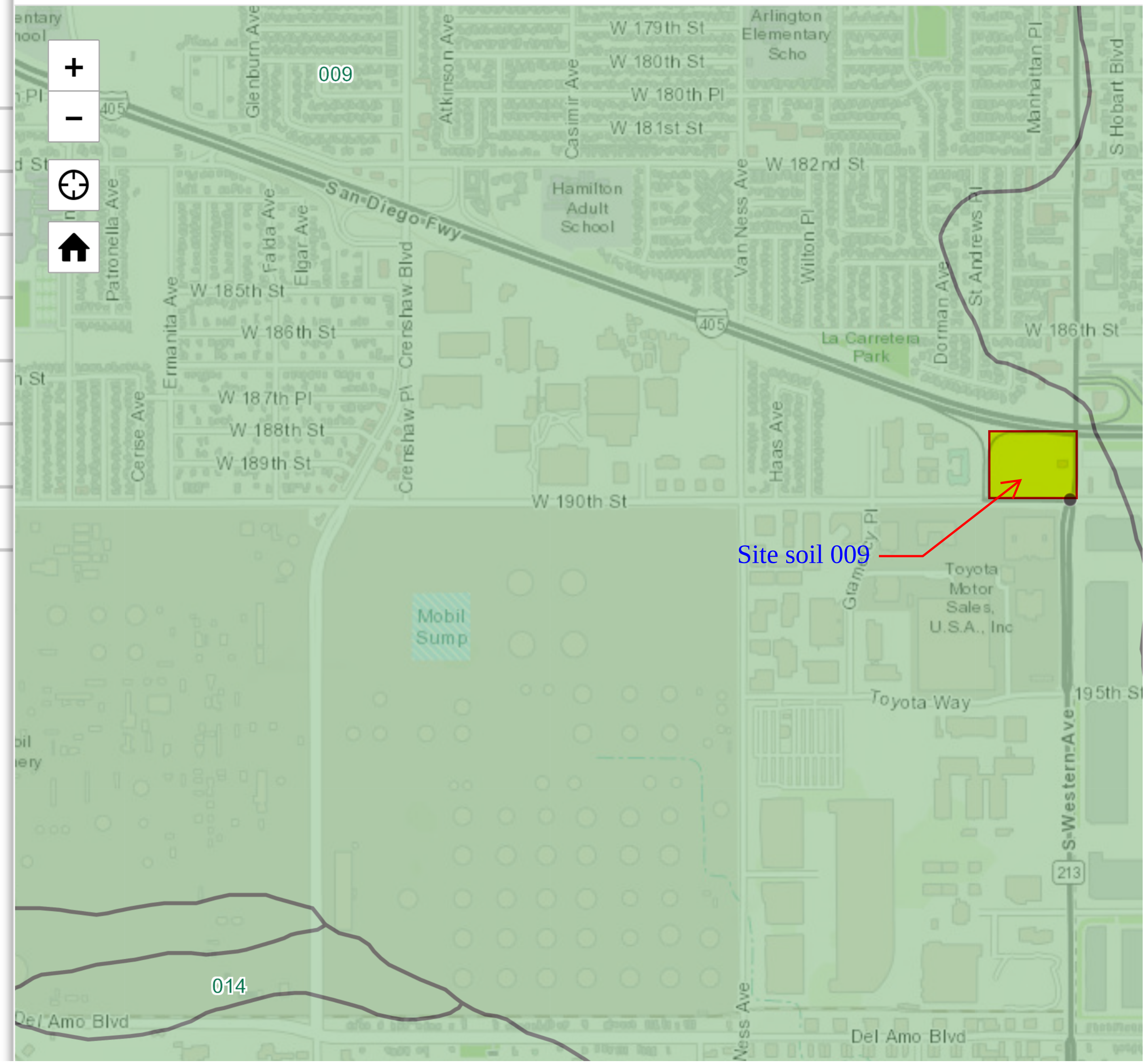
LA County Hydrology Map



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Attachment B

Geotechnical Investigation

GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM

engineering group, inc.

GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED COMMERCIAL CENTER
190TH STREET & WESTERN AVENUE
TORRANCE, CALIFORNIA

SALEM PROJECT NO. 3-219-0913
DECEMBER 27, 2019

PREPARED FOR:

MS. KATIE ROUNDS
KAIDENCE GROUP
5070 N. 40TH STREET, SUITE 210
PHOENIX, AZ 85018

PREPARED BY:

SALEM ENGINEERING GROUP, INC.
8711 MONROE COURT, SUITE A
RANCHO CUCAMONGA, CA 91730
P: (909) 980-6455
F: (909) 980-6435
www.salem.net

8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
Phone (909) 980-6455
Fax (909) 980-6435

December 27, 2019

Project No. 3-219-0913

Ms. Katie Rounds
Kaidence Group
5070 N. 40th Street, Suite 210
Phoenix, AZ 85018

**SUBJECT: GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL CENTER
190TH STREET & WESTERN AVENUE
TORRANCE, CALIFORNIA**

Dear Ms. Rounds:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Geotechnical Engineering Investigation report for the Proposed Commercial Center to be located at the subject site.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Clarence Jiang, GE
Senior Geotechnical Engineer
RGE 2477

R. Sammy Salem, MS, PE, GE
Principal Engineer
RCE 52762 / RGE 2549

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8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
Phone (909) 980-6455
Fax (909) 980-6435

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL CENTER
190TH STREET & WESTERN AVENUE
TORRANCE, CALIFORNIA

1. PURPOSE AND SCOPE

This report presents the results of our Geotechnical Engineering Investigation for the Proposed Commercial Center to be located on the northwest corner of 190th Street and Western Avenue in the City of Torrance, California (see Figure 1, Vicinity Map).

The purpose of our geotechnical engineering investigation was to observe and sample the subsurface conditions encountered at the site, and provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed.

The scope of this investigation included a field exploration, laboratory testing, engineering analysis and the preparation of this report. Our field exploration was performed on December 2 and 3, 2019 and included the drilling of fifteen (15) small-diameter soil borings to a maximum depth of approximately 51½ feet at the site. Additionally, six (6) percolation tests were performed at depths of approximately 5 to 10 feet below existing grade for determination of the infiltration rate. The locations of the soil borings and the percolation tests are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation, exploratory boring logs are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties for engineering analyses. Appendix B presents the laboratory test results in tabular and graphic format.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report. Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

2. PROJECT DESCRIPTION

We understand that the proposed development of the site will include demolition of existing improvements and construction of a commercial center consisting of five (5) restaurant buildings ranging in sizes from 2,200 square feet to 5,700 square feet. The total building area will be 22,768 square feet. Parking and landscaping are planned to be associated with the development. Maximum wall load is expected to be on the order of 5 kips per foot. Maximum column load is expected to be on the order of 100 kips. Floor slab soil bearing pressure is expected to be on the order of 150 psf.

A site grading plan was not available at the time of preparation of this report. As the site area is essentially level, we anticipate that cuts and fills during earthwork will be minimal and limited to providing level positive site drainage. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified. The site configuration and locations of proposed improvements are shown on the Site Plan, Figure 2.

3. SITE LOCATION AND DESCRIPTION

The site is rectangular in shape and encompasses approximately 5.28 acres. The site is located on the northwest corner of 190th Street and Western Boulevard in the City of Torrance, California (see Vicinity Map, Figure 1).

The site was formerly occupied by multiple structures in the central, southwest and southeast areas of the site. The central portion of the site was occupied by a furniture manufacturing building which was removed during the early 2000s. The southwestern portion of the site was occupied by a Unocal retail gas station and automotive service station from the late 1960s until they were demolished in 1996 and 1997. The southeastern portion of the site was occupied an ARCO retail gas station and an automotive service station from 1970 to 1989. Both gas stations were former leaking underground storage tank (LUST) sites that have been closed and identified as an historic recognized environmental condition (HREC). All storage tanks have been removed.

The site is currently occupied by a vacant restaurant building (Mill's) at the eastern central portion of the site with asphalt concrete paving, as well as additional vacant lots. Most of the site is being used as parking for delivery vans and passage vehicles. Weeds have grown between the cracks within the asphalt concrete paving throughout the site.

The site is bounded by I-405 to the north, Western Avenue to the east, 190th Street to the south, and the I-405 eastbound onramp/offramp to the west. The site is relatively flat with an elevation of approximately 60 feet above mean sea level based on Google Earth imagery.

4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-1 through B-15) were drilled on December 2 and 3, 2019 in the area shown on the Site Plan, Figure 2. Our test borings were advanced with an 8-inch diameter hollow stem auger rotated by a truck-mounted Mobile B-61 drill rig to a maximum depth of approximately 51½ feet below existing grade.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer and stratification lines were approximated on the basis of observations made at the time of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2487).

A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A." The logs of the test borings are presented in Appendix "A." The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The locations of the test borings were determined by measuring from features shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted. Soil samples were obtained from the test borings at the depths shown on the logs of borings. The MCS samples were recovered and capped at both ends to preserve the samples at their natural moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content. The borings were backfilled with soil cuttings after completion of the drilling.

5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture and density, shear strength, consolidation potential, expansion potential, maximum density and optimum moisture determination, and gradation of the materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and the results of laboratory test are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

6. GEOLOGIC SETTING

The subject site is located within the southern portions of the Central Basin of the Los Angeles Coastal Plain, within the Peninsular Ranges Geomorphic Province of California. The Los Angeles Coastal Plain is situated between the Santa Monica Mountains to the northwest, the San Gabriel Mountains to the northeast, the Santa Ana Mountains to the east, and the Pacific Ocean to the west and south.

The Los Angeles Basin is dominated by northwest-trending faults and adjacent anticlinal uplifts. The intervening deep synclinal troughs are filled with poorly consolidated Upper Pleistocene and unconsolidated Holocene sediments. Tectonism of the region is dominated by the interaction of the East Pacific Plate and the North American Plate along a transform boundary. Deposits encountered on the subject site during exploratory drilling are discussed in detail in this report.

7. GEOLOGIC HAZARDS

7.1 Faulting and Seismicity

The Peninsular Range has historically been a province of relatively high seismic activity. The nearest faults to the project site are associated with the Newport-Inglewood fault system located approximately 3.1 miles from the site.

There are no known active fault traces in the project vicinity. Based on mapping and historical seismicity, the seismicity of the Peninsular Range has been generally considered high by the scientific community. Soils on site are classified as Site Class D in accordance with Chapter 16 of the California Building Code. The proposed structures are determined to be in Seismic Design Category D.

To determine the distance of known active faults within 100 miles of the site, we used the United States Geological Survey (USGS) web-based application *2008 National Seismic Hazard Maps - Fault Parameters*. Site latitude is 33.8591° North; site longitude is 118.3103° West. The ten closest active faults are summarized below in Table 7.1.

TABLE 7.1
REGIONAL FAULT SUMMARY

Fault Name	Distance to Site (miles)	Maximum Earthquake Magnitude, M_w
Newport Inglewood Connected alt 1	3.1	7.5
Newport Inglewood Connected alt 2	3.4	7.5
Palos Verdes Connected	4.9	7.7
Puente Hills (LA)	9.1	7.0
Puente Hills (Santa Fe Springs)	10.4	6.7
Santa Monica Connected alt 2	14.7	7.4
Elysian Park (Upper)	15.0	6.7
Santa Monica Connected, alt 1	15.2	7.3
Puente Hills (Coyote Hills)	15.5	6.9
Hollywood	16.5	6.7

The faults tabulated above and numerous other faults in the region are sources of potential ground motion. However, earthquakes that might occur on other faults throughout California are also potential generators of significant ground motion and could subject the site to intense ground shaking.

7.2 Surface Fault Rupture

The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards. No active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low.

7.3 Ground Shaking

Based on the CBC, a Site Class D was selected for the site based on soil conditions encountered and our experience in the vicinity of the subject site. Table 9.3.1 includes design seismic coefficients and spectral response parameters, based on the 2016 California Building Code (CBC) for the project foundation design.

Based on the Office of Statewide Health and Planning Development (OSHPD) Seismic Design Maps, the estimated design peak ground acceleration adjusted for site class effects (PGA_M) was determined to be 0.596g (based on both probabilistic and deterministic seismic ground motion).

7.4 Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile. However, liquefaction has occurred in soils other than clean sand.

The soils on the project site consisted predominately of medium dense to dense silty sand and silty, clayey sand; and firm to hard sandy silt, sandy clay, silt, silty clay, clayey silt, and sandy silty clay. Based on regional groundwater data, the historically highest groundwater is at a depth of approximately 75 feet below ground surface. Low to very low cohesion strength is associated with the sandy soil.

A seismic hazard, which could cause damage to the proposed development during seismic shaking, is the post-liquefaction settlement of the liquefied sands. Based on the State of California, Seismic Hazard Zone Map, Torrance Quadrangle, Dated March 25, 1999, the site is **not** located within a liquefaction potential zone. Therefore, liquefaction analysis for the site would not be required.

7.5 Lateral Spreading

Lateral spreading is a phenomenon in which soils move laterally during seismic shaking and is often associated with liquefaction. The amount of movement depends on the soil strength, duration and intensity of seismic shaking, topography, and free face geometry. Due to the relatively flat site topography, we judge the likelihood of lateral spreading to be low.

7.6 Landslides

There are no known landslides at the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a hazard to this project.

7.7 Tsunamis and Seiches

The site is not located within a coastal area. Therefore, tsunamis (seismic sea waves) are not considered a significant hazard at the site. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.

8. SOIL AND GROUNDWATER CONDITIONS

8.1 Subsurface Conditions

The subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the soils within the depth of exploration consisted of medium dense to dense silty sand and silty, clayey sand; and firm to hard sandy silt, sandy clay, silt, silty clay, clayey silt, and sandy silty clay.

According to the Draft Geotechnical Engineering Exploration and Analysis Report, Project No. 2G-1905003, dated July 19, 2019 prepared by Giles Engineering Associates, Inc. (GILES), up to 16 inches of asphalt concrete was encountered where the former ARCO gas station building was located (southeastern portion of site). The existing pavement at our boring locations consisted of 2 to 3 inches of asphaltic concrete (AC) underlain by 3 to 10 inches of aggregate base (AB). Some of the existing pavement is in a poor condition with severe cracking and weed growth.

Based on GILES's report, up to 11 feet of fill soils were encountered within the proposed Chick-fil-A building area (proposed Building 3 area). The fill materials consisted of sandy clay with some gravel and asphalt fragments, and coarse sand.

Our field investigation found up to approximately 9 feet of potential fill soils in borings B-9 and B-10 at the southwestern portion of the site (proposed Building 1 area). This portion of the site was previously occupied by a Unocal gas station with underground storage tanks. Thicker fill soils may be present on site between our boring locations. Verification of the extent of fill should be determined during site grading.

Field and laboratory tests suggest that the deeper native soils are moderately strong and slightly compressible. These soils extended to the termination depth of our borings. The soils were classified in the field during the drilling and sampling operations. The stratification lines were approximated by the field engineer on the basis of observations made at the time of drilling. The actual boundaries between different soil types may be gradual and soil conditions may vary.

For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted. The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The locations of the test borings were determined by measuring from feature shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

8.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free groundwater was not encountered during this investigation. According to the regional groundwater data, the historically highest groundwater is estimated to be at a depth of approximately 75 feet below existing grade.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

8.3 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water.

A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride.

The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be 900 mg/kg. ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 8.3 below.

TABLE 8.3
WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS

Water Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Minimum Concrete Compressive Strength	Cementations Materials Type
0.09*****	Not Severe*	S0	N/A	2,500 psi	No Restriction

*** Since the sulfate content is near 0.1% (moderate exposure severity), it's recommended additional corrosion testing be performed during construction to determine the concrete requirements.**

The water-soluble chloride concentration detected in saturation extract from the soil samples was 233 mg/kg. This level of chloride concentration is considered to be mildly corrosive.

It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed.

8.4 Percolation Testing

Six (6) percolation/infiltration tests (P-1 through P-6) were performed in accordance with the criteria set in the Low Impact Development BMP Guideline of the County of Los Angeles, Department of Public Works.

Results of the falling head tests are presented in the attachments to this report. The approximate locations of the percolation tests are shown on the attached Site Plan, Figure 2. The holes were pre-saturated before percolation testing commenced. Percolation rates were measured by filling the test hole with clean water and measuring the water drops at a certain time interval.

The percolation rate data are presented in tabular format at the end of this Appendix. The difference in the percolation/infiltration rates are reflected by the varied type of soil materials at the bottom of the test hole. The test results are as follows:

Test No.	Depth (feet)	Measured Percolation Rate (inch/hour)	Total Reduction Factor*	Design Infiltration Rate (inch/hour)**	Soil Type
P-1	10	0.11	4.0	**0.028**	Sandy SILT (ML)
P-2	10	0.08	4.0	**0.020**	Sandy SILT (ML)
P-3	10	0.09	4.0	**0.023**	Sandy SILT (ML)
P-4	5	0.05	4.0	**0.013**	Silty Clay (CL)
P-5	10	0.13	4.0	**0.033**	Sandy SILT (ML)
P-6	5	0.05	4.0	**0.013**	Silty Clay (CL)

*** $RF_t = 2$, $RF_v = 1$, $RF_s = 2$, Total Reduction Factor, $RF = RF_t \times RF_v \times RF_s = 4$**
**** Design Infiltration Rate = Measure Percolation Rate/ RF**

Please be advised that when performing percolation testing services in relatively small diameter borings, that the testing may not fully model the actual full scale long term performance of a given site. This is particularly true where percolation test data is to be used in the design of large infiltration system such as may be proposed for the site. The measured percolation rate includes dispersion of the water at the sidewalls of the boring as well as into the underlying soils. Subsurface conditions, including percolation rates, can change over time as fine-grained soils migrate. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

The soil percolation or infiltration rates are based on tests conducted with clear water. The percolation/infiltration rates may vary with time as a result of soil clogging from water impurities. The percolation/infiltration rates will deteriorate over time due to the soil conditions. The soils may also become less permeable to impermeable if the soil is compacted. The percolation/infiltration rate may become slower if the surrounding soil is wet or saturated due to prolonged rainfalls. Thus, periodic maintenance consisting of clearing the bottom of the drainage basin of clogged soils should be expected.

Additional percolation tests should be conducted at bottom of the proposed infiltration system during construction to determine the actual percolation rate. Infiltration system shall be located at minimum distances of 10 feet from any foundations and 10 feet from property lines. Infiltration in compacted fill is not allowed. Provided that the infiltration system is located at a minimum distance of 10 feet away from any foundations, the infiltration would not result in distress to the adjacent buildings.

The scope of our services did not include a groundwater study and was limited to the performance of percolation testing and the submitted of the data only. Our services did not include those associated with an Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring logs regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction of improvements at the site as planned, provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing program, and our understanding of the proposed development at this time.

9.1.2 The primary geotechnical constraints identified in our investigation is the presence of fill soil, undocumented fill soil, potentially compressible (collapsible) material, and expansive material at the site. Recommendations to mitigate the effects of these soils are provided in this report.

9.1.3 The scope of this investigation did not include subsurface exploration within the existing building or areas inaccessible to our drill rig. As such, subsurface soil conditions and materials present below the existing site structures are unknown and may be different than those noted within this report. The presence of potentially unacceptable fill materials, undocumented fill, and/or loose soil material that may be present below existing site features shall be taken into consideration. Our firm shall be present at the time of demolition activities to verify soil conditions are consistent with those identified as part of this investigation.

9.1.4 The site was a leaking underground storage tank (LUST) cleanup site. It is recommended that a Soil Management Plan (SMP) be prepared and distributed to construction personnel. The SMP will establish protocols for handling, sampling, storage, and disposal of any suspected hydrocarbon-affected soils generated during grading and construction activities.

9.1.5 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is suspected that possible demolition activities of the existing structures may disturb the upper soils. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.

9.1.6 Based on GILES's report, up to 11 feet of fill soils were encountered within the proposed Building 1 – Chick-fil-A building area (former ARCO gas station). Based on our exploration, up to 9 feet of potential fill soils were encountered within the proposed Building 1 area (former Unocal gas station). Deeper fill soils may be present on-site between the tests boring locations since the areas were occupied by underground storage tanks (USTs). Undocumented fill materials are not suitable to support any future structures and should be excavated and recompacted in accordance with Section 9.5 of this report. The extent and consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify the fill condition.

9.1.7 The majority of the upper soils within the project site are identified primarily as silty clay. The clayey soils exhibit a moderate swell potential and are subject to volumetric changes if moisture contents vary. The clayey soil, in its present condition, possess hazards to construction in terms of possible post-construction movement of the foundations and floor systems if no mitigation measures are employed. The estimate swell pressures of the clayey material may cause movement affecting slabs and brittle exterior finishes. Accordingly, measures are considered necessary to reduce anticipated soil movement.

9.1.8 To minimize the potential soil movement due to expansive soil conditions, it is recommended that the upper 12 inches of soil beneath the required granular aggregate subbase within slab on grade and exterior flatwork areas be replaced with Non-Expansive Engineered Fill meeting the requirements of Section 9.4. Other than complete soil replacement, mitigation measures will not eliminate post-construction soil movement, but will reduce the soil movement. Success of the mitigation measures will depend on the thoroughness of the contractor and developer in dealing with the soil conditions. In any event, the developer should be aware that some soil movement is to be expected.

9.1.9 As an alternative to the use of non-expansive soils, its' recommended the slab to have a minimum thickness of 5 inches and a minimum concrete compressive strength of 4,500 psi.

9.1.10 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed remodels may be supported using conventional shallow foundations provided that the recommendations presented herein are incorporated in the design and construction of the project.

9.1.11 Provided the site is graded in accordance with the recommendations of this report and foundations constructed as described herein, we estimate that total settlement due to static load utilizing conventional shallow foundations for the proposed structures will be within 1 inch and corresponding differential settlement will be less than ½ inch over 20 feet.

9.1.12 SALEM shall review the grading and foundation plans prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required. If SALEM is not provided plans and specifications for review, we cannot assume any responsibility for the future performance of the project.

9.1.13 SALEM shall be present at the site during site demolition and preparation to observe site clearing/demolition, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

9.1.14 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

9.2 Seismic Design Criteria

9.2.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2016 CBC, our recommended parameters are shown below. These parameters were determined using California's Office of Statewide Health Planning and Development (OSHPD) (https://seismicmaps.org/) in accordance with the 2016 CBC. The Site Class was determined based on the soils encountered during our field exploration.

TABLE 9.2.1
SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value
Site Coordinates (Datum = NAD 83)		33.8591 Lat -118.3103 Lon
Site Class	--	D
Soil Profile Name	--	Stiff Soil
Risk Category	--	II
Site Coefficient for PGA	F_{PGA}	1.000
Peak Ground Acceleration (adjusted for Site Class effects)	PGA_M	0.596 g
Seismic Design Category	SDC	D
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_S	1.590 g
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.589 g
Site Class Modified Site Coefficient	F_a	1.000
Site Class Modified Site Coefficient	F_v	1.500
MCE Spectral Response Acceleration (Short period - 0.2 sec) $S_{MS} = F_a S_S$	S_{MS}	1.590 g
MCE Spectral Response Acceleration (1.0 sec. period) $S_{M1} = F_v S_1$	S_{M1}	0.884 g
Design Spectral Response Acceleration $S_{DS}=⅔S_{MS}$ (short period - 0.2 sec)	S_{DS}	1.060 g
Design Spectral Response Acceleration $S_{D1}=⅔S_{M1}$ (1.0 sec. period)	S_{D1}	0.589 g

9.2.2 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.3 Soil and Excavation Characteristics

9.3.1 Based on the soil conditions encountered in our soil borings, the onsite soils can be excavated with moderate effort using conventional heavy-duty excavation equipment.

9.3.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

9.3.3 The upper soils within the project site are identified primarily as silty clay. The clayey soils are moisture sensitive and moderately expansive.

9.3.4 The near surface soils identified as part of our investigation are, generally, moist to very moist due to the absorption characteristics of the soil. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

9.4 Materials for Fill

9.4.1 The upper soils are predominately silty clay. The test results indicate that the soils have a moderate expansion potential (EI=43). It is recommended that the upper 12 inches of soil within the building pad and exterior flatwork areas be replaced with Non-Expansive Fill (EI≤20).

9.4.2 The soils with an EI greater than 20 (EI>20) but no greater than 50 (EI≤50) may be placed below a depth of 12 inches within the building pad and exterior flatwork areas or in the parking lot and non-structural areas.

9.4.3 Import soil shall be well-graded, slightly cohesive silty fine sand or sandy silt, with relatively impervious characteristics when compacted. A clean sand or very sandy soil is not acceptable for this purpose. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.4.3.

TABLE 9.4.3
IMPORT FILL REQUIREMENTS

Minimum Percent Passing No. 200 Sieve	20
Maximum Percent Passing No. 200 Sieve	50
Minimum Percent Passing No. 4 Sieve	80
Maximum Particle Size	3"
Maximum Plasticity Index	12
Maximum Expansion Index	20

9.4.4 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.

9.4.5 Environmental characteristics and corrosion potential of import soil materials should also be considered.

9.4.6 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

9.5 Grading

9.5.1 A SALEM representative should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

9.5.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

9.5.3 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), any existing uncertified fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report.

9.5.4 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 2 to 4 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation, will not be suitable for use as Engineered Fill or within 5 feet of building pads or within pavement areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.5.5 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is suspected that possible demolition activities of the existing structures may disturb the upper soils. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.

9.5.6 Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of building, including footings and non-cantilevered overhangs carrying structural loads.

9.5.7 Any undocumented fill material encountered during grading should be removed and replaced with engineered fill. The actual depth of the overexcavation and recompaction should be determined by our field representative during construction.

9.5.8 To minimize post-construction soil movement and provide uniform support for the proposed buildings located within the former gas station areas (i.e. Buildings 1 and 3), overexcavation and recompaction should be performed to a minimum depth of **six (6) feet** below existing grade or **four (4) feet** below proposed footing bottom, whichever is deeper. Deeper overexcavation and recompaction will be required if any undocumented fill materials are encountered during grading. Based on our investigation, the depth of overexcavation may be deeper than 10 feet. The overexcavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings.

9.5.9 For the proposed buildings not located within the former gas station areas, it's recommended overexcavation and recompaction be performed to a minimum depth of **three (3) feet** below existing grade or **two (2) feet** below proposed footing bottom, whichever is deeper. Deeper overexcavation and recompaction will be required if any undocumented fill materials are encountered during grading. The overexcavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings.

9.5.10 Prior to placement of fill soils, the upper 10 to 12 inches of native subgrade soils should be scarified, moisture-conditioned to slightly above the optimum moisture content, and recompacted to a minimum of 90% (95% for granular non-expansive soils) of the maximum dry density on ASTM D1557 Test Method.

9.5.11 To minimize the potential soil movement, it is recommended that the upper 12 inches of soil beneath the required granular aggregate subbase within slab on grade and exterior flatwork areas be removed and replaced with Non-Expansive Engineered Fill meeting the requirements of Section 9.4.

9.5.12 As an alternative to the use of non-expansive soils, its' recommended the slab to have a minimum thickness of 5 inches and a minimum concrete compressive strength of 4,500 psi.

9.5.13 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in thin lifts to allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

9.5.14 Engineered Fill soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 90% (95% for granular non-cohesive soils) relative compaction.

9.5.15 Non-Expansive Engineered Fill and non-cohesive soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 95% relative compaction.

9.5.16 Within pavement areas, it is recommended that scarification, moisture conditioning, and recompaction be performed to at least 12 inches below existing grade or finish grade, whichever is deeper. The upper 12 inches of final pavement subgrade, whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned to slightly above the optimum moisture content and compacted to at least 90% (95% for granular non-expansive soils) relative compaction.

9.5.17 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

9.5.18 Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base.

9.5.19 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

9.5.20 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier moths of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties.

Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

9.5.21 The wet soils may become non conducive to site grading as the upper soils yield under the weight of the construction equipment. Therefore, mitigation measures should be performed for stabilization.

Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of slurry, crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation.

To expedite the stabilizing process, slurry or crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose. If the use of slurry or crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by

6 to 24 inches of slurry or ¾-inch to 1-inch crushed rocks. The thickness of the slurry or rock layer depends on the severity of the soil instability.

The recommended 6 to 24 inches of slurry or crushed rock material will provide a stable platform. It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. A layer of geofabric is recommended to be placed on top of the compacted crushed rock to minimize migration of soil particles into the voids of the crushed rock, resulting in soil movement. Although it is not required, the use of geogrid (e.g. Tensar TX7) below the crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization.

Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

9.6 Shallow Foundations

9.6.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings and isolated pad footings bearing in properly compacted Engineered Fill.

9.6.2 Bearing wall footings considered for the structures should be continuous with a minimum width of 15 inches and extend to a minimum depth of 18 inches below the lowest adjacent grade. Isolated column footings should have a minimum width of 24 inches and extend a minimum depth of 18 inches below the lowest adjacent grade. The bottom of footing excavations should be maintained free of loose and disturbed soil. Footing concrete should be placed into a neat excavation.

9.6.3 For design purposes, total settlement due to static loading on the order of 1 inch may be assumed for shallow footings. Differential settlement due to static loading, along a 20-foot exterior wall footing or between adjoining column footings, should be ½ inch, producing an angular distortion of 0.002. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. The footing excavations should not be allowed to dry out any time prior to pouring concrete.

9.6.4 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

Loading Condition	Allowable Bearing
Dead Load Only	2,500 psf
Dead-Plus-Live Load	3,000 psf
Total Load, Including Wind or Seismic Loads	4,000 psf

9.6.5 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.30 acting between the base of foundations and the supporting native subgrade.

9.6.6 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. An increase of one-third is permitted when using the alternate load combination that includes wind or earthquake loads.

9.6.7 Minimum reinforcement for continuous footings should consist of four No. 5 steel reinforcing bars; two placed near the top of the footing and two near the bottom. Reinforcement for spread footings should be designed by the project structural engineer.

9.6.8 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.

9.6.9 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

9.7 Concrete Slabs-on-Grade

9.7.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by six (6) inches of compacted clean granular aggregate subbase material compacted to at least 95% relative compaction.

9.7.2 Granular aggregate subbase material shall conform to ASTM D-2940, Latest Edition (Table 1, bases) with at least 95 percent passing a 1½-inch sieve and not more than 8% passing a No. 200 sieve or its approved equivalents to prevent capillary moisture rise.

9.7.3 The use of processed asphalt in the granular aggregate subbase material (i.e. recycled or miscellaneous base) will have to be approved by the owner. Asphalt is a petroleum hydrocarbon with numerous components, including naphthalene and other semi-volatile constituents that are regulated by California. This material in the subsurface could become a potential vapor intrusion risk (naphthalene is a recent risk-driver that DTSC is actively pursuing).

9.7.4 We recommend reinforcing slabs, at a minimum, with No. 4 reinforcing bars placed 18 inches on center, each way.

9.7.5 Slabs subject to structural loading may be designed utilizing a modulus of subgrade reaction K of 100 pounds per square inch per inch. The K value was approximated based on inter-relationship of soil classification and bearing values (Portland Cement Association, Rocky Mountain Northwest).

9.7.6 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.

9.7.7 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement. The exterior floors should be poured separately in order to act independently of the walls and foundation system.

9.7.8 It is recommended that the utility trenches within the structures be compacted, as specified in our report, to minimize the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the structures is recommended.

9.7.9 Moisture within the structures may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structures. To minimize moisture vapor intrusion, it is recommended that a vapor retarder be installed in accordance with manufacturer's recommendations and/or ASTM guidelines, whichever is more stringent. In addition, ventilation of the structures is recommended to reduce the accumulation of interior moisture.

9.7.10 In areas where it is desired to reduce floor dampness where moisture-sensitive coverings are anticipated, construction should have a suitable waterproof vapor retarder (a minimum of 15 mils thick polyethylene vapor retarder sheeting, Raven Industries "VaporBlock 15, Stego Industries 15 mil "StegoWrap" or W.R. Meadows Sealtight 15 mil "Perminator") incorporated into the floor slab design. The water vapor retarder should be decay resistant material complying with ASTM E96 not exceeding 0.04 perms, ASTM E154 and ASTM E1745 Class A. The vapor barrier should be placed between the concrete slab and the compacted granular aggregate subbase material. The water vapor retarder (vapor barrier) should be installed in accordance with ASTM Specification E 1643-94.

9.7.11 The concrete maybe placed directly on vapor retarder. The vapor retarder should be inspected prior to concrete placement. Cut or punctured retarder should be repaired using vapor retarder material lapped 6 inches beyond damaged areas and taped.

9.7.12 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

9.7.13 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

9.8 Lateral Earth Pressures and Frictional Resistance

9.8.1 Active, at-rest and passive unit lateral earth pressures against footings and walls are summarized in the table below:

Lateral Pressure Drained and Level Backfill	Equivalent Fluid Pressure, pcf
Active Pressure	50
At-Rest Pressure	70
Passive Pressure	250
Related Parameters	
Allowable Coefficient of Friction	0.30
In-Place Soil Density (lbs/ft^3)	120

9.8.2 Active pressure applies to walls, which are free to rotate. At-rest pressure applies to walls, which are restrained against rotation. The preceding lateral earth pressures assume sufficient drainage behind retaining walls to prevent the build-up of hydrostatic pressure.

9.8.3 The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

9.8.4 A safety factor consistent with the design conditions should be included in their usage.

9.8.5 For stability against lateral sliding, which is resisted solely by the passive pressure, we recommend a minimum safety factor of 1.5.

9.8.6 For stability against lateral sliding, which is resisted by the combined passive and frictional resistance, a minimum safety factor of 2.0 is recommended.

9.8.7 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.1.

9.8.8 For dynamic seismic lateral loading the following equation shall be used:

Dynamic Seismic Lateral Loading Equation
Dynamic Seismic Lateral Load = $\frac{3}{8}\gamma K_h H^2$
Where: γ = In-Place Soil Density
K_h = Horizontal Acceleration = $\frac{2}{3}PGA_M$
H = Wall Height

9.9 Retaining Walls

9.9.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The gravel should conform to Class II permeable materials graded in accordance with the current CalTrans Standard Specifications.

9.9.2 Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

9.9.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The top of the perforated pipe should be placed at or below the bottom of the adjacent floor slab or pavements. The pipe should be placed in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Slots should be no wider than 1/8-inch in diameter, while perforations should be no more than ¼-inch in diameter.

9.9.4 If retaining walls are less than 5 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 2-inch minimum diameter holes (concrete walls) or unmortared head joints (masonry walls) and placed no higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

9.9.5 During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

9.10 Temporary Excavations

9.10.1 We anticipate that the majority of the sandy site soils will be classified as Cal-OSHA "Type C" soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

9.10.2 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

9.10.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

9.10.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in the following table:

RECOMMENDED EXCAVATION SLOPES

Depth of Excavation (ft)	Slope (Horizontal : Vertical)
0-5	1:1
5-10	2:1

9.10.5 If, due to space limitation, excavations near property lines or existing structures are performed in a vertical position, slot cuts, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.

9.10.6 Braced shorings should be designed for a maximum pressure distribution of 30H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.

9.10.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM Engineering Group, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

9.11 Underground Utilities

9.11.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 90% (95% for granular non-expansive soils) relative compaction at or above optimum moisture content.

9.11.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 6 to 12 inches above the crown of the pipe. Pipe bedding and backfill material should conform to the requirements of the governing utility agency.

9.11.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the building or structure to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.

9.11.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

9.12 Surface Drainage

9.12.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

9.12.2 The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 5 percent for a minimum distance of 10 feet.

9.12.3 Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building and drainage gradients maintained to carry all surface water to collection facilities and off site. These grades should be maintained for the life of the project. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed.

9.12.4 Roof drains should be installed with appropriate downspout extensions out-falling on splash blocks so as to direct water a minimum of 5 feet away from the structures or be connected to the storm drain system for the development.

9.13 Pavement Design

9.13.1 Based on site soil conditions, an R-value of 15 was used for the preliminary flexible asphaltic concrete pavement design. The R-value may be verified during grading of the pavement areas.

9.13.2 The pavement design recommendations provided herein are based on the State of California Department of Transportation (CALTRANS) design manual. The following table shows the recommended pavement sections for various traffic indices.

TABLE 9.13.2
ASPHALT CONCRETE PAVEMENT

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Compacted Subgrade**
5.0 (Parking & Vehicle Drive Areas)	3.0"	8.0"	12.0"
6.0 (Heavy Truck Areas)	3.0"	11.5"	12.0"

95% compaction based on ASTM D1557-07 Test Method
***90% (95% for granular non-cohesive soils) compaction based on ASTM D1557 Test Method*

9.13.3 The following recommendations are for light-duty and heavy-duty Portland Cement Concrete pavement sections.

TABLE 9.13.3
PORTLAND CEMENT CONCRETE PAVEMENT

Traffic Index	Portland Cement Concrete*	Class II Aggregate Base**	Compacted Subgrade***
5.0 (Light Duty)	5.0"	6.0"	12.0"
6.0 (Heavy Duty)	6.5"	8.0"	12.0"

** Minimum Compressive Strength of 4,000 psi*
*** 95% compaction based on ASTM D1557 Test Method*
****90% (95% for granular non-cohesive soils) compaction based on ASTM D1557 Test Method*

9.13.4 The concrete pavement should be reinforced with a minimum of No. 4 bars at 18-inch on-center both ways placed at mid-height or specified by the structural engineer.

10. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

10.1 Plan and Specification Review

10.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

10.2 Construction Observation and Testing Services

10.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

10.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

10.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

11. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur beyond the boring locations. The nature and extent of such variations may not become evident until construction is initiated.

If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase.

Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants.

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil.

The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping. The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (909) 980-6455.

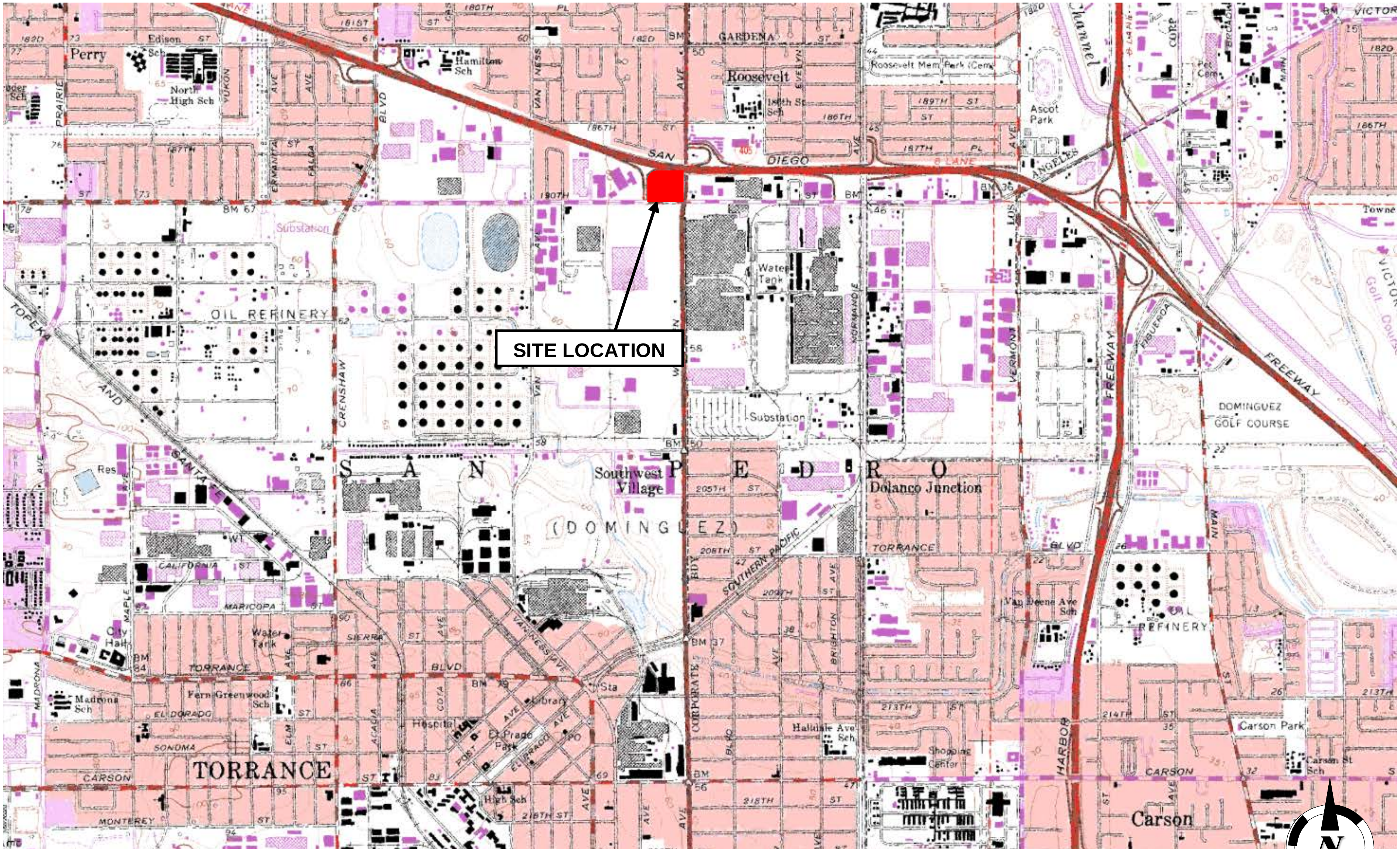
Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Jared Christiansen, EIT
Geotechnical Staff Engineer

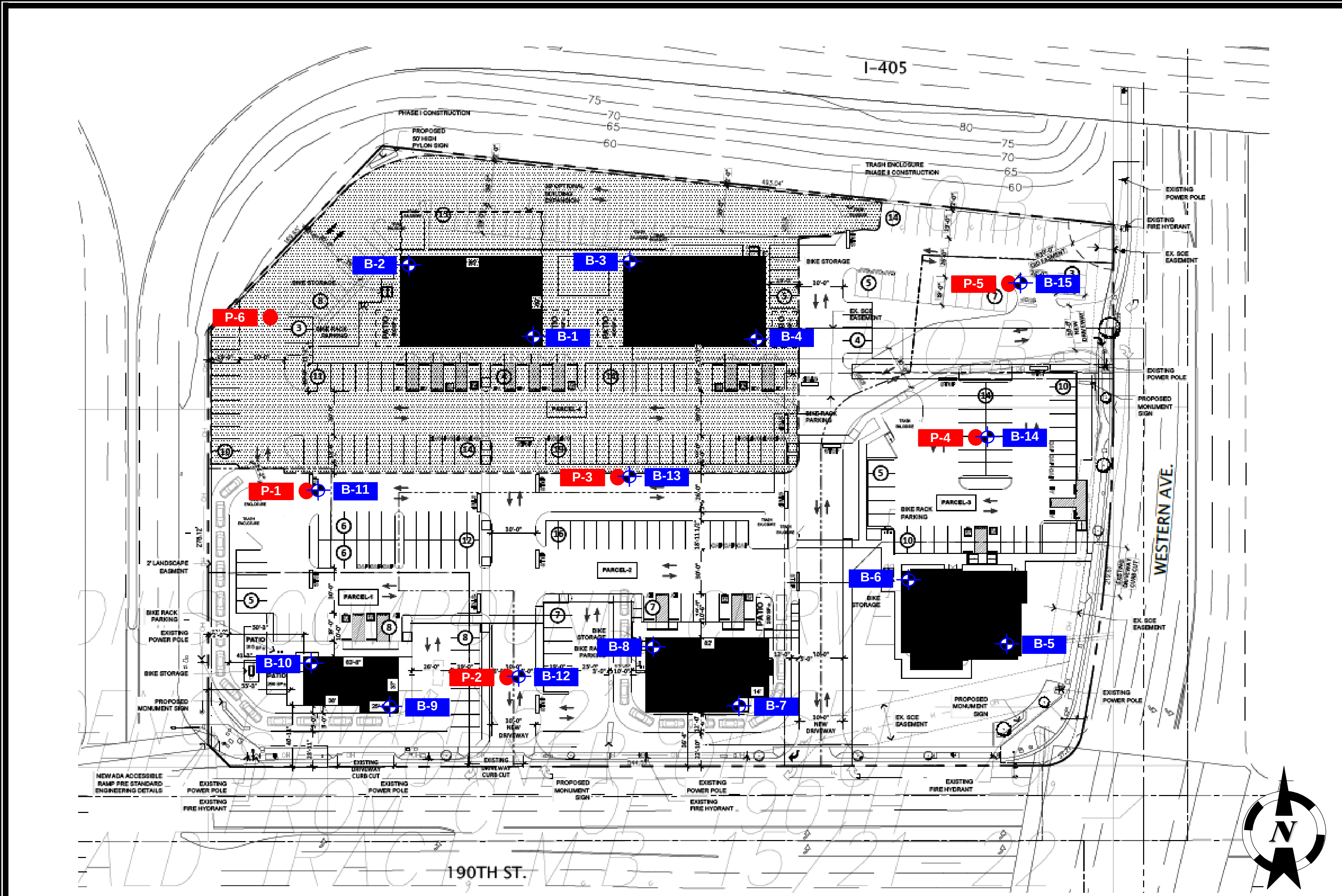
Clarence Jiang, GE
Senior Geotechnical Engineer
RGE 2477

R. Sammy Salem, MS, PE, GE
Principal Engineer
RCE 52762 / RGE 2549



Source Image: U.S. Geological Survey, Torrance, California, N3345-W11815/7.5, 1964 (Photorevised 1981)

VICINITY MAP **GEOTECHNICAL ENGINEERING INVESTIGATION** **Proposed Commercial Center** **190th Street and Western Avenue** **Torrance, California**	SCALE: NOT TO SCALE	DATE: 12/2019	SALEM engineering group, inc.
	DRAWN BY: JC	APPROVED BY: CJ	
	PROJECT NO. 3-219-0913	FIGURE NO. 1	



SITE PLAN **GEOTECHNICAL ENGINEERING INVESTIGATION** **Proposed Commercial Center** **190th Street and Western Avenue** **Torrance, California**	SCALE: NOT TO SCALE	DATE: 12/2019	LEGEND:
	DRAWN BY: JC	APPROVED BY: CJ	B-1 Soil Boring Locations P-1 Percolation Locations
	PROJECT NO. 3-219-0913	FIGURE NO. 2	All Locations Approximate

SALEM engineering group, inc.

APPENDIX

A

APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation (drilling) was conducted on December 2 and 3, 2019 and included a site visit, subsurface exploration, percolation testing and soil sampling. The locations of the exploratory borings and percolation tests are shown on the Site Plan, Figure 2. Boring logs for our exploration are presented in figures following the text in this appendix. Borings were located in the field using existing reference points. Therefore, actual boring locations may deviate slightly.

In general, our borings were performed using a truck-mounted Mobile B-61 drill rig equipped with an 8-inch hollow stem auger. Sampling in the borings was accomplished using a hydraulic 140-pound hammer with a 30-inch drop. Samples were obtained with a 3-inch outside-diameter (OD), split spoon (California Modified) sampler, and a 2-inch OD, Standard Penetration Test (SPT) sampler. The number of blows required to drive the sampler the last 12 inches (or fraction thereof) of the 18-inch sampling interval were recorded on the boring logs. The blow counts shown on the boring logs should not be interpreted as standard SPT "N" values; corrections have not been applied. Upon completion, the borings were backfilled with drill cuttings.

Subsurface conditions encountered in the exploratory borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

Test Boring: B-1 **Page** 1 **Of:** 2

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

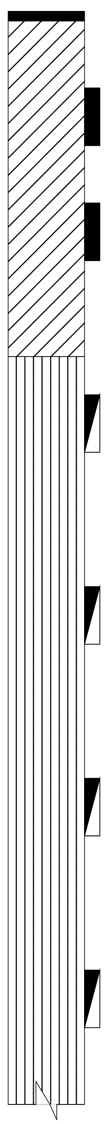
Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Loose Asphalt Concrete = 3 in.				
	7/6 15/6 20/6	CL	Silty Clay Very stiff; dark brown; moist.	35	14.4	116.7	
55 / 5	6/6 14/6 25/6		Grades as above, brown.	39	13.9	108.8	
50 / 10	7/6 8/6 9/6	ML	SILT Stiff; brown; moist; with clay.	17	11.8	-	
45 / 15	6/6 8/6 12/6		Grades as above; very moist.	20	20.8	-	
40 / 20	6/6 8/6 13/6	ML	Clayey SILT Very stiff; brown; very moist.	21	24.0	-	
35 / 25	5/6 8/6 11/6	ML	SILT Stiff; brown; very moist; with clay.	19	20.0	-	

Notes:

Figure Number A-1

SALEM engineering group, inc.

Project Number: 3-219-0913

Date: 12/02/2019

Test Boring: B-1

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
30 / 30	4/6 7/6 8/6		Grades as Above; wet.	15	28.3	-	
25 / 35	7/6 13/6 23/6	SM	Silty SAND Dense; tan; moist; fine to coarse grain sand; trace gravel.	36	7.2	-	
20 / 40	15/6 17/6 21/6		Grades as above; fine to medium grain sand; with gravel.	38	6.6	-	
15 / 45	7/6 8/6 10/6	ML	Sandy SILT Stiff; brown; saturated; fine grain sand; with clay.	18	37.4	-	
10 / 50	8/6 13/6 15/6	ML	Clayey SILT with Sand Very stiff; brown; saturated; fine grain sand.	28	40.4	-	
			End of Boring at 51.5 feet BGS.				
5 / 55							
0 / 60							

Notes:

Figure Number A-1

Test Boring: B-2 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Loose Asphalt Concrete = 3 in.				
	5/6 11/6 13/6	CL	Silty Clay Very stiff; dark brown; moist; fine grain sand.	24	17.2	105.9	
55 / 5	9/6 18/6 24/6		Grades as above; hard; brown.	42	15.5	118	
50 / 10	5/6 9/6 10/6	ML	SILT Very stiff; brown; moist; with clay.	19	13.1	-	
45 / 15	5/6 6/6 12/6		Grades as above; very moist.	18	19.8	-	
			End of Boring at 16.5 feet BGS.				
40 / 20							
35 / 25							

Notes:

Figure Number A-2

SALEM engineering group, inc.

Test Boring: B-3 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Loose Asphalt Concrete = 3 in.				
		CL	Silty Clay				
	9/6 13/6 19/6		Very stiff; dark brown; moist.	32	15.3	100.1	
55 / 5	12/6 18/6 20/6		Grades as above.	38	13.7	120.2	
50 / 10		ML	SILT				
	9/6 9/6 10/6		Very stiff; brown; moist; with clay.	19	10.2	-	
45 / 15	6/6 11/6 17/6		Grades as above; very moist.	18	18.9	-	
			End of Boring at 16.5 feet BGS.				
40 / 20							
35 / 25							

Notes:

Figure Number A-3

Test Boring: B-4 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 — 0		CL	Silty Clay with Sand Very stiff; dark brown; moist; fine grain sand.				
	7/6 13/6 17/6			30	16.3	112.2	
55 — 5	8/6 14/6 19/6		Grades as above; brown.	33	15.4	117.1	
50 — 10		ML	SILT Stiff; brown; moist; with clay.				
	4/6 5/6 10/6			15	15.3	-	
45 — 15	6/6 9/6 11/6		Grades as above; very moist.	20	17.9	-	
		ML	Clayey SILT Very stiff; brown; very moist.				
40 — 20	6/6 10/6 15/6				23.8	-	
			End of Boring at 21.5 feet BGS.				
35 — 25							

Notes:

Figure Number A-4

SALEM engineering group, inc.

Test Boring: B-5 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 — 0		AC	Asphalt Concrete = 3 in.				
		AB	Aggregate Base = 4.5 in.				
	4/6 7/6 13/6	CL	Silty Clay Stiff; dark brown; very moist.	20	18.4	107	
55 — 5	3/6 5/6 7/6	ML	Clayey SILT Stiff; brown; very moist.	12	22.1	102.1	
50 — 10	3/6 6/6 7/6	ML	Sandy SILT Stiff; brown; very moist; fine grain sand; with clay.	13	21.3	-	
45 — 15	3/6 5/6 8/6		Grades as Above.	13	22.7	-	
40 — 20	7/6 12/6 16/6	ML	Clayey SILT Very stiff; brown; very moist.	28	24.3	-	
			End of Boring at 21.5 feet BGS.				
35 — 25							

Notes:

Figure Number A-5

SALEM engineering group, inc.

Test Boring: B-6 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

Project: Proposed Commercial Center

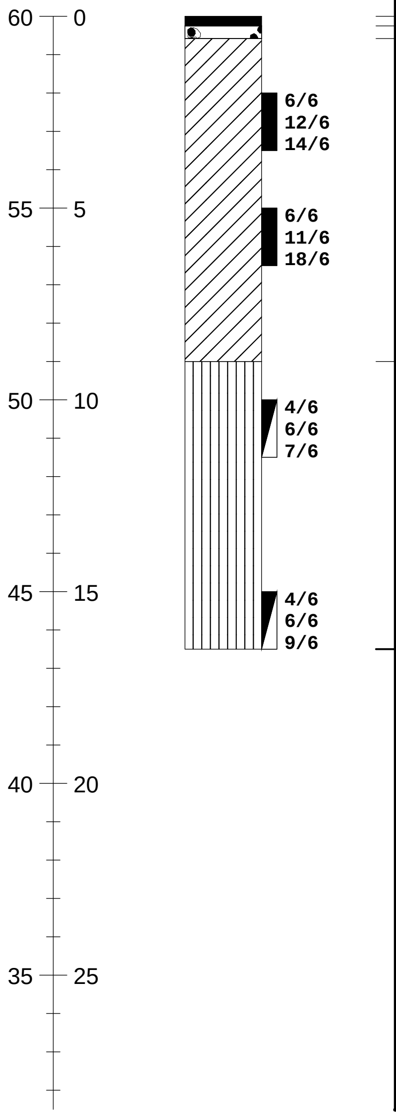
Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Asphalt Concrete = 3 in.				
		AB	Aggregate Base = 4 in.				
	6/6 12/6 14/6	CL	Silty Clay Very stiff; dark brown; very moist.	26	19.2	109.3	
55 / 5	6/6 11/6 18/6		Grades as above; moist.	29	14.1	115.5	
50 / 10	4/6 6/6 7/6	ML	Sandy SILT Stiff; brown; very moist; fine grain sand; with clay.	13	21.1	-	
45 / 15	4/6 6/6 9/6		Grades as above.	15	23.4	-	
			End of Boring at 16.5 feet BGS.				
40 / 20							
35 / 25							

Notes:

Figure Number A-6

Test Boring: B-7 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Asphalt Concrete = 2 in.				
		AB	Aggregate Base = 3 in.				
	4/6 7/6 10/6	CL	Silty Clay Stiff; dark brown; very moist.	17	23.2	101.4	
55 / 5	6/6 9/6 10/6		Grades as above; brown.	19	20.7	106.2	
50 / 10	4/6 5/6 6/6	ML	SILT Stiff; brown; very moist; with clay.	11	20.4	-	
45 / 15	3/6 4/6 7/6		Grades as above; wet.	11	25.9	-	
		ML	Clayey SILT Very stiff; brown; very moist.				
40 / 20	7/6 8/6 13/6			21	23.9	-	
			End of Boring at 21.5 feet BGS.				
35 / 25							

Notes:

Figure Number A-7

Test Boring: B-8 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Asphalt Concrete = 2 in.				
		AB	Aggregate Base = 3 in.				
	9/6 10/6 12/6	CL	Silty Clay with Sand Very stiff; dark brown; wet; fine grain sand.	22	25.4	103.0	
55 / 5	6/6 11/6 14/6		Grades as above; very moist.	25	19.6	101.9	
		ML	Sandy SILT Stiff; brown; very moist; fine grain sand; with clay.				
50 / 10	5/6 6/6 6/6			12	19.6	-	
45 / 15	6/6 8/6 10/6		Grades as above; wet.	18	25.5	-	
			End of Boring at 16.5 feet BGS.				
40 / 20							
35 / 25							

Notes:

Figure Number A-8

Test Boring: B-9 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

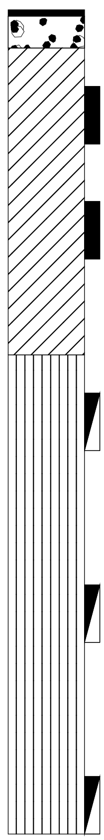
Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 — 0		AC	Loose Asphalt Concrete = 2 in.				
		AB	Aggregate Base = 10 in.				
	5/6 10/6 11/6	CL	POTENTIAL FILL Sandy Silty Clay Very stiff; dark brown; moist; fine grain sand.	21	15.4	113.7	
55 — 5	5/6 9/6 13/6		Grades as above; very moist.	21	20.9	104.0	
50 — 10	2/6 4/6 4/6	ML	Sandy SILT Firm; brown; very moist; fine grain sand; with clay.	8	20.6	-	
45 — 15	3/6 5/6 7/6		Grades as above; stiff; wet.	12	26.0	-	
			Clayey SILT with Sand Stiff; brown; wet; fine grain sand.				
40 — 20	4/6 6/6 7/6			13	26.8	-	
			End of Boring at 21.5 feet BGS.				
35 — 25							

Notes:

Figure Number A-9

Test Boring: B-10 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

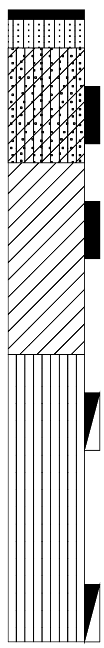
Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Loose Asphalt Concrete = 3 in.				
	9/6 13/6 14/6	SM SC-SM	POTENTIAL FILL Silty SAND Brown; moist; with gravel; trace clay.	27	7.9	123.0	
55 / 5	4/6 7/6 8/6	CL	POTENTIAL FILL Silty, Clayey SAND Medium dense; brown; moist; fine to medium grain sand; trace gravel.	15	15.6	111.4	
50 / 10	3/6 4/6 4/6	ML	POTENTIAL FILL Sandy CLAY Stiff; dark brown; moist; fine grain sand; trace gravel.	8	18.1	-	
			SILT with Sand Firm; brown; very moist; fine grain sand; with clay.				
45 / 15	4/6 5/6 7/6		Grades as above; stiff.	12	24.6	-	
			End of Boring at 16.5 feet BGS.				
40 / 20							
35 / 25							

Notes:

Figure Number A-10

![SALEM engineering group, inc.]

Test Boring: B-11 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip-140lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Loose Asphalt Concrete = 3 in.				
		CL	Silty Clay				
	5/6 7/6 14/6		Very stiff; dark brown; very moist.	21	17.0	107.6	
55 / 5	5/6 12/6 15/6		Grades as above; brown.	27	18.3	111.4	
	4/6 6/6 9/6	ML	Sandy SILT Stiff; brown; very moist; fine grain sand; with clay.	15	24.6	-	
50 / 10			End of Boring at 10 feet BGS.				
45 / 15							
40 / 20							
35 / 25							

Notes:

Figure Number A-11

SALEM engineering group, inc.

Test Boring: B-12 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/02/2019

Client: Kaidence Group

Project: Proposed Commercial Center

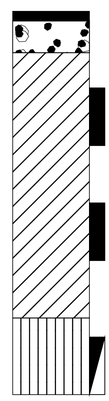
Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Asphalt Concrete = 3 in.				
		AB	Aggregate Base = 10 in.				
	3/6 8/6 10/6	CL	Sandy Silty Clay Stiff; dark brown; very moist; fine grain sand.	18	22.2	101.6	
55 / 5	4/6 11/6 16/6		Grades as above; very stiff; brown.	27	17.6	110.0	
	4/6 4/6 5/6	ML	SILT with Sand Stiff; brown; moist; fine grain sand; with clay.	9	16.3	-	
50 / 10			End of Boring at 10 feet BGS.				
45 / 15							
40 / 20							
35 / 25							

Notes:

Figure Number A-12

Test Boring: B-13 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

SALEM engineering group, inc.

Project: Proposed Commercial Center

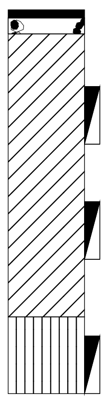
Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Asphalt Concrete = 2.5 in.				
		AB	Aggregate Base = 5 in.				
		CL	Silty Clay with Sand Dark brown; very moist; fine grain sand.		21.1	-	
55 / 5			Grades as above; brown.		19.6	-	
		ML	Sandy SILT Brown; very moist; fine grain sand; with clay.		21.9	-	
50 / 10			End of boring at 10 feet BGS.				
45 / 15							
40 / 20							
35 / 25							

Notes:

Figure Number A-13

SALEM engineering group, inc.

Test Boring: B-14 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Asphalt Concrete = 3 in.				
		AB	Aggregate Base = 4 in.				
	3/6 5/6 7/6	CL	Silty Clay Stiff; dark brown; wet.	12	25.3	98.1	
	5/6 9/6 14/6		Grades as above; very stiff; brown; very moist.	23	18.1	106.9	
55 / 5			End of boring at 5 feet BGS.				
50 / 10							
45 / 15							
40 / 20							
35 / 25							

Notes:

Figure Number A-14

SALEM engineering group, inc.

Test Boring: B-15 **Page** 1 **Of:** 1

Project Number: 3-219-0913

Date: 12/03/2019

Client: Kaidence Group

Project: Proposed Commercial Center

Location: NWC 190th Street and Western Avenue, Torrance, California

Drilled By: GP Drilling **Logged By:** SK

Drill Type: Mobile B-61 **Elevation:** 60'

Auger Type: 8 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in. **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
60 / 0		AC	Loose Asphalt Concrete = 3 in.				
	8/6 16/6 18/6	CL	Silty Clay with Sand Very stiff; dark brown; moist; fine grain sand.	34	16.4	113.8	
55 / 5	5/6 9/6 10/6	ML	Clayey SILT with Sand Stiff; brown; moist; fine grain sand.	19	16.6	105.2	
50 / 10	5/6 7/6 8/6	ML	Sandy SILT Stiff; brown; moist; fine grain sand; with clay.	15	14.9	-	
			End of Boring at 10 feet BGS.				
45 / 15							
40 / 20							
35 / 25							

Notes:

Figure Number A-15

KEY TO SYMBOLS

Symbol Description

Strata symbols

Asphaltic Concrete

Lean Clay

Silt

Silty sand

Aggregate Base

Poorly graded clayey silty sand

Misc. Symbols

Boring continues

Soil Samplers

California sampler

Standard penetration test

Notes:

Consistency Classification

Blows Per Foot (Uncorrected)

Granular Soils

	MCS	SPT
Very loose	<5	<4
Loose	5 -15	4 - 10
Medium dense	16 - 40	11 - 30
Dense	41 - 65	31 - 50
Very dense	>65	>50

Cohesive Soils

	MCS	SPT
Very soft	<3	<2
Soft	3 - 5	2 - 4
Firm	6 - 10	5 - 8
Stiff	11 - 20	9 - 15
Very Stiff	21 - 40	16 - 30
Hard	>40	>30

MCS = Modified California Sampler
SPT = Standard Penetration Test Sampler

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-1**
Tested by: **SK**
Drilled Hole Depth: **10** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill-Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:40	12:10	10.0	Y	0:30	7.26	7.38	1.44	30	72.38	858.5		0.17
12:10	12:40	10.0	N	0:30	7.38	7.48	1.20	30	60.32	825.4		0.15
12:40	13:10	10.0	N	0:30	7.48	7.57	1.08	30	54.29	796.7		0.14
13:10	13:40	10.0	N	0:30	7.57	7.65	0.96	30	48.25	771.1		0.13
13:40	14:10	10.0	N	0:30	7.65	7.73	0.96	30	48.25	746.9		0.13
14:10	14:40	10.0	N	0:30	7.73	7.80	0.84	30	42.22	724.3		0.12
14:40	15:10	10.0	N	0:30	7.80	7.86	0.72	30	36.19	704.7		0.10
15:10	15:40	10.0	N	0:30	7.86	7.92	0.72	30	36.19	686.6		0.11
15:40	16:10	10.0	N	0:30	7.92	7.98	0.72	30	36.19	668.5		0.11
16:10	16:40	10.0	N	0:30	7.98	8.04	0.72	30	36.19	650.4		0.11
Recommended for Design:							**Percolation Rate***		**36.19**			**0.11**

Percolation Test Worksheet

Project: Proposed Commercial Center
190th Street & Western Avenue
Torrance, California

Job No.: 3-219-0913
Date Drilled: 12/2/2019
Soil Classification:

Vol. in 1" Wtr Col. (in^3): 50.3

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: P-2
Tested by: SK
Drilled Hole Depth: 10 ft.

Presoaking Date: 12/2/2019
Test Date: 12/3/2019

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:30	12:00	10.0	Y	0:30	7.73	7.81	0.96	30	48.25	722.8		0.13
12:00	12:30	10.0	N	0:30	7.81	7.88	0.84	30	42.22	700.2		0.12
12:30	13:00	10.0	N	0:30	7.88	7.95	0.84	30	42.22	679.1		0.12
13:00	13:30	10.0	N	0:30	7.95	8.01	0.72	30	36.19	659.5		0.11
13:30	14:00	10.0	N	0:30	8.01	8.07	0.72	30	36.19	641.4		0.11
14:00	14:30	10.0	N	0:30	8.07	8.12	0.60	30	30.16	624.8		0.10
14:30	15:00	10.0	N	0:30	8.12	8.17	0.60	30	30.16	609.7		0.10
15:00	15:30	10.0	N	0:30	8.17	8.21	0.48	30	24.13	596.1		0.08
15:30	16:00	10.0	N	0:30	8.21	8.25	0.48	30	24.13	584.1		0.08
16:00	16:30	10.0	N	0:30	8.25	8.29	0.48	30	24.13	572.0		0.08
Recommended for Design:								**Percolation Rate***	**24.13**			**0.08**

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-3**
Tested by: **SK**
Drilled Hole Depth: **10** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
12:10	12:40	10.0	Y	0:30	7.13	7.26	1.56	30	78.41	896.2		0.17
12:40	13:10	10.0	N	0:30	7.26	7.37	1.32	30	66.35	860.0		0.15
13:10	13:40	10.0	N	0:30	7.37	7.47	1.20	30	60.32	828.4		0.15
13:40	14:10	10.0	N	0:30	7.47	7.56	1.08	30	54.29	799.7		0.14
14:10	14:40	10.0	N	0:30	7.56	7.64	0.96	30	48.25	774.1		0.12
14:40	15:10	10.0	N	0:30	7.64	7.70	0.72	30	36.19	753.0		0.10
15:10	15:40	10.0	N	0:30	7.70	7.76	0.72	30	36.19	734.9		0.10
15:40	16:10	10.0	N	0:30	7.76	7.82	0.72	30	36.19	716.8		0.10
16:10	16:40	10.0	N	0:30	7.82	7.87	0.60	30	30.16	700.2		0.09
16:40	17:10	10.0	N	0:30	7.87	7.92	0.60	30	30.16	685.1		0.09
Recommended for Design:							**Percolation Rate***		**32.17**			**0.09**

Percolation Test Worksheet

Project: Proposed Commercial Center
190th Street & Western Avenue
Torrance, California

Job No.: 3-219-0913
Date Drilled: 12/2/2019
Soil Classification:

Vol. in 1" Wtr Col. (in^3): 50.3

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: P-4
Tested by: SK
Drilled Hole Depth: 5 ft.

Presoaking Date: 12/2/2019
Test Date: 12/3/2019

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:50	12:20	5.0	Y	0:30	2.80	2.87	0.84	30	42.22	703.2		0.12
12:20	12:50	5.0	N	0:30	2.87	2.92	0.60	30	30.16	685.1		0.09
12:50	13:20	5.0	N	0:30	2.92	2.96	0.48	30	24.13	671.5		0.07
13:20	13:50	5.0	N	0:30	2.96	3.00	0.48	30	24.13	659.5		0.07
13:50	14:20	5.0	N	0:30	3.00	3.03	0.36	30	18.10	648.9		0.06
14:20	14:50	5.0	N	0:30	3.03	3.06	0.36	30	18.10	639.9		0.06
14:50	15:20	5.0	N	0:30	3.06	3.09	0.36	30	18.10	630.8		0.06
15:20	15:50	5.0	N	0:30	3.09	3.12	0.36	30	18.10	621.8		0.06
15:50	16:20	5.0	N	0:30	3.12	3.14	0.24	30	12.06	614.2		0.04
16:20	16:50	5.0	N	0:30	3.14	3.16	0.24	30	12.06	608.2		0.04
Recommended for Design:								**Percolation Rate***	**14.07**			**0.05**

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-5**
Tested by: **SK**
Drilled Hole Depth: **10** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
12:00	12:30	10.0	Y	0:30	7.67	7.78	1.32	30	66.35	736.4		0.18
12:30	13:00	10.0	N	0:30	7.78	7.88	1.20	30	60.32	704.7		0.17
13:00	13:30	10.0	N	0:30	7.88	7.97	1.08	30	54.29	676.1		0.16
13:30	14:00	10.0	N	0:30	7.97	8.05	0.96	30	48.25	650.4		0.15
14:00	14:30	10.0	N	0:30	8.05	8.13	0.96	30	48.25	626.3		0.15
14:30	15:00	10.0	N	0:30	8.13	8.20	0.84	30	42.22	603.7		0.14
15:00	15:30	10.0	N	0:30	8.20	8.27	0.84	30	42.22	582.6		0.14
15:30	16:00	10.0	N	0:30	8.27	8.33	0.72	30	36.19	563.0		0.13
16:00	16:30	10.0	N	0:30	8.33	8.39	0.72	30	36.19	544.9		0.13
16:30	17:00	10.0	N	0:30	8.39	8.45	0.72	30	36.19	526.8		0.14
Recommended for Design:								**Percolation Rate***	**36.19**			**0.13**

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-6**
Tested by: **SK**
Drilled Hole Depth: **5** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:45	12:15	5.0	Y	0:30	3.14	3.21	0.84	30	42.22	600.7		0.14
12:15	12:45	5.0	N	0:30	3.21	3.27	0.72	30	36.19	581.1		0.12
12:45	13:15	5.0	N	0:30	3.27	3.32	0.60	30	30.16	564.5		0.11
13:15	13:45	5.0	N	0:30	3.32	3.36	0.48	30	24.13	550.9		0.09
13:45	14:15	5.0	N	0:30	3.36	3.39	0.36	30	18.10	540.4		0.07
14:15	14:45	5.0	N	0:30	3.39	3.42	0.36	30	18.10	531.3		0.07
14:45	15:15	5.0	N	0:30	3.42	3.44	0.24	30	12.06	523.8		0.05
15:15	15:45	5.0	N	0:30	3.44	3.46	0.24	30	12.06	517.7		0.05
15:45	16:15	5.0	N	0:30	3.46	3.48	0.24	30	12.06	511.7		0.05
16:15	16:45	5.0	N	0:30	3.48	3.50	0.24	30	12.06	505.7		0.05
Recommended for Design:								**Percolation Rate***	**12.06**			**0.05**

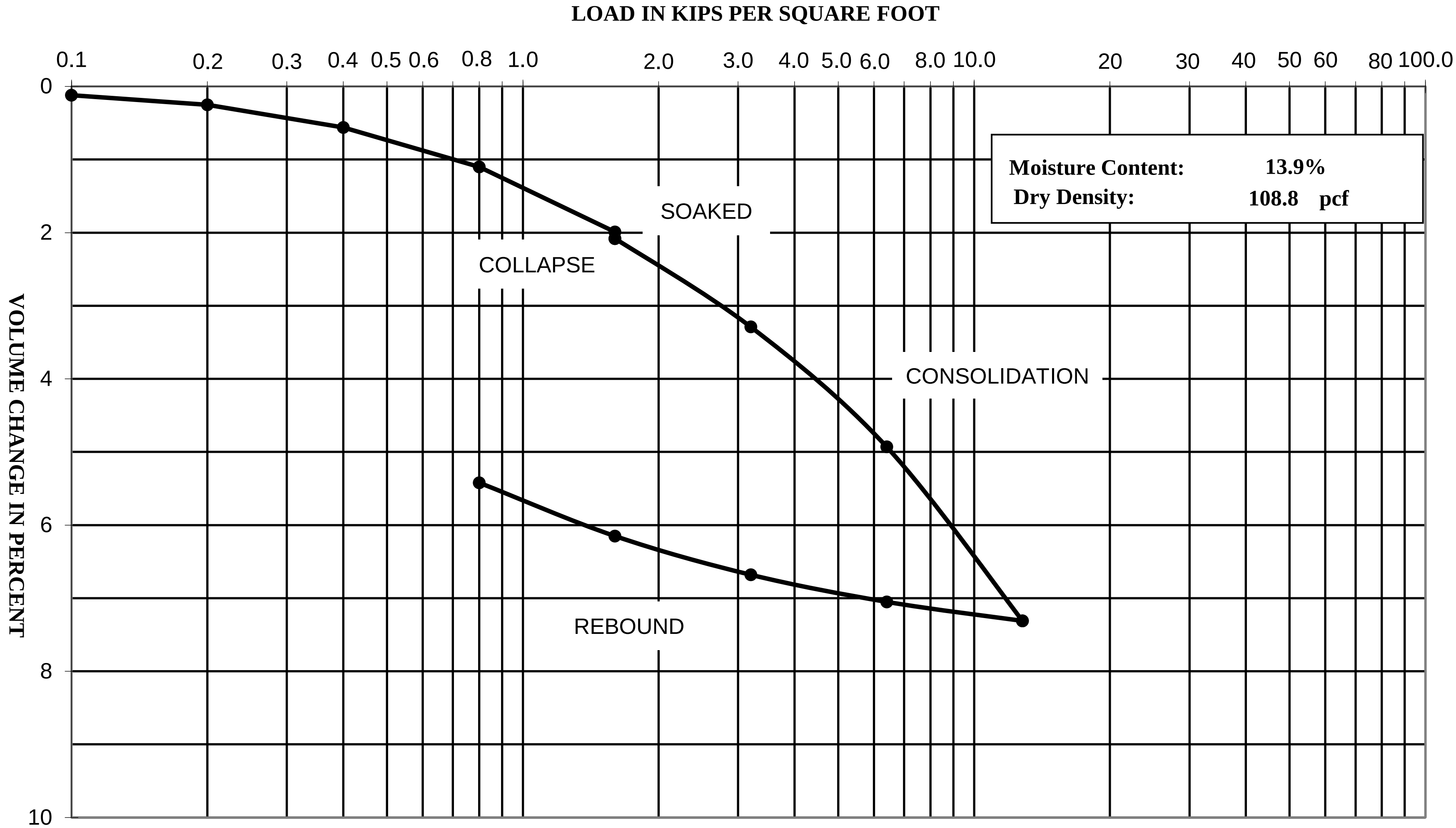
APPENDIX

B

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM), Caltrans, or other suggested procedures. Selected samples were tested for in-situ dry density and moisture content, corrosivity, consolidation, shear strength, expansion, maximum density and optimum moisture content, and grain size distribution. The results of the laboratory tests are summarized in the following figures.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



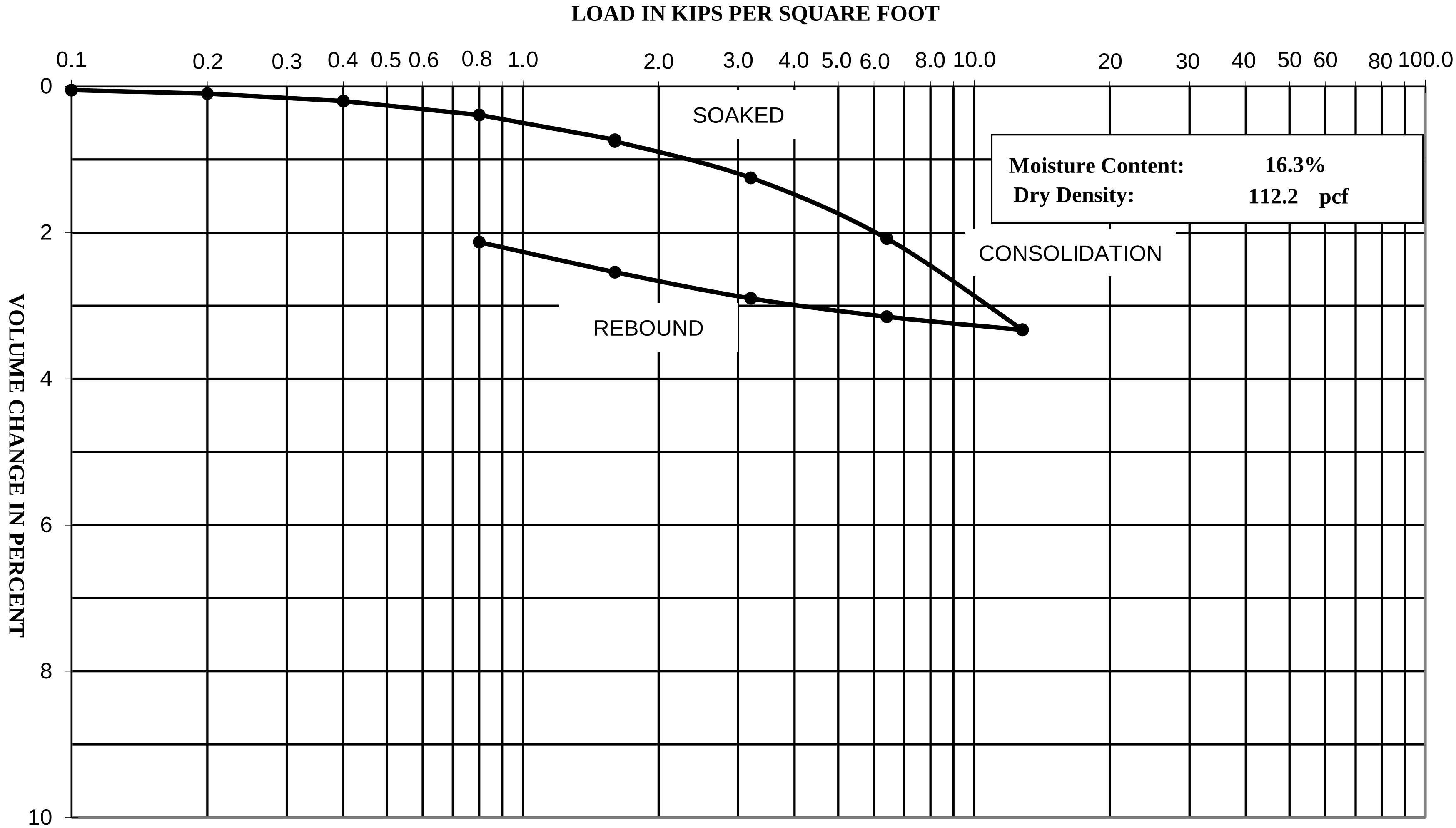
Project Name: Proposed Commercial Center - Torrance, CA

Project Number: 3-219-0913

Boring: B-1 @ 5'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



Project Name: Proposed Commercial Center - Torrance, CA

Project Number: 3-219-0913

Boring: B-4 @ 2'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
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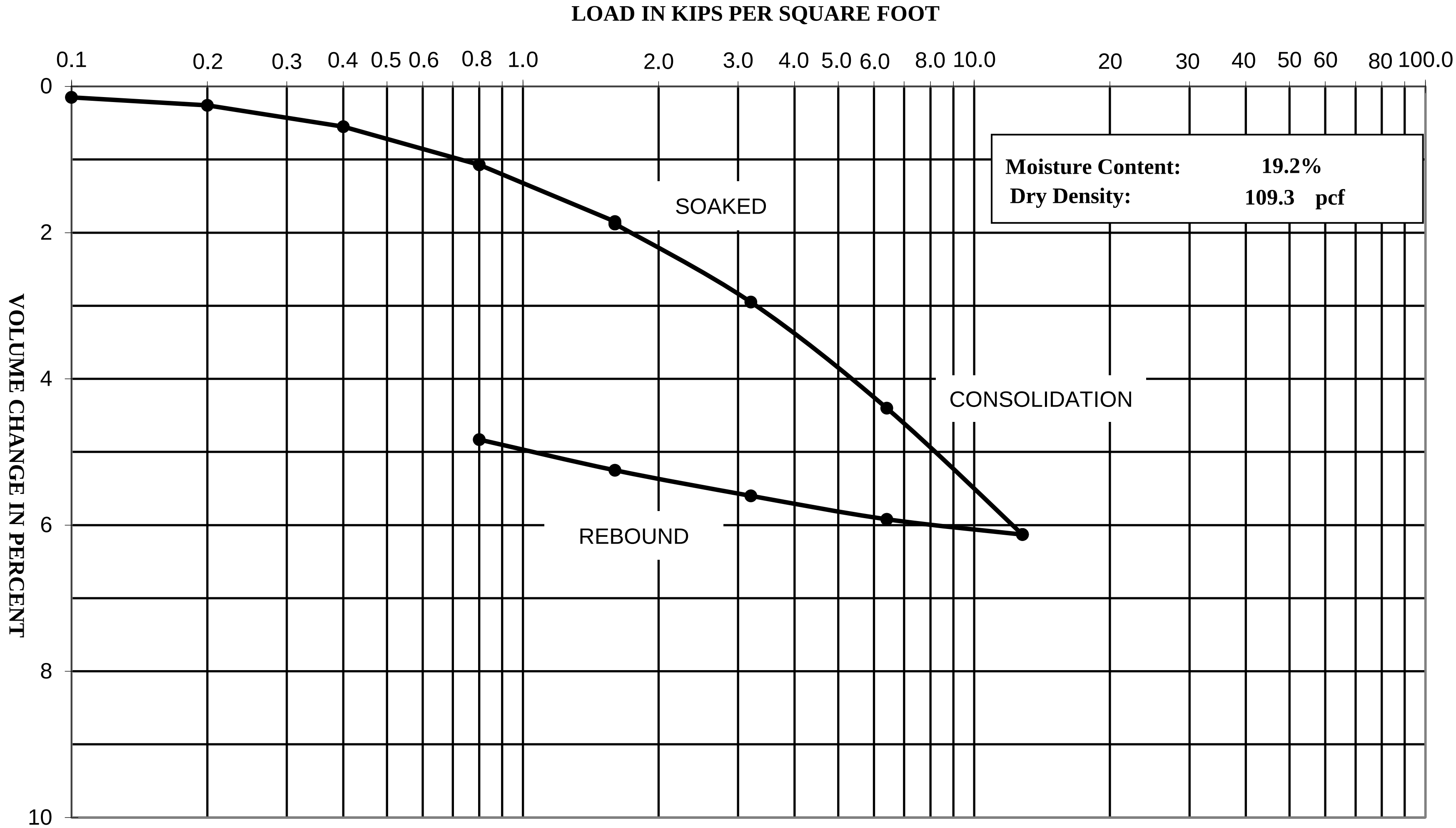

Project Name: Proposed Commercial Center - Torrance, CA

Project Number: 3-219-0913

Boring: B-6 @ 2'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
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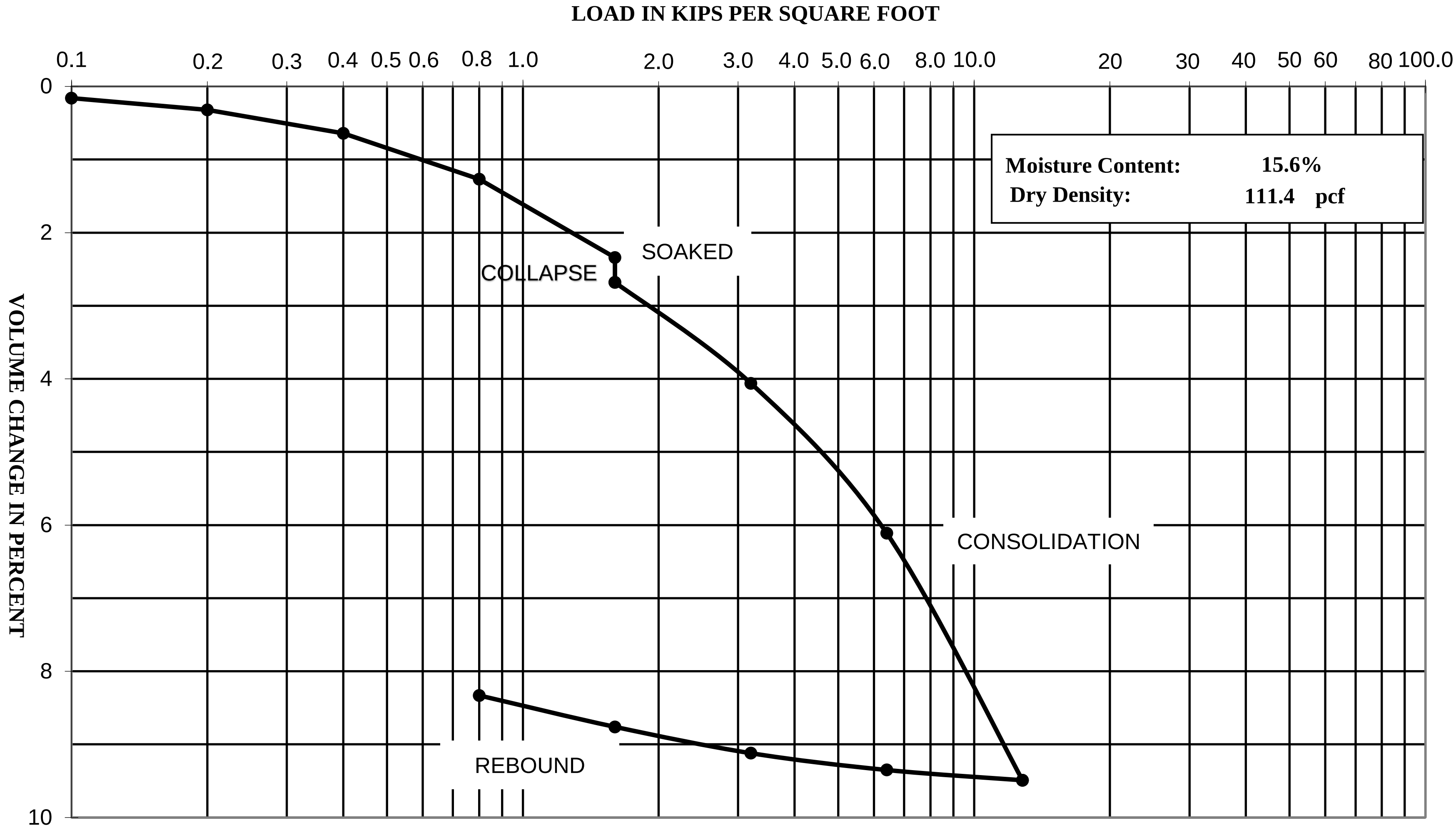


Project Name: Proposed Commercial Center - Torrance, CA

Project Number: 3-219-0913

Boring: B-10 @ 5'

SALEM engineering group, inc.

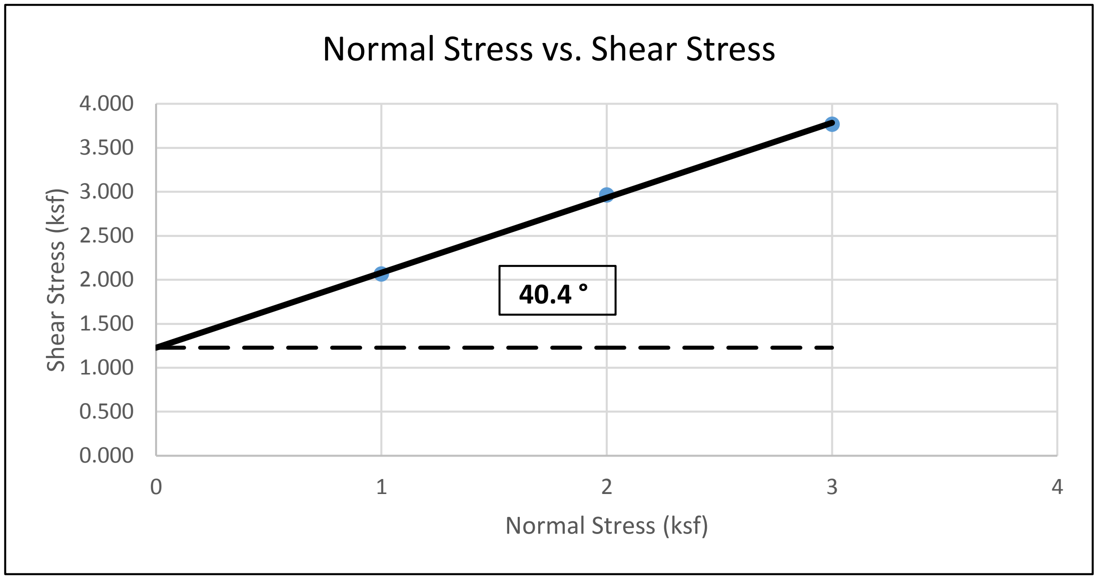
Direct Shear Test (ASTM D3080)

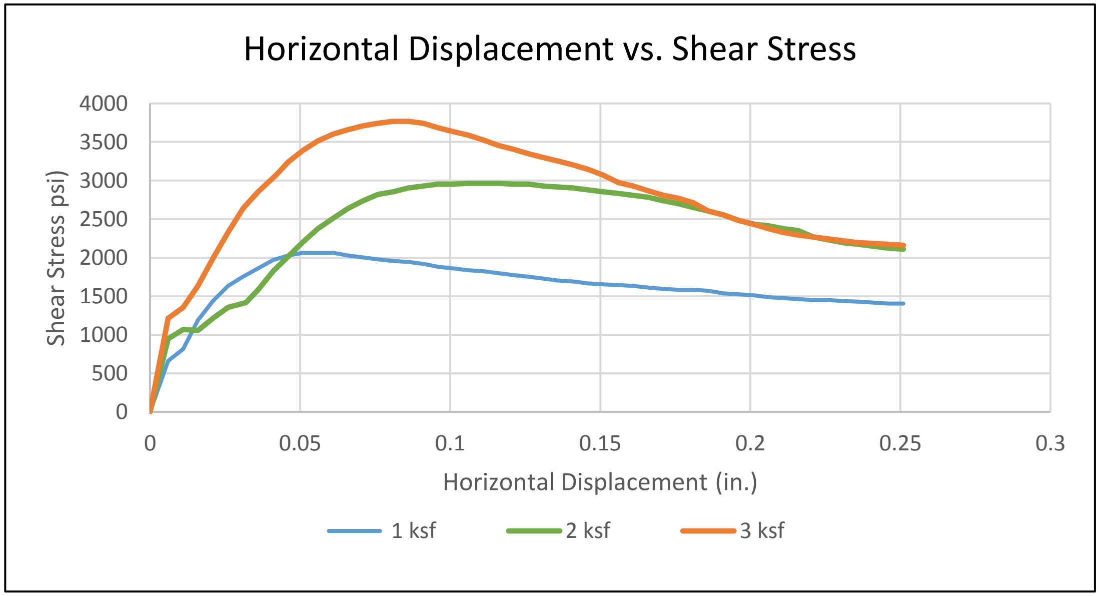
Project Name:	Proposed Commercial Center - Torrance, CA
Project Number:	3-219-0913
Client:	Kaidence Group
Sample Location:	B-1 @ 2'
Sample Type:	Undisturbed Ring
Soil Classification:	Silty Clay (CL)
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	12/11/2019
Equipment Used:	Geomatic Direct Shear Machine

	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.004		
Peak Shear Stress (ksf)	2.064	2.964	3.768
Residual Shear Stress (ksf)	0.000	0.000	0.000

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	14.4		
Final Moisture Content (%)	19.8	18.8	17.8
Dry Density (pcf)	116.5	115.5	114.4

Peak Shear Strength Values	
Slope	0.85
Friction Angle	40.4
Cohesion (psf)	1228





SALEM engineering group, inc.

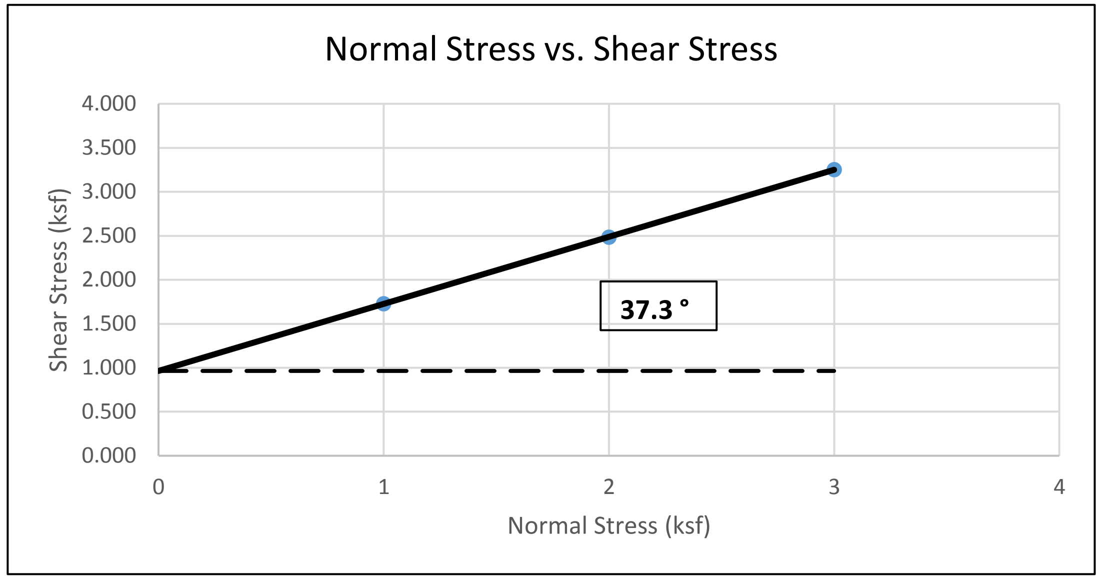
Direct Shear Test (ASTM D3080)

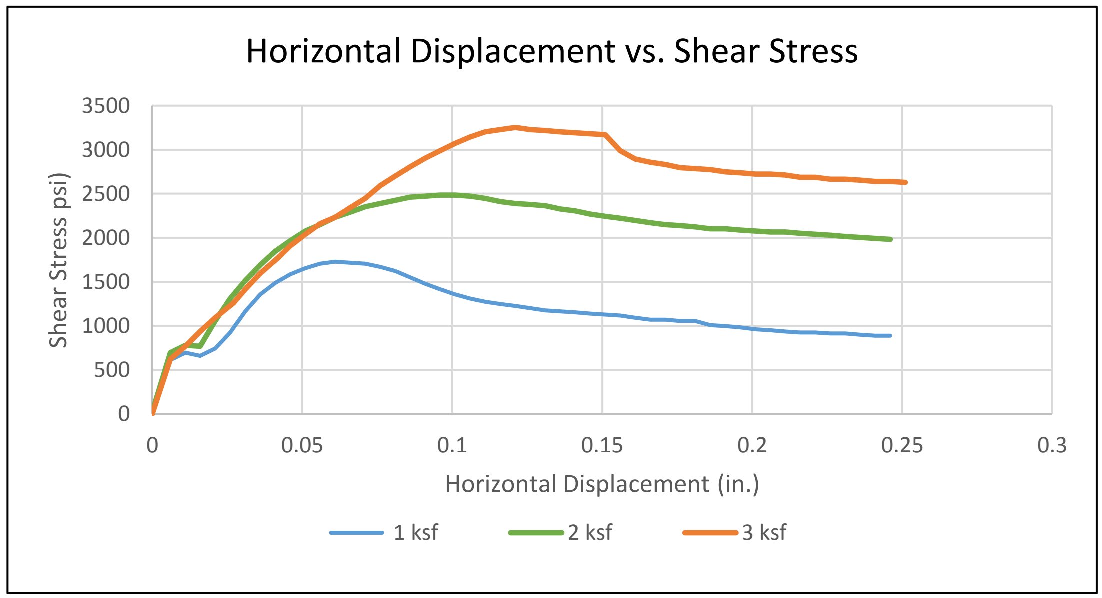
Project Name:	Proposed Commercial Center - Torrance, CA
Project Number:	3-219-0913
Client:	Kaidence Group
Sample Location:	B-4 @ 5'
Sample Type:	Undisturbed Ring
Soil Classification:	Silty Clay with Sand (CL)
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	12/12/2019
Equipment Used:	Geomatic Direct Shear Machine

	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.002		
Peak Shear Stress (ksf)	1.728	2.484	3.252
Residual Shear Stress (ksf)	0.000	0.000	0.000

	Sample 1	Sample 2	Sample 3
Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	15.4		
Final Moisture Content (%)	17.3	17.7	18.0
Dry Density (pcf)	113.8	114.8	114.5

Peak Shear Strength Values	
Slope	0.76
Friction Angle	37.3
Cohesion (psf)	964





SALEM
engineering group, inc.

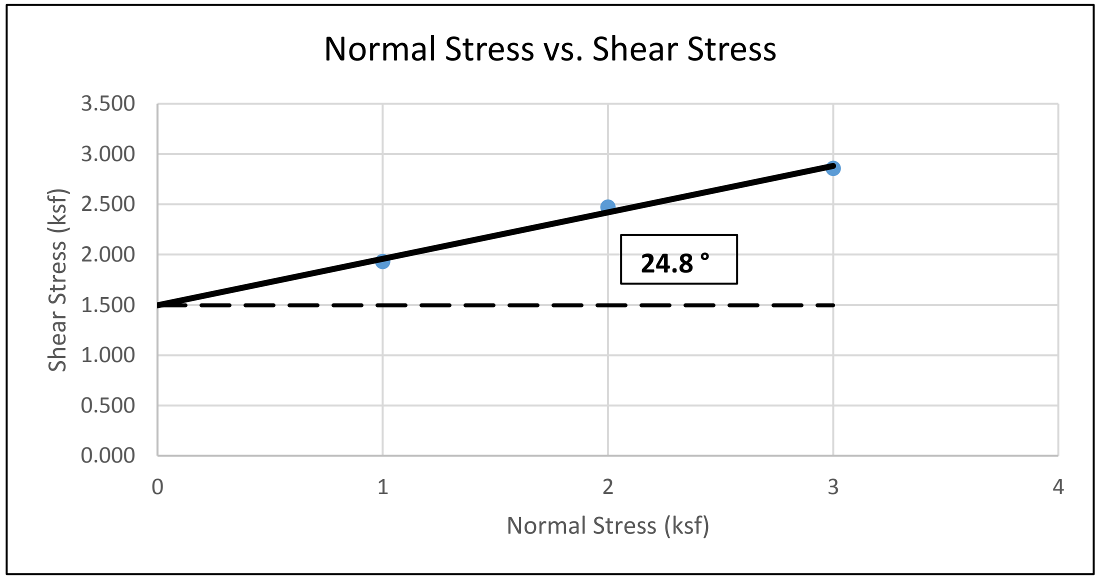
Direct Shear Test (ASTM D3080)

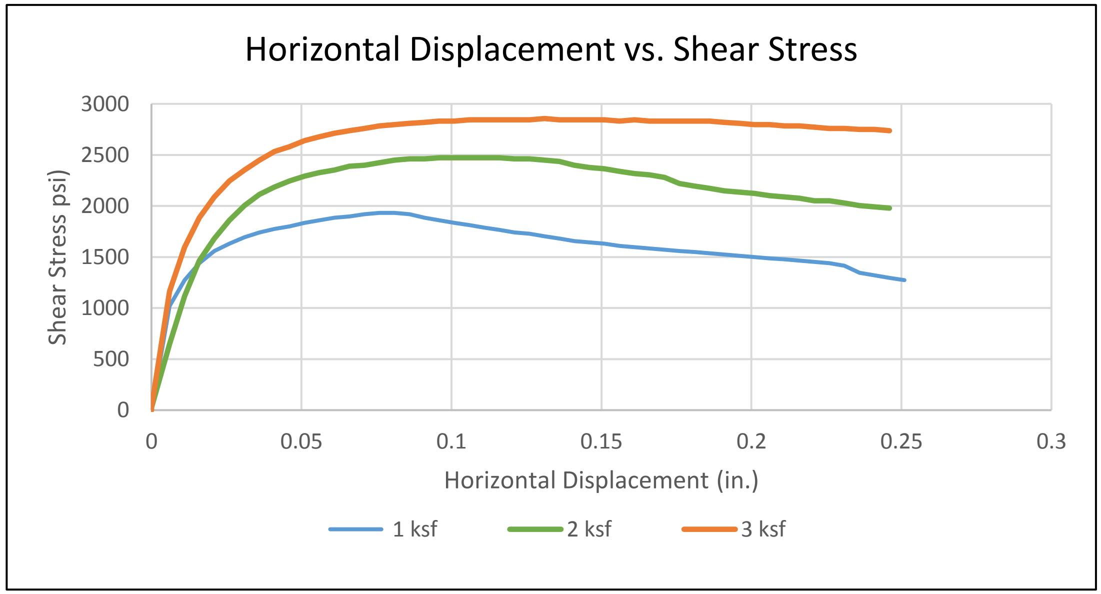
Project Name:	Proposed Commercial Center - Torrance, CA
Project Number:	3-219-0913
Client:	Kaidence Group
Sample Location:	B-6 @ 5'
Sample Type:	Undisturbed Ring
Soil Classification:	Silty Clay (CL)
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	12/13/2019
Equipment Used:	Geomatic Direct Shear Machine

	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.004		
Peak Shear Stress (ksf)	1.932	2.472	2.856
Residual Shear Stress (ksf)	0.000	0.000	0.000

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	14.1		
Final Moisture Content (%)	18.3	17.5	17.2
Dry Density (pcf)	114.9	112.5	112.7

Peak Shear Strength Values	
Slope	0.46
Friction Angle	24.8
Cohesion (psf)	1496





Direct Shear Test (ASTM D3080)

Project Name:	Proposed Commercial Center - Torrance, CA
Project Number:	3-219-0913
Client:	Kaidence Group
Sample Location:	B-10 @ 2'
Sample Type:	Undisturbed Ring
Soil Classification:	Silty, Clayey SAND (SC-SM)
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	12/16/2019
Equipment Used:	Geomatic Direct Shear Machine

	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.004		
Peak Shear Stress (ksf)	1.236	1.949	2.472
Residual Shear Stress (ksf)	0.000	0.000	0.000

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	7.9		
Final Moisture Content (%)	19.3	17.0	17.0
Dry Density (pcf)	115.1	123.2	119.2

Peak Shear Strength Values	
Slope	0.62
Friction Angle	31.7
Cohesion (psf)	649.8

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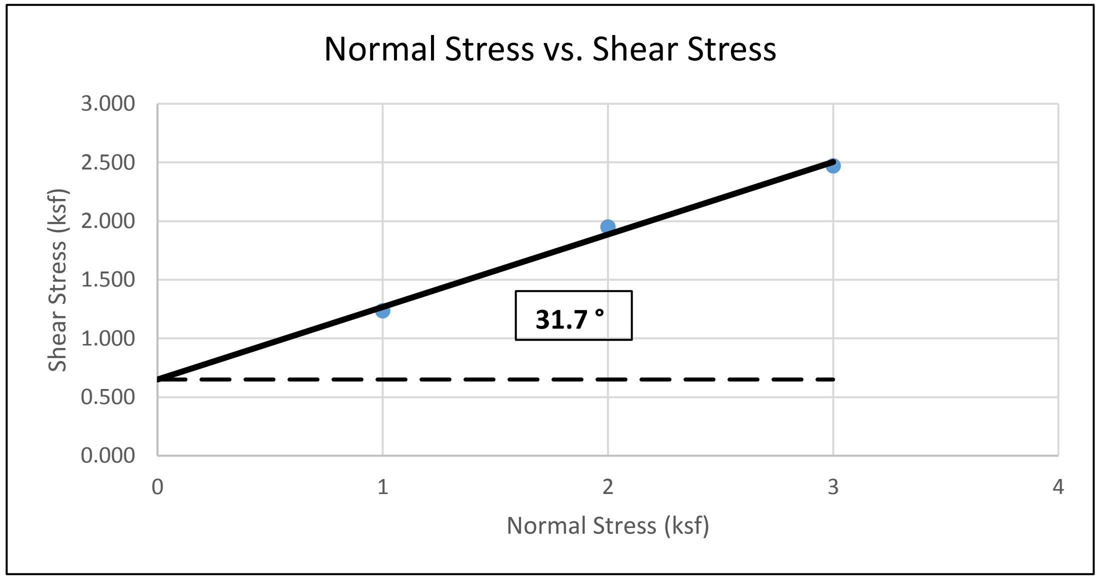
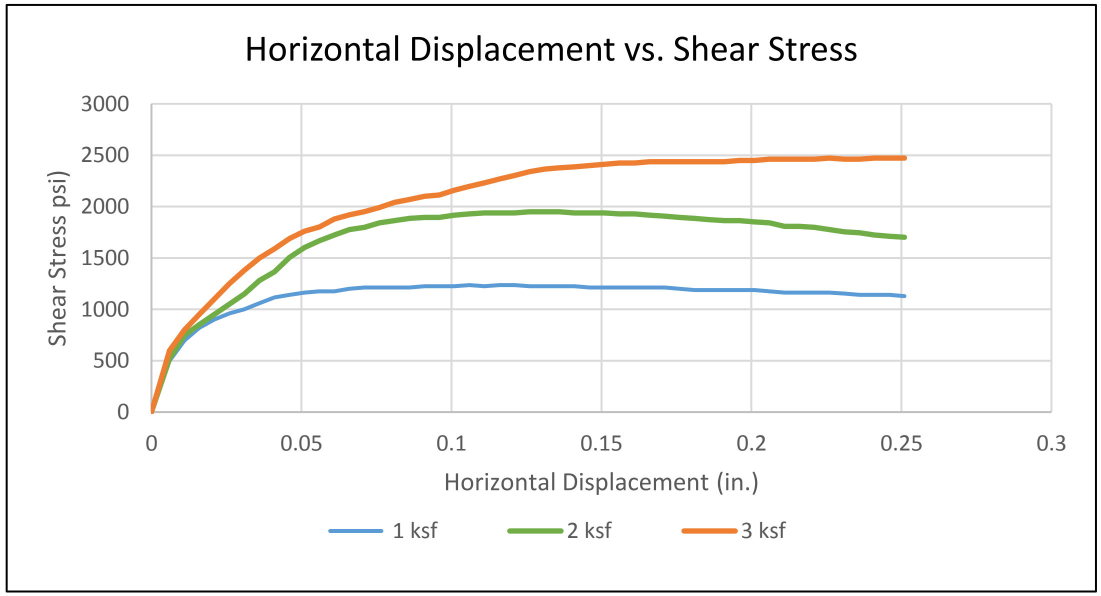
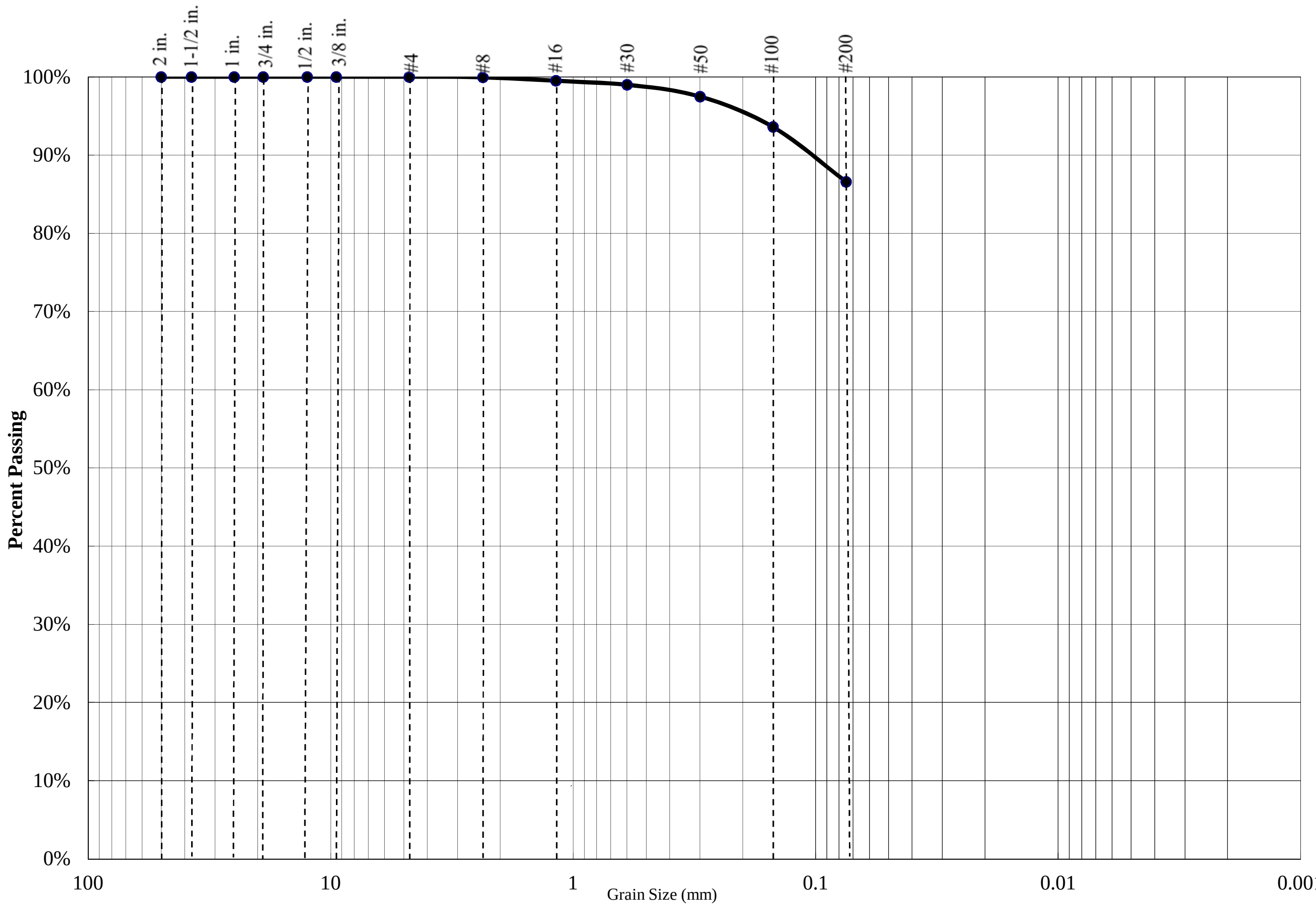




SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	13%	87%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	100.0%
#16	99.5%
#30	99.0%
#50	97.5%
#100	93.6%
#200	86.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
Silty Clay (CL)

Project Name: Proposed Commercial Center - Torrance, CA

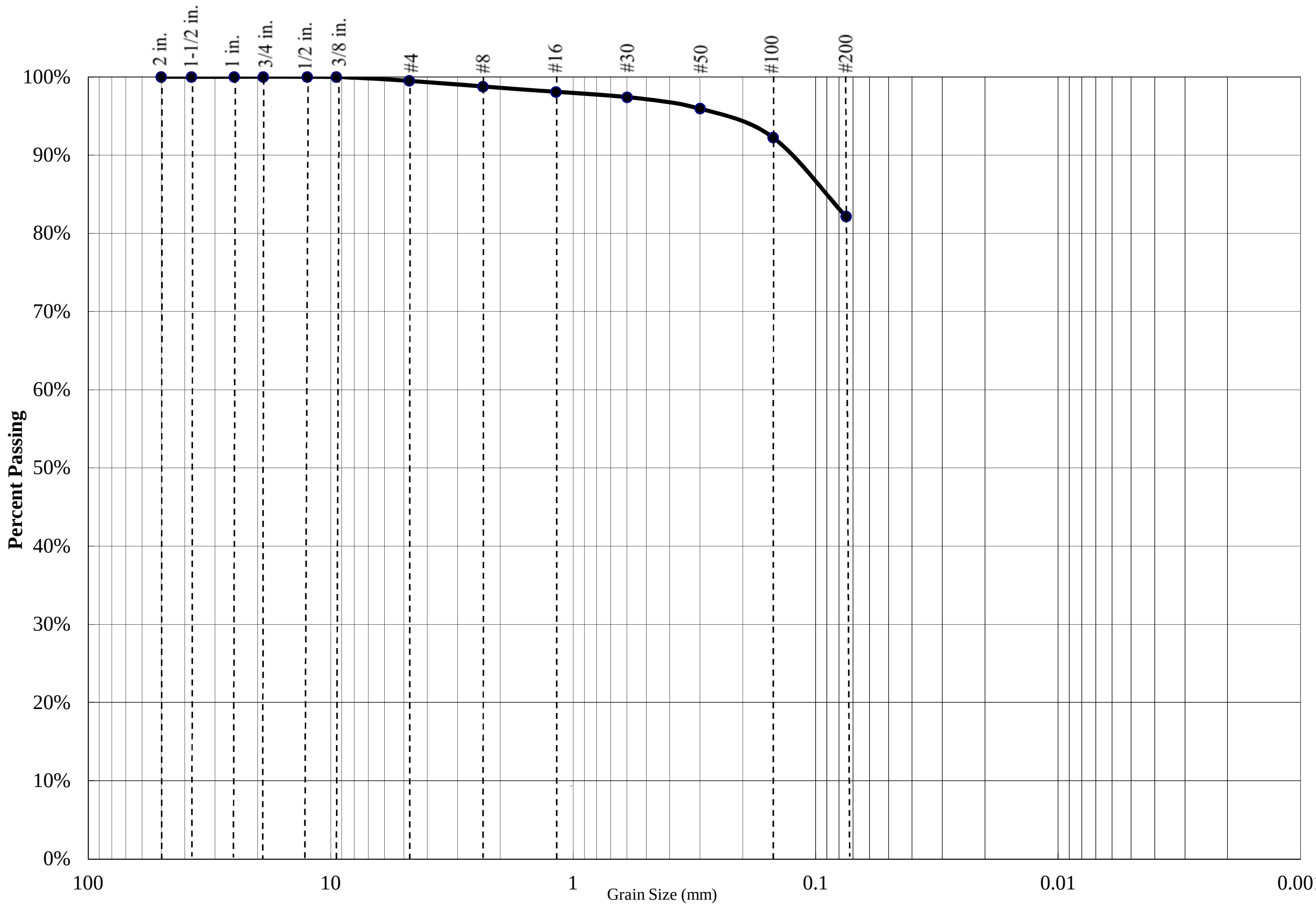
Project Number: 3-219-0913

Boring: B-1 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
1%	17%	82%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.5%
#8	98.8%
#16	98.1%
#30	97.4%
#50	95.9%
#100	92.3%
#200	82.1%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients					
D_{85}=		**D_{60}=**		**D_{50}=**	
D_{30}=		**D_{15}=**		**D_{10}=**	
C_u=	N/A	**C_c=**	N/A		

USCS CLASSIFICATION
Silty Clay with Sand (CL)

Project Name: Proposed Commercial Center - Torrance, CA

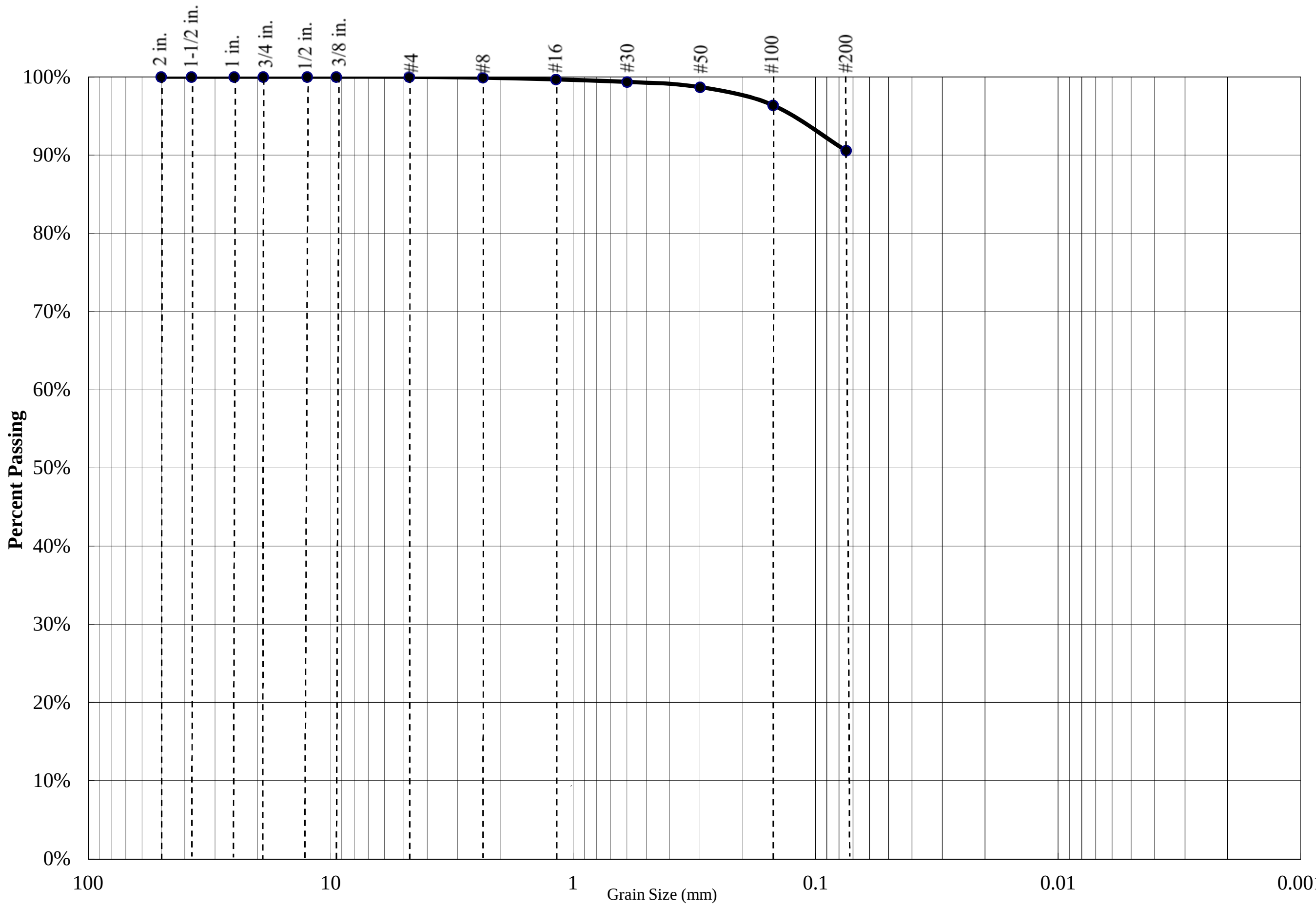
Project Number: 3-219-0913

Boring: B-1 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	9%	91%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.9%
#16	99.7%
#30	99.4%
#50	98.7%
#100	96.4%
#200	90.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
SILT (ML)

Project Name: Proposed Commercial Center - Torrance, CA

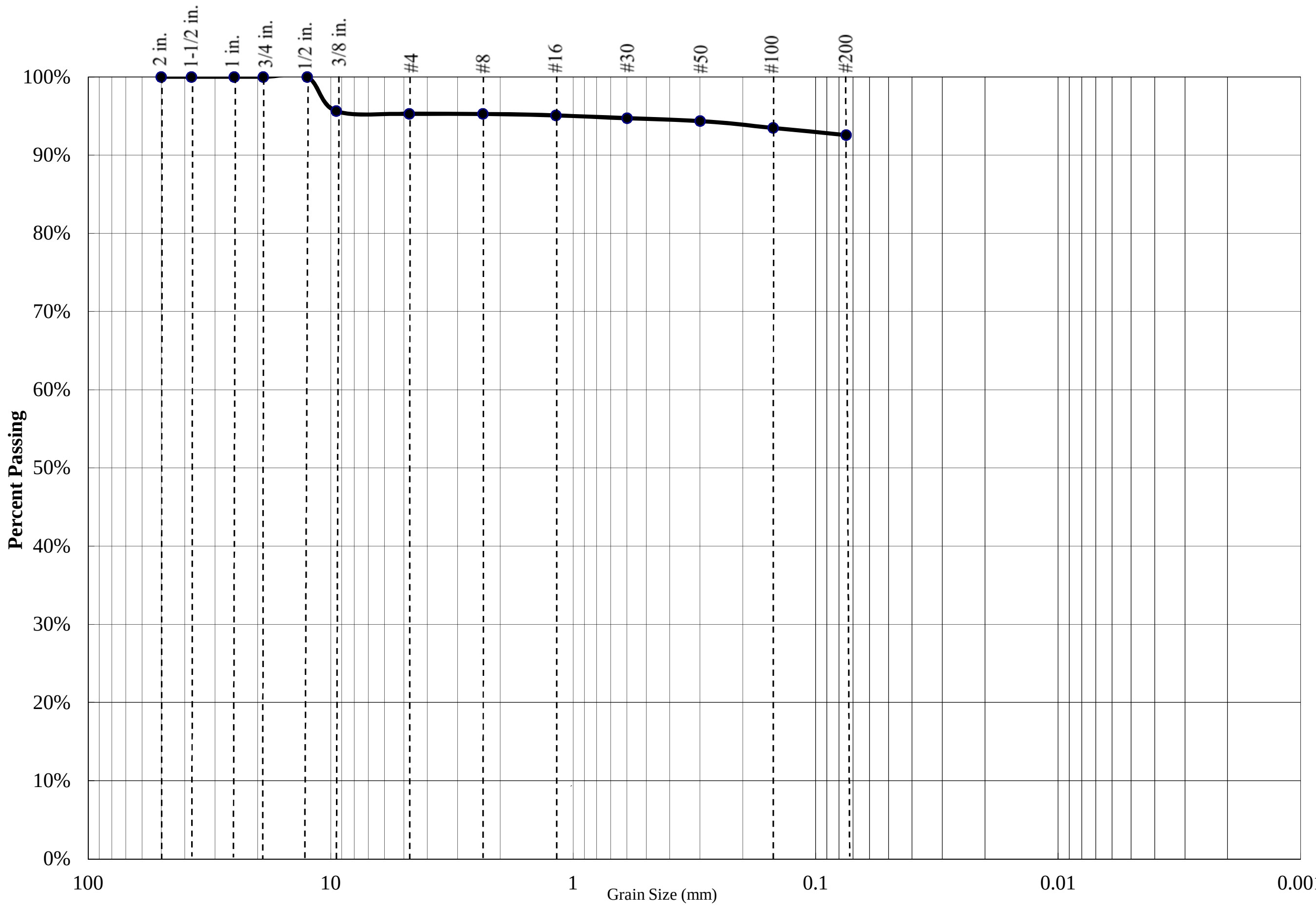
Project Number: 3-219-0913

Boring: B-1 @ 15'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
5%	3%	93%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	95.6%
#4	95.3%
#8	95.3%
#16	95.1%
#30	94.7%
#50	94.4%
#100	93.5%
#200	92.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
SILT (ML)

Project Name: Proposed Commercial Center - Torrance, CA

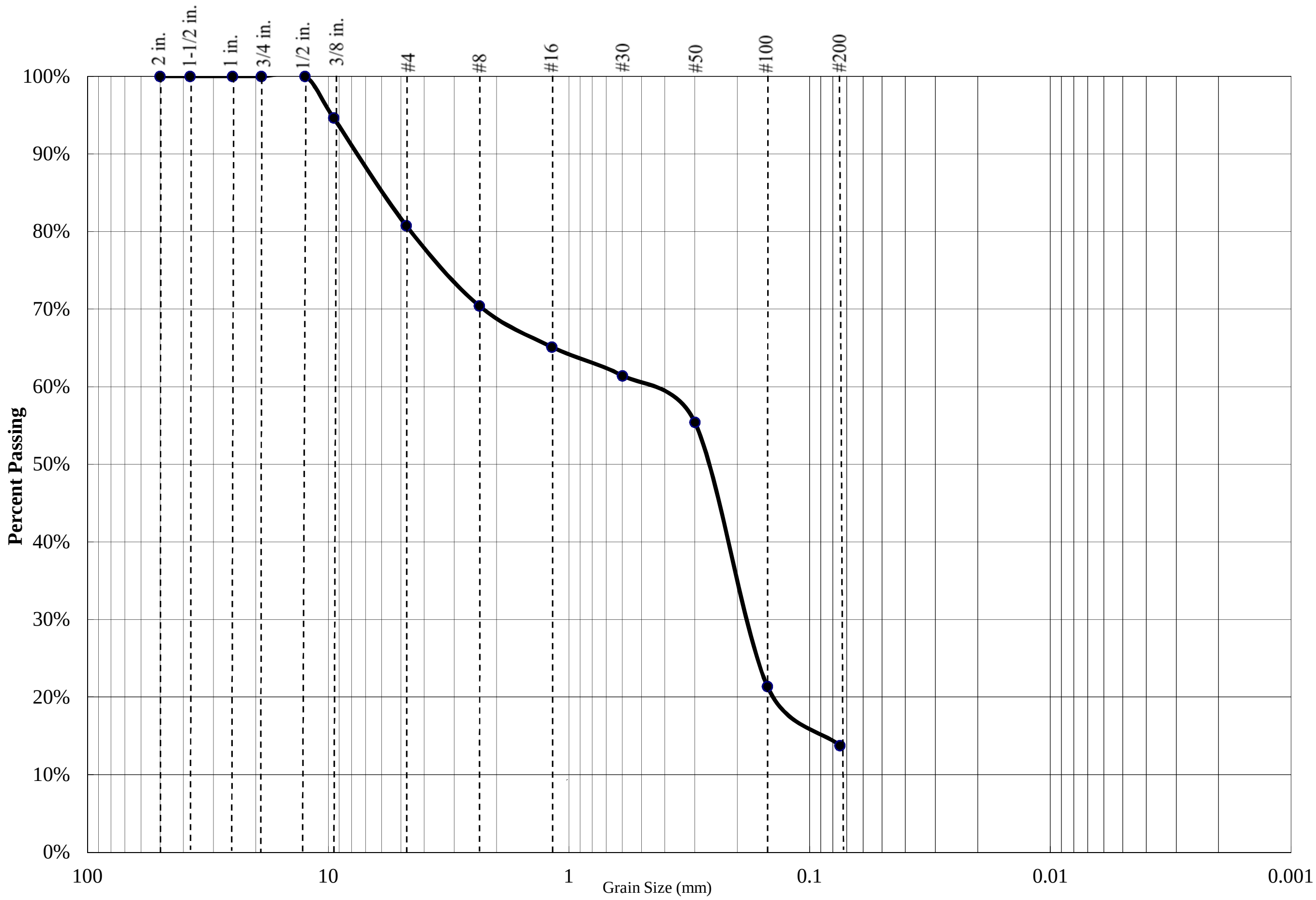
Project Number: 3-219-0913

Boring: B-1 @ 30'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
19%	67%	14%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	94.6%
#4	80.8%
#8	70.4%
#16	65.1%
#30	61.4%
#50	55.4%
#100	21.4%
#200	13.8%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Silty SAND (SM)

Project Name: Proposed Commercial Center - Torrance, CA

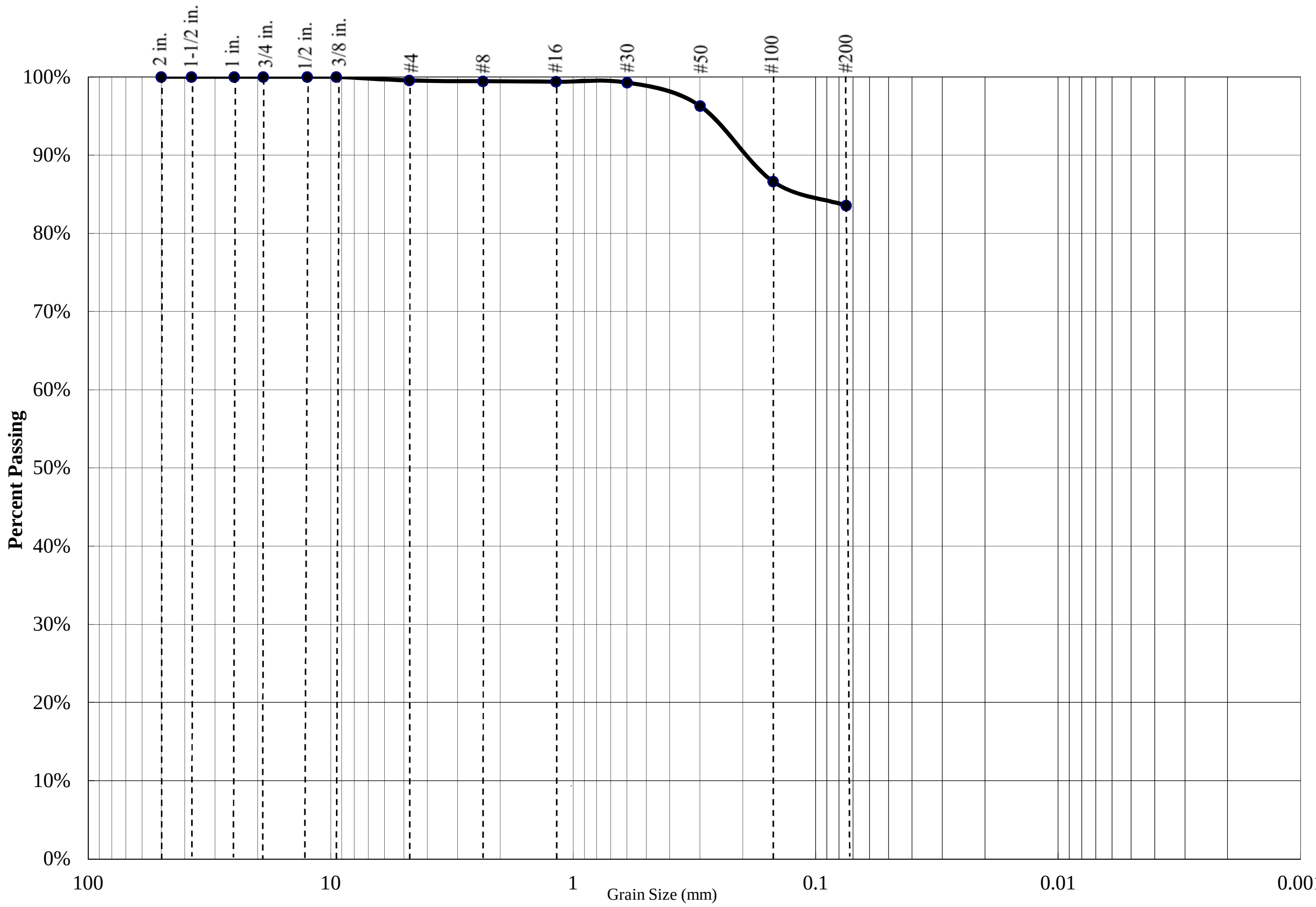
Project Number: 3-219-0913

Boring: B-1 @ 40'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	16%	84%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.6%
#8	99.4%
#16	99.4%
#30	99.3%
#50	96.3%
#100	86.6%
#200	83.5%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Clayey SILT with Sand (ML)

Project Name: Proposed Commercial Center - Torrance, CA

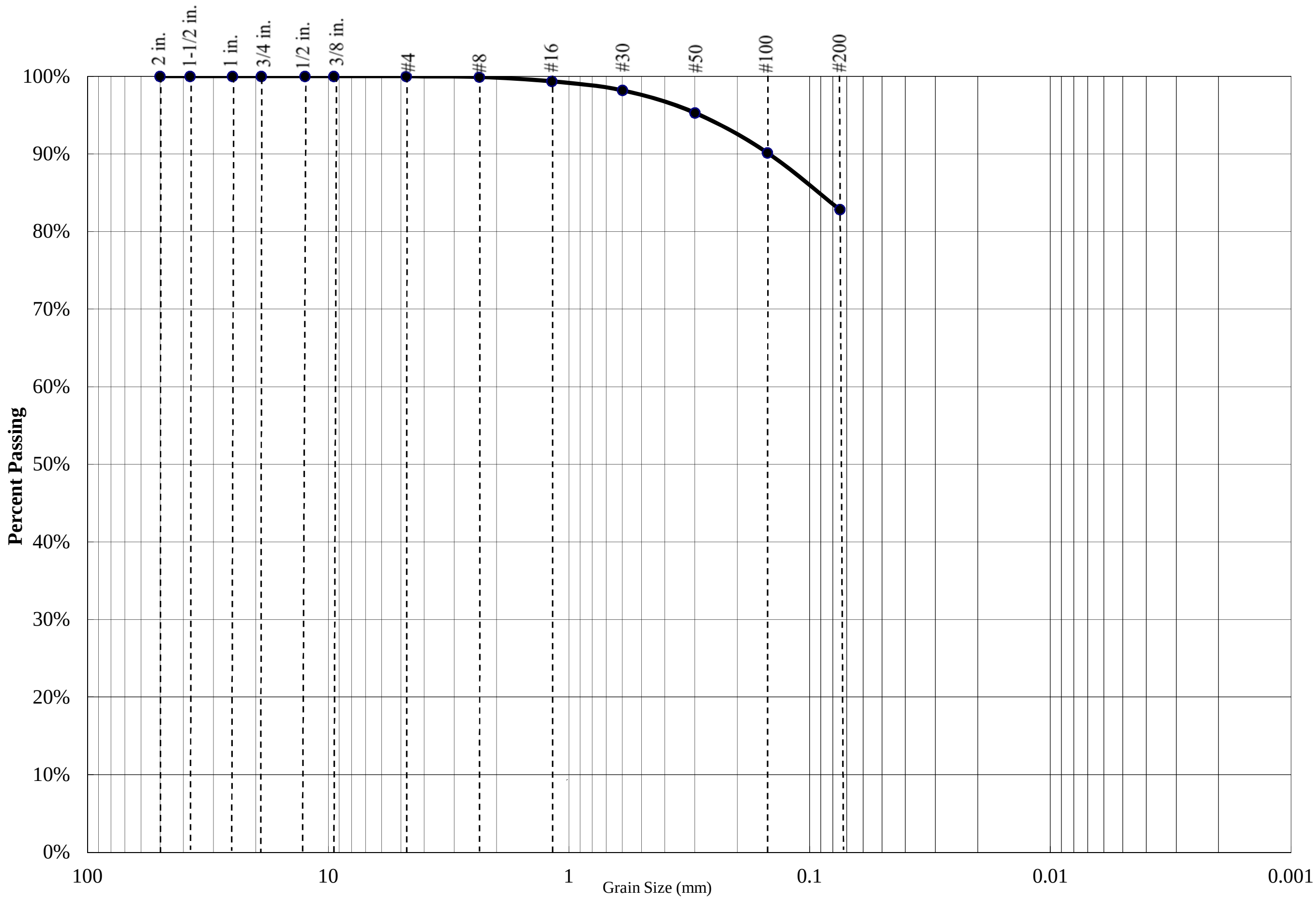
Project Number: 3-219-0913

Boring: B-1 @ 50'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	17%	83%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.9%
#16	99.3%
#30	98.2%
#50	95.3%
#100	90.1%
#200	82.8%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Silty Clay with Sand (CL)

Project Name: Proposed Commercial Center - Torrance, CA

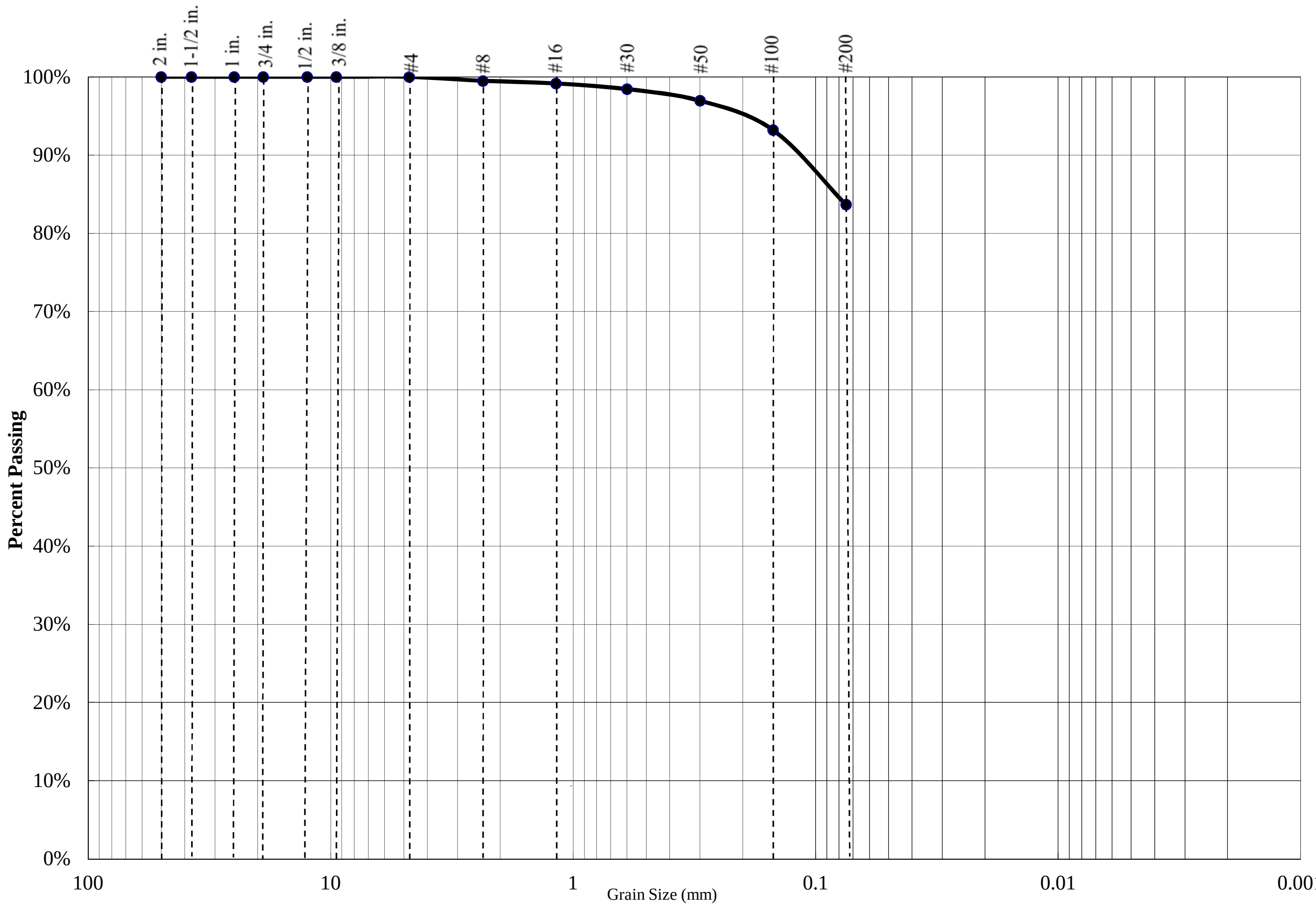
Project Number: 3-219-0913

Boring: B-4 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	16%	84%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.5%
#16	99.2%
#30	98.4%
#50	97.0%
#100	93.2%
#200	83.7%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients					
D_{85}=		**D_{60}=**		**D_{50}=**	
D_{30}=		**D_{15}=**		**D_{10}=**	
C_u=	N/A	**C_c=**	N/A		

USCS CLASSIFICATION
Silty Clay with Sand (CL)

Project Name: Proposed Commercial Center - Torrance, CA

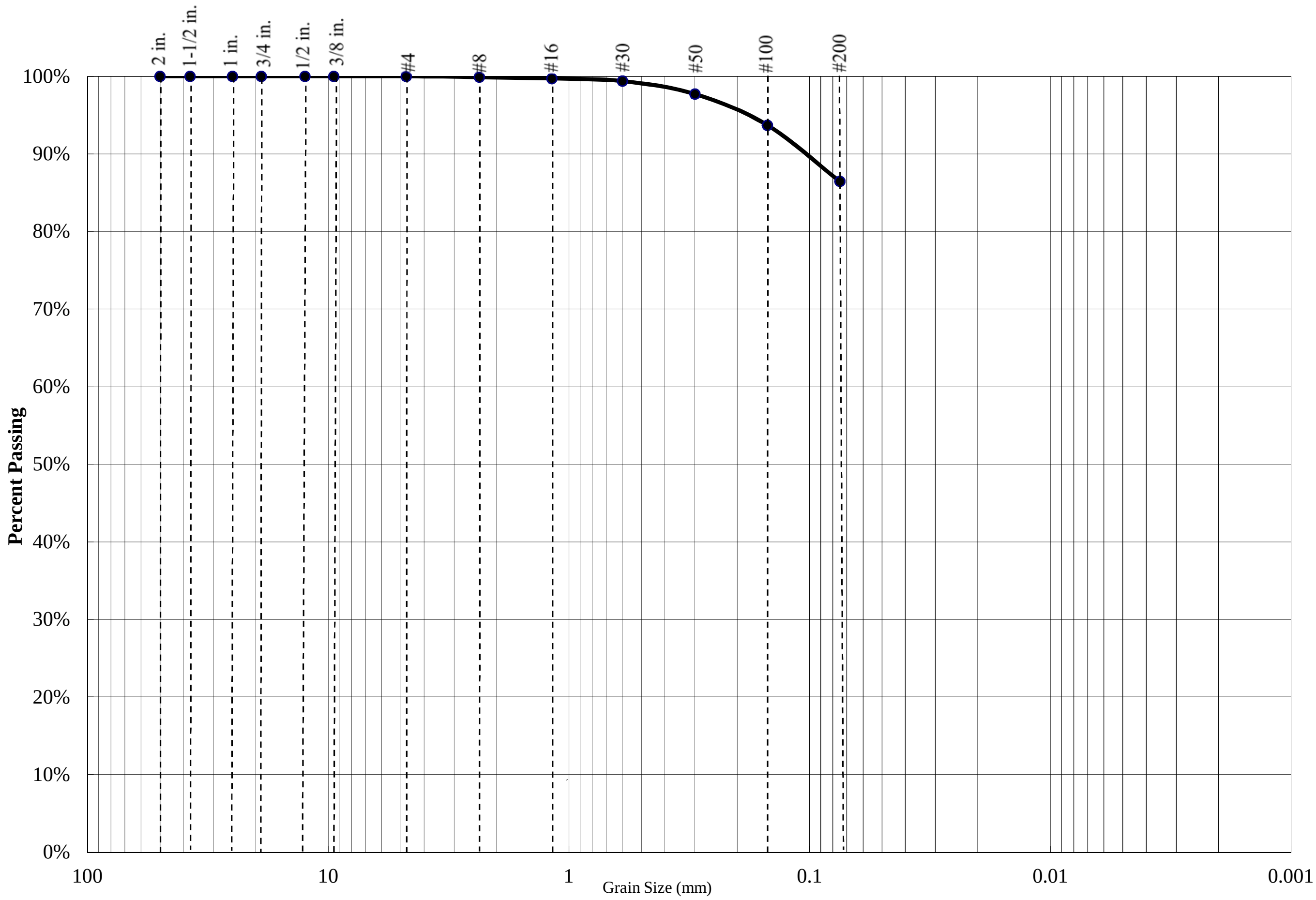
Project Number: 3-219-0913

Boring: B-4 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	13%	86%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.9%
#16	99.7%
#30	99.4%
#50	97.7%
#100	93.7%
#200	86.5%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Silty Clay (CL)

Project Name: Proposed Commercial Center - Torrance, CA

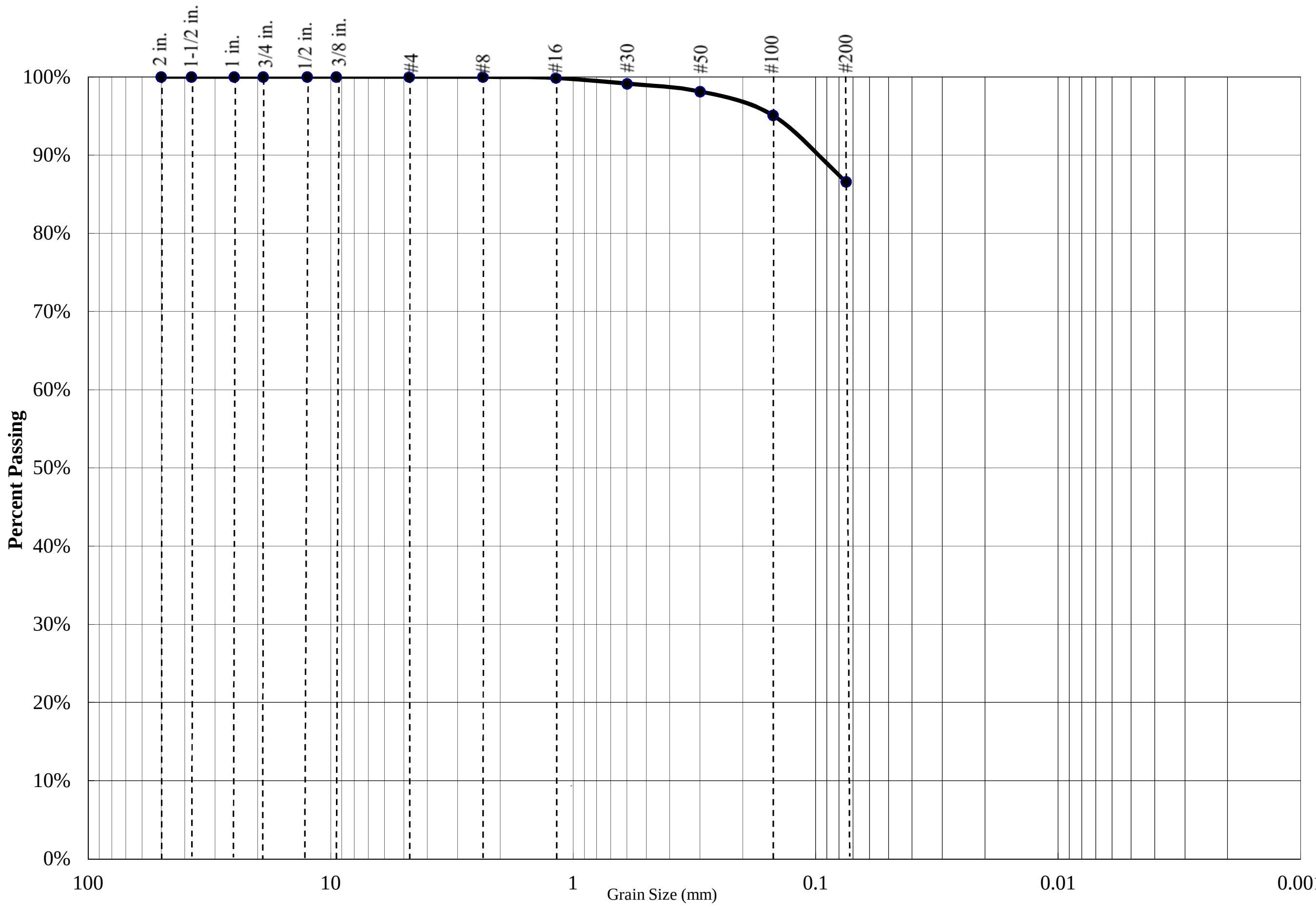
Project Number: 3-219-0913

Boring: B-6 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	13%	87%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	100.0%
#16	99.9%
#30	99.1%
#50	98.1%
#100	95.1%
#200	86.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Silty Clay (CL)

Project Name: Proposed Commercial Center - Torrance, CA

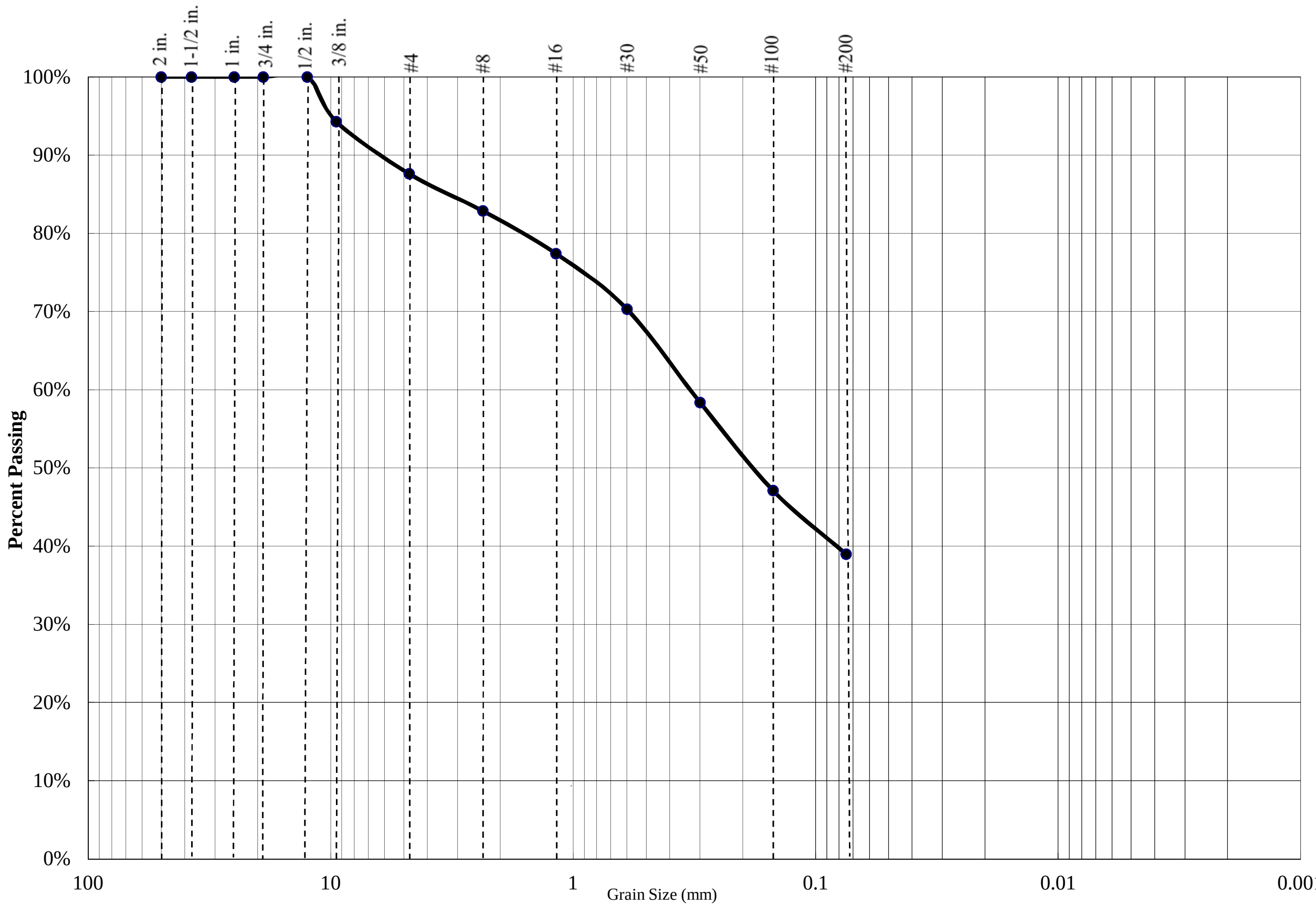
Project Number: 3-219-0913

Boring: B-6 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
12%	49%	39%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	94.3%
#4	87.6%
#8	82.9%
#16	77.4%
#30	70.3%
#50	58.4%
#100	47.1%
#200	39.0%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Silty, Clayey SAND (SC-SM)

Project Name: Proposed Commercial Center - Torrance, CA

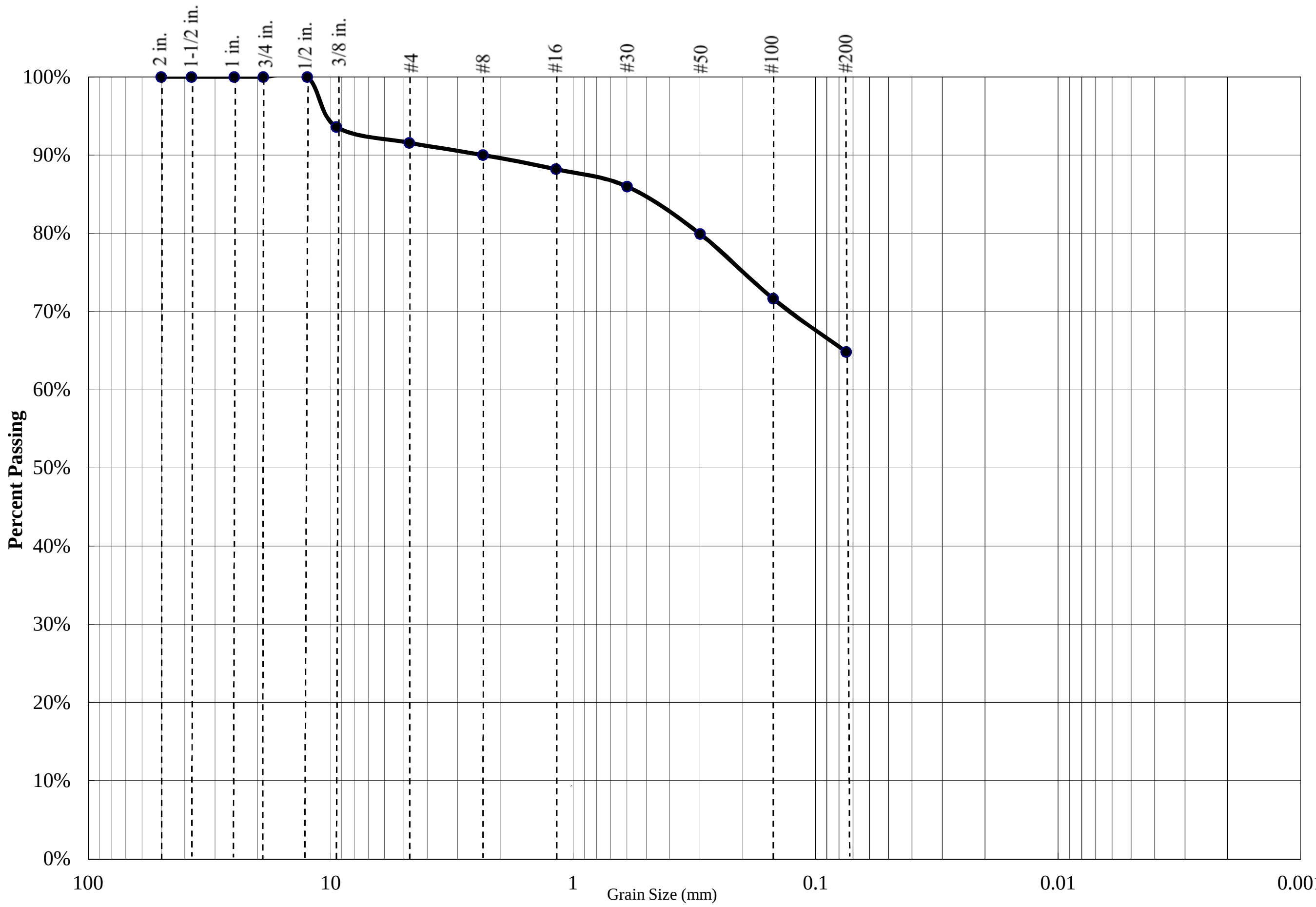
Project Number: 3-219-0913

Boring: B-10 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
8%	27%	65%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	93.6%
#4	91.6%
#8	90.0%
#16	88.2%
#30	86.0%
#50	79.9%
#100	71.6%
#200	64.8%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
Sandy CLAY (CL)

Project Name: Proposed Commercial Center - Torrance, CA

Project Number: 3-219-0913

Boring: B-10 @ 5'

SALEM engineering group, inc.

EXPANSION INDEX TEST
ASTM D4829

Project Name: Proposed Commercial Center - Torrance, CA
Project Number: 3-219-0913
Date Sampled: 12/02/19 - 12/03/19   Date Tested: 12/11/19
Sampled By: SK   Tested By: M. Noorzay
Sample Location: B-1 @ 0'-4'
Soil Description: Brown Silty Clay (CL)

Trial #	1	2	3
Weight of Soil & Mold, g.	771.0		
Weight of Mold, g.	368.5		
Weight of Soil, g.	402.5		
Wet Density, pcf	121.4		
Weight of Moisture Sample (Wet), g.	800.0		
Weight of Moisture Sample (Dry), g.	726.0		
Moisture Content, %	10.2		
Dry Density, pcf	110.2		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	52.0		

Time	Inital	30 min	1 hr	6 hrs	12 hrs	24 hrs
Dial Reading	0	0.009	0.022	--	--	0.042

Expansion Index $_{measured}$ = 42
Expansion Index $_{50}$ = 43.3

Expansion Index = 43

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

SALEM engineering group, inc.

CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: Proposed Commercial Center - Torrance, CA
Project Number: 3-219-0913
Date Sampled: 12/02/19 - 12/03/19 Date Tested: 12/11/19
Sampled By: SK Tested By: M. Noorzay
Soil Description: Brown Silty Clay (CL)

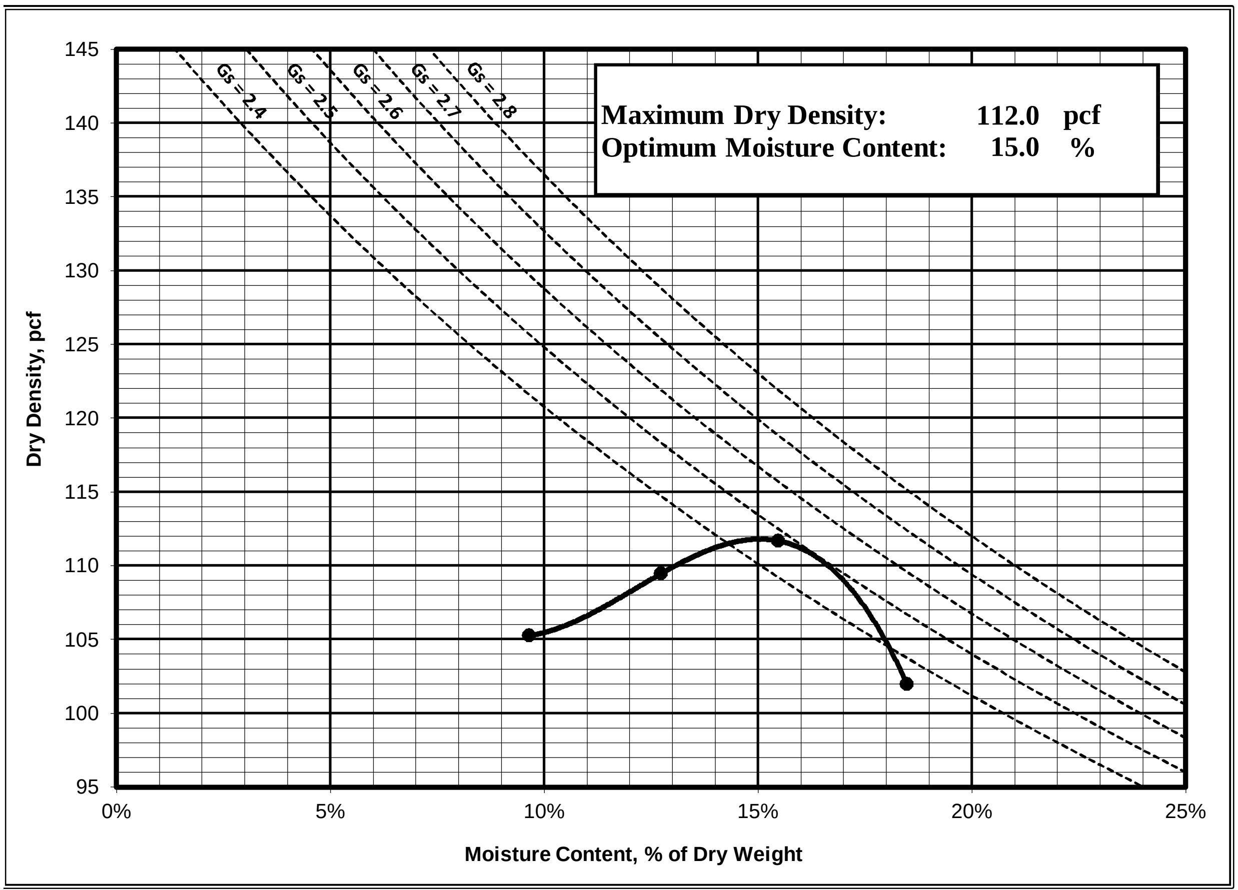
Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-1 @ 0'-4'	900 mg/kg	236 mg/kg	8.3
1b.	B-1 @ 0'-4'	900 mg/kg	232 mg/kg	8.3
1c.	B-1 @ 0'-4'	900 mg/kg	232 mg/kg	8.3
Average:		**900 mg/kg**	**233 mg/kg**	**8.3**

SALEM engineering group, inc.

Laboratory Compaction Curve
ASTM D1557

Project Name: Proposed Commercial Center - Torrance, CA
Project Number: 3-219-0913
Date Sampled: 12/02/19 - 12/03/19 Date Tested: 12/10/19
Sampled By: SK Tested By: M. Noorzay
Sample Location: B-1 @ 0'-4'
Soil Description: Brown Silty Clay (CL)
Test Method: Method A

	1	2	3	4
Weight of Moist Specimen & Mold, (g)	4003.2	4124.3	4208.0	4085.0
Weight of Compaction Mold, (g)	2258.4	2258.4	2258.4	2258.4
Weight of Moist Specimen, (g)	1744.8	1865.9	1949.6	1826.6
Volume of Mold, (ft^3)	0.0333	0.0333	0.0333	0.0333
Wet Density, (pcf)	115.4	123.4	128.9	120.8
Weight of Wet (Moisture) Sample, (g)	100.0	100.0	100.0	100.0
Weight of Dry (Moisture) Sample, (g)	91.2	88.7	86.6	84.4
Moisture Content, (%)	9.6%	12.7%	15.5%	18.5%
Dry Density, (pcf)	105.2	109.5	111.7	102.0



SALEM engineering group, inc.

APPENDIX

C

APPENDIX C
GENERAL EARTHWORK AND PAVEMENT SPECIFICATIONS

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

1.0 SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including, but not limited to, the furnishing of all labor, tools and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans and disposal of excess materials.

2.0 PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of SALEM Engineering Group, Incorporated, hereinafter referred to as the Soils Engineer and/or Testing Agency. Attainment of design grades, when achieved, shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary adjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer, or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

3.0 TECHNICAL REQUIREMENTS: All compacted materials shall be densified to no less that 95 percent of relative compaction (90 percent for cohesive soils) based on ASTM D1557 Test Method (latest edition), UBC or CAL-216, or as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

4.0 SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the Geotechnical Engineering Report. The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

5.0 DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or wind-blown materials attributable to his work. Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.

6.0 CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter and all other matter determined by the Soils Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed improvement areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations is not permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

7.0 SUBGRADE PREPARATION: Surfaces to receive Engineered Fill and/or building or slab loads shall be prepared as outlined above, scarified to a minimum of 12 inches, moisture-conditioned as necessary, and recompacted to 95 percent relative compaction (90 percent for cohesive soils).

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 95 percent relative compaction (90 percent for cohesive soils). All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any fill material.

8.0 EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

9.0 FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence or approval of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills, provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

10.0 PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. Compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer. Both cut and fill shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

11.0 SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing, or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill is as specified.

12.0 DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

The term "Standard Specifications": hereinafter referred to, is the most recent edition of the Standard Specifications of the State of California, Department of Transportation. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as determined by ASTM D1557 Test Method (latest edition) or California Test Method 216 (CAL-216), as applicable.

13.0 PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 95% (90% for cohesive soil) based upon ASTM D1557. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

14.0 AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, ¾-inch or 1½-inches maximum size. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

15.0 AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II Subbase material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216, and it shall be spread and compacted in accordance with the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

16.0 ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10, unless otherwise stipulated or local conditions warrant more stringent grade. The mineral aggregate shall be Type A or B, ½ inch maximum size, medium grading, and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning, and mixing of the materials shall conform to Section 39. The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with a combination steel-wheel and pneumatic rollers, as described in the Standard Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-1**
Tested by: **SK**
Drilled Hole Depth: **10** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:40	12:10	10.0	Y	0:30	7.26	7.38	1.44	30	72.38	858.5		0.17
12:10	12:40	10.0	N	0:30	7.38	7.48	1.20	30	60.32	825.4		0.15
12:40	13:10	10.0	N	0:30	7.48	7.57	1.08	30	54.29	796.7		0.14
13:10	13:40	10.0	N	0:30	7.57	7.65	0.96	30	48.25	771.1		0.13
13:40	14:10	10.0	N	0:30	7.65	7.73	0.96	30	48.25	746.9		0.13
14:10	14:40	10.0	N	0:30	7.73	7.80	0.84	30	42.22	724.3		0.12
14:40	15:10	10.0	N	0:30	7.80	7.86	0.72	30	36.19	704.7		0.10
15:10	15:40	10.0	N	0:30	7.86	7.92	0.72	30	36.19	686.6		0.11
15:40	16:10	10.0	N	0:30	7.92	7.98	0.72	30	36.19	668.5		0.11
16:10	16:40	10.0	N	0:30	7.98	8.04	0.72	30	36.19	650.4		0.11
Recommended for Design:							**Percolation Rate***		**36.19**			**0.11**

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-2**
Tested by: **SK**
Drilled Hole Depth: **10** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:30	12:00	10.0	Y	0:30	7.73	7.81	0.96	30	48.25	722.8		0.13
12:00	12:30	10.0	N	0:30	7.81	7.88	0.84	30	42.22	700.2		0.12
12:30	13:00	10.0	N	0:30	7.88	7.95	0.84	30	42.22	679.1		0.12
13:00	13:30	10.0	N	0:30	7.95	8.01	0.72	30	36.19	659.5		0.11
13:30	14:00	10.0	N	0:30	8.01	8.07	0.72	30	36.19	641.4		0.11
14:00	14:30	10.0	N	0:30	8.07	8.12	0.60	30	30.16	624.8		0.10
14:30	15:00	10.0	N	0:30	8.12	8.17	0.60	30	30.16	609.7		0.10
15:00	15:30	10.0	N	0:30	8.17	8.21	0.48	30	24.13	596.1		0.08
15:30	16:00	10.0	N	0:30	8.21	8.25	0.48	30	24.13	584.1		0.08
16:00	16:30	10.0	N	0:30	8.25	8.29	0.48	30	24.13	572.0		0.08
Recommended for Design:								**Percolation Rate***	**24.13**			**0.08**

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-3**
Tested by: **SK**
Drilled Hole Depth: **10** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
12:10	12:40	10.0	Y	0:30	7.13	7.26	1.56	30	78.41	896.2		0.17
12:40	13:10	10.0	N	0:30	7.26	7.37	1.32	30	66.35	860.0		0.15
13:10	13:40	10.0	N	0:30	7.37	7.47	1.20	30	60.32	828.4		0.15
13:40	14:10	10.0	N	0:30	7.47	7.56	1.08	30	54.29	799.7		0.14
14:10	14:40	10.0	N	0:30	7.56	7.64	0.96	30	48.25	774.1		0.12
14:40	15:10	10.0	N	0:30	7.64	7.70	0.72	30	36.19	753.0		0.10
15:10	15:40	10.0	N	0:30	7.70	7.76	0.72	30	36.19	734.9		0.10
15:40	16:10	10.0	N	0:30	7.76	7.82	0.72	30	36.19	716.8		0.10
16:10	16:40	10.0	N	0:30	7.82	7.87	0.60	30	30.16	700.2		0.09
16:40	17:10	10.0	N	0:30	7.87	7.92	0.60	30	30.16	685.1		0.09
Recommended for Design:								**Percolation Rate***	**32.17**			**0.09**

Percolation Test Worksheet

Project: Proposed Commercial Center
190th Street & Western Avenue
Torrance, California

Job No.: 3-219-0913
Date Drilled: 12/2/2019
Soil Classification:

Vol. in 1" Wtr Col. (in^3): 50.3

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: P-4
Tested by: SK
Drilled Hole Depth: 5 ft.

Presoaking Date: 12/2/2019
Test Date: 12/3/2019

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:50	12:20	5.0	Y	0:30	2.80	2.87	0.84	30	42.22	703.2		0.12
12:20	12:50	5.0	N	0:30	2.87	2.92	0.60	30	30.16	685.1		0.09
12:50	13:20	5.0	N	0:30	2.92	2.96	0.48	30	24.13	671.5		0.07
13:20	13:50	5.0	N	0:30	2.96	3.00	0.48	30	24.13	659.5		0.07
13:50	14:20	5.0	N	0:30	3.00	3.03	0.36	30	18.10	648.9		0.06
14:20	14:50	5.0	N	0:30	3.03	3.06	0.36	30	18.10	639.9		0.06
14:50	15:20	5.0	N	0:30	3.06	3.09	0.36	30	18.10	630.8		0.06
15:20	15:50	5.0	N	0:30	3.09	3.12	0.36	30	18.10	621.8		0.06
15:50	16:20	5.0	N	0:30	3.12	3.14	0.24	30	12.06	614.2		0.04
16:20	16:50	5.0	N	0:30	3.14	3.16	0.24	30	12.06	608.2		0.04
Recommended for Design:								**Percolation Rate***	**14.07**			**0.05**

Percolation Test Worksheet

Project: Proposed Commercial Center
190th Street & Western Avenue
Torrance, California

Job No.: 3-219-0913
Date Drilled: 12/2/2019
Soil Classification:

Vol. in 1" Wtr Col. (in^3): 50.3

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: P-5
Tested by: SK
Drilled Hole Depth: 10 ft.

Presoaking Date: 12/2/2019
Test Date: 12/3/2019

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
12:00	12:30	10.0	Y	0:30	7.67	7.78	1.32	30	66.35	736.4		0.18
12:30	13:00	10.0	N	0:30	7.78	7.88	1.20	30	60.32	704.7		0.17
13:00	13:30	10.0	N	0:30	7.88	7.97	1.08	30	54.29	676.1		0.16
13:30	14:00	10.0	N	0:30	7.97	8.05	0.96	30	48.25	650.4		0.15
14:00	14:30	10.0	N	0:30	8.05	8.13	0.96	30	48.25	626.3		0.15
14:30	15:00	10.0	N	0:30	8.13	8.20	0.84	30	42.22	603.7		0.14
15:00	15:30	10.0	N	0:30	8.20	8.27	0.84	30	42.22	582.6		0.14
15:30	16:00	10.0	N	0:30	8.27	8.33	0.72	30	36.19	563.0		0.13
16:00	16:30	10.0	N	0:30	8.33	8.39	0.72	30	36.19	544.9		0.13
16:30	17:00	10.0	N	0:30	8.39	8.45	0.72	30	36.19	526.8		0.14
Recommended for Design:							**Percolation Rate***		**36.19**			**0.13**

Percolation Test Worksheet

Project: **Proposed Commercial Center**
190th Street & Western Avenue
Torrance, California

Job No.: **3-219-0913**
Date Drilled: **12/2/2019**
Soil Classification:

Vol. in 1" Wtr Col. (in^3): **50.3**

Hole Dia.: 8 in.
Pipe Dia.: 3 in.

Test Hole No.: **P-6**
Tested by: **SK**
Drilled Hole Depth: **5** ft.

Presoaking Date: **12/2/2019**
Test Date: **12/3/2019**

Pipe stickup: 0 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Volume of Water Discharged (in^3)	Test Area (sidewalls & bottom) (in^2)		Measured Perc Rate (in/hr)
11:45	12:15	5.0	Y	0:30	3.14	3.21	0.84	30	42.22	600.7		0.14
12:15	12:45	5.0	N	0:30	3.21	3.27	0.72	30	36.19	581.1		0.12
12:45	13:15	5.0	N	0:30	3.27	3.32	0.60	30	30.16	564.5		0.11
13:15	13:45	5.0	N	0:30	3.32	3.36	0.48	30	24.13	550.9		0.09
13:45	14:15	5.0	N	0:30	3.36	3.39	0.36	30	18.10	540.4		0.07
14:15	14:45	5.0	N	0:30	3.39	3.42	0.36	30	18.10	531.3		0.07
14:45	15:15	5.0	N	0:30	3.42	3.44	0.24	30	12.06	523.8		0.05
15:15	15:45	5.0	N	0:30	3.44	3.46	0.24	30	12.06	517.7		0.05
15:45	16:15	5.0	N	0:30	3.46	3.48	0.24	30	12.06	511.7		0.05
16:15	16:45	5.0	N	0:30	3.48	3.50	0.24	30	12.06	505.7		0.05
Recommended for Design:								**Percolation Rate***	**12.06**			**0.05**

Attachment C

Calculations

Peak Flow Hydrologic Analysis

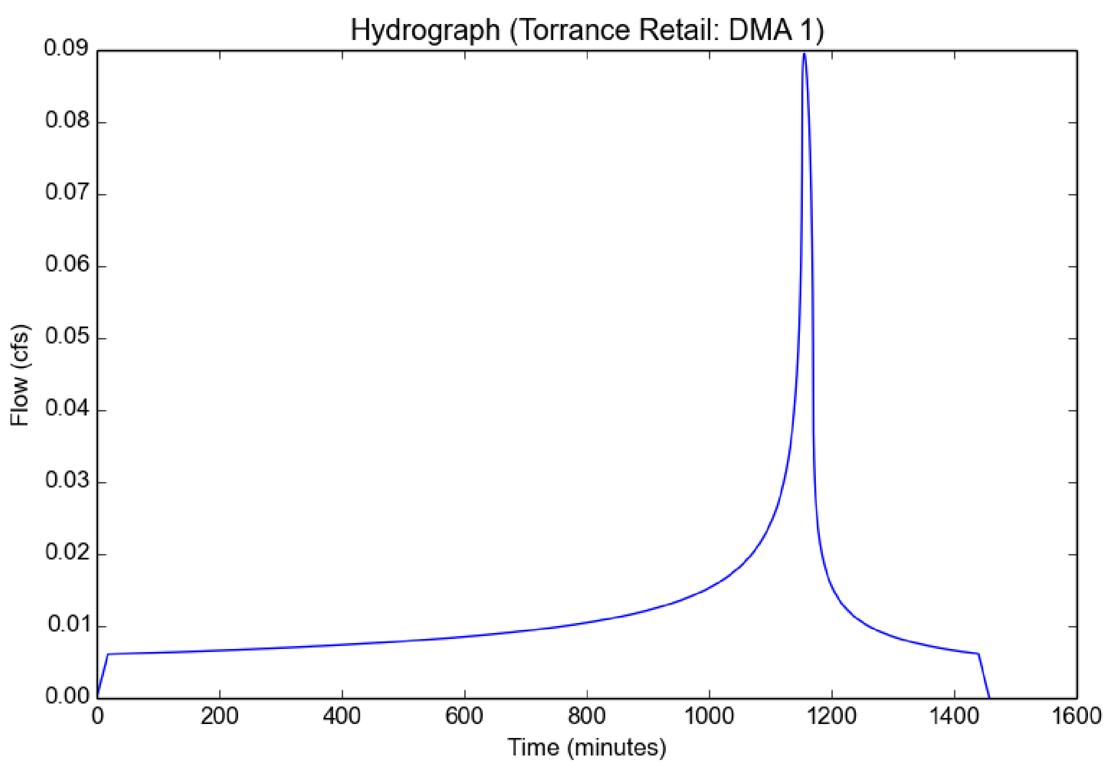
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 1_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 1
Area (ac)	0.464
Flow Path Length (ft)	208.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.695
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.2941
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.656
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	0.0895
Burned Peak Flow Rate (cfs)	0.0895
24-Hr Clear Runoff Volume (ac-ft)	0.0226
24-Hr Clear Runoff Volume (cu-ft)	986.2082



Peak Flow Hydrologic Analysis

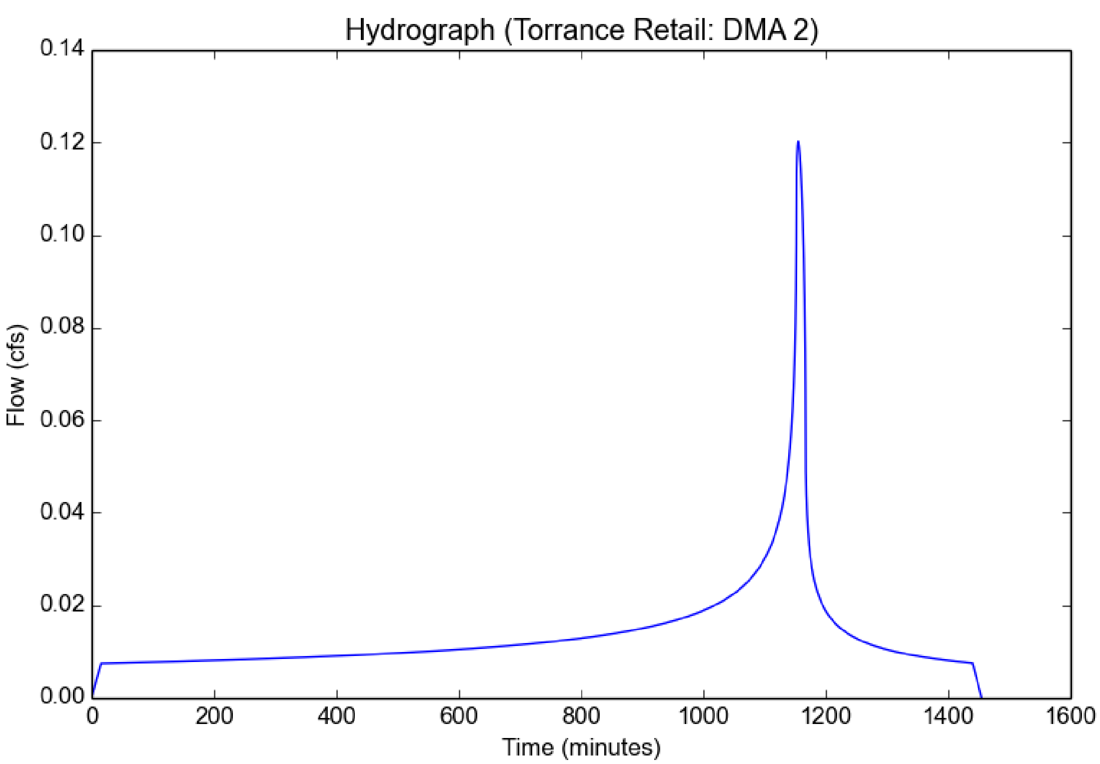
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 2_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 2
Area (ac)	0.444
Flow Path Length (ft)	216.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.93
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.3204
Undeveloped Runoff Coefficient (Cu)	0.1172
Developed Runoff Coefficient (Cd)	0.8452
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.1202
Burned Peak Flow Rate (cfs)	0.1202
24-Hr Clear Runoff Volume (ac-ft)	0.0279
24-Hr Clear Runoff Volume (cu-ft)	1214.2033



Peak Flow Hydrologic Analysis

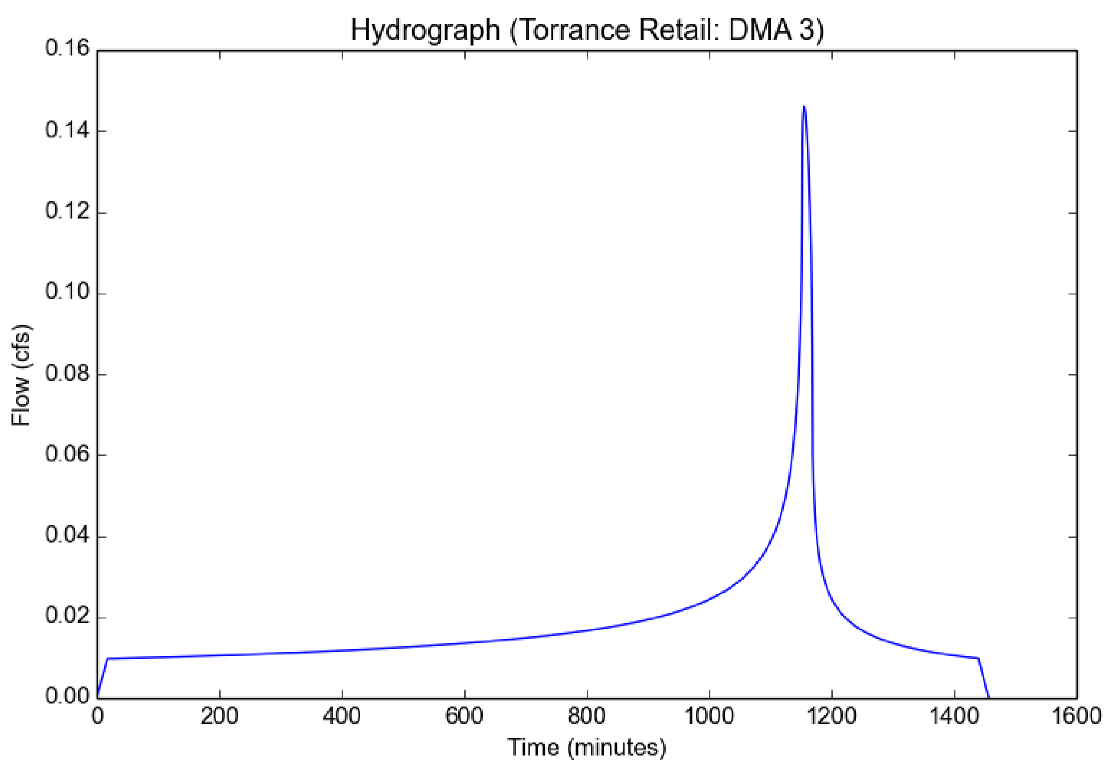
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 3_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 3
Area (ac)	0.638
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.013
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.822
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.3021
Undeveloped Runoff Coefficient (Cu)	0.1018
Developed Runoff Coefficient (Cd)	0.7579
Time of Concentration (min)	17.0
Clear Peak Flow Rate (cfs)	0.1461
Burned Peak Flow Rate (cfs)	0.1461
24-Hr Clear Runoff Volume (ac-ft)	0.036
24-Hr Clear Runoff Volume (cu-ft)	1566.0636



Peak Flow Hydrologic Analysis

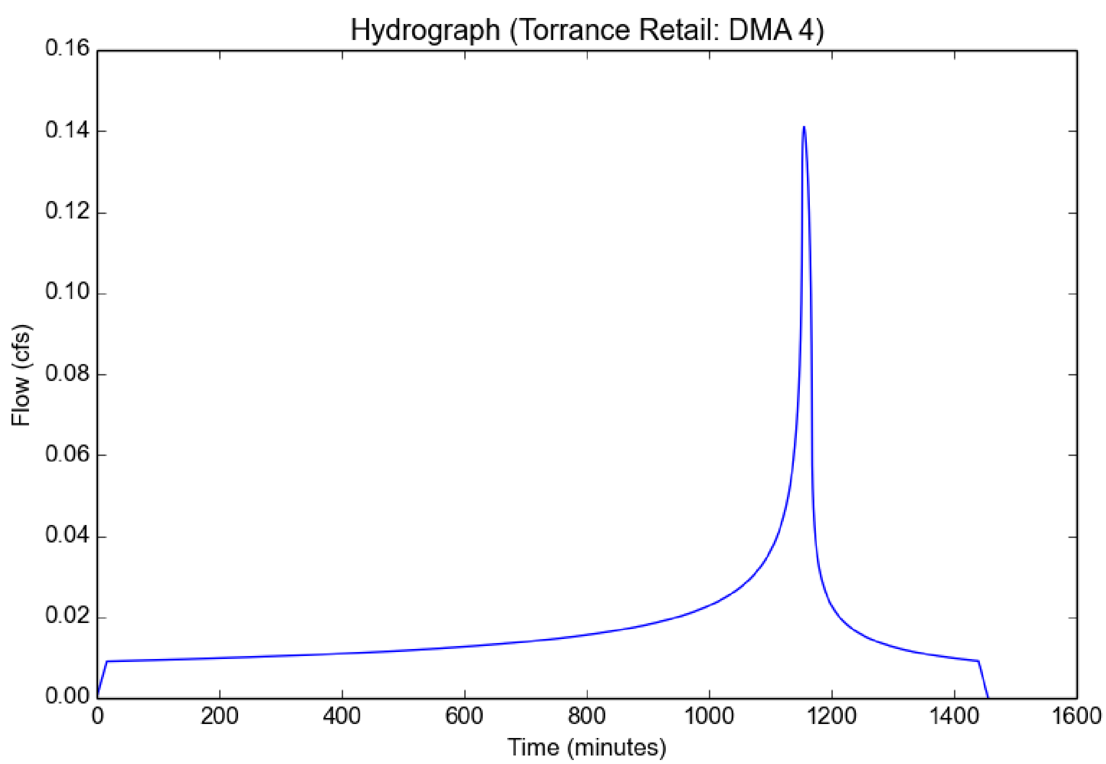
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 4_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 4
Area (ac)	0.605
Flow Path Length (ft)	252.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.81
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.3108
Undeveloped Runoff Coefficient (Cu)	0.1091
Developed Runoff Coefficient (Cd)	0.7497
Time of Concentration (min)	16.0
Clear Peak Flow Rate (cfs)	0.141
Burned Peak Flow Rate (cfs)	0.141
24-Hr Clear Runoff Volume (ac-ft)	0.0337
24-Hr Clear Runoff Volume (cu-ft)	1466.3196



Peak Flow Hydrologic Analysis

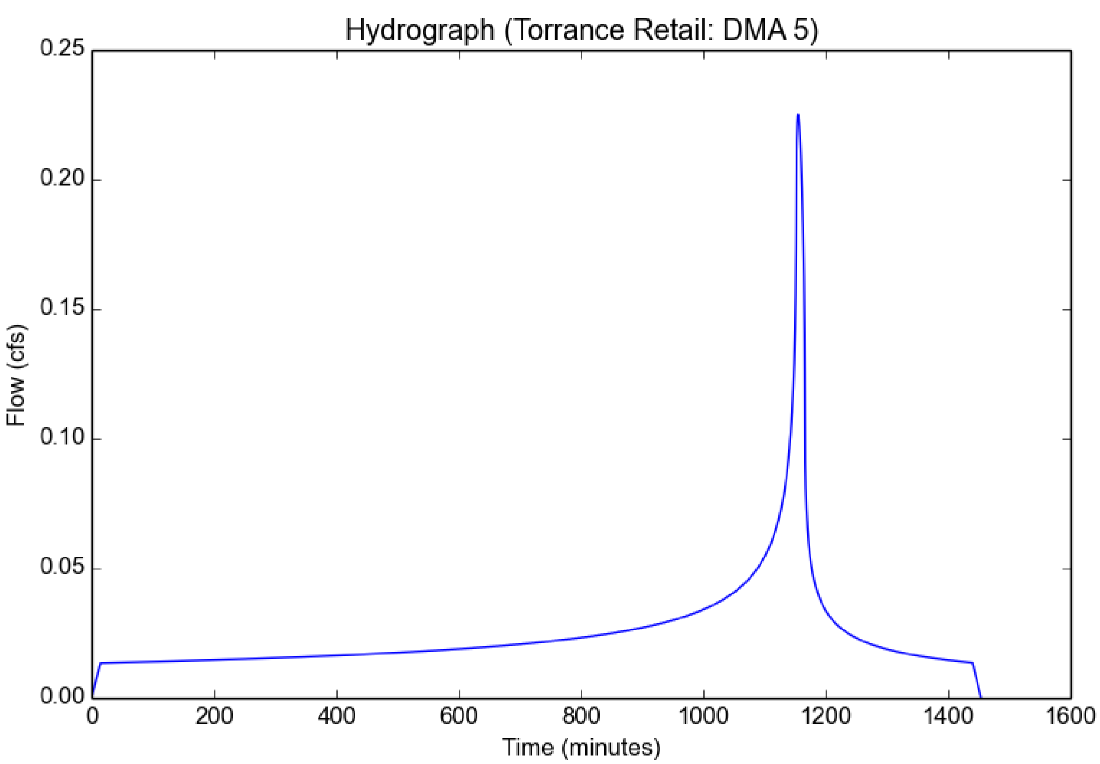
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 5_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 5
Area (ac)	0.913
Flow Path Length (ft)	170.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.8
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.331
Undeveloped Runoff Coefficient (Cu)	0.126
Developed Runoff Coefficient (Cd)	0.7452
Time of Concentration (min)	14.0
Clear Peak Flow Rate (cfs)	0.2252
Burned Peak Flow Rate (cfs)	0.2252
24-Hr Clear Runoff Volume (ac-ft)	0.0503
24-Hr Clear Runoff Volume (cu-ft)	2189.5719



Peak Flow Hydrologic Analysis

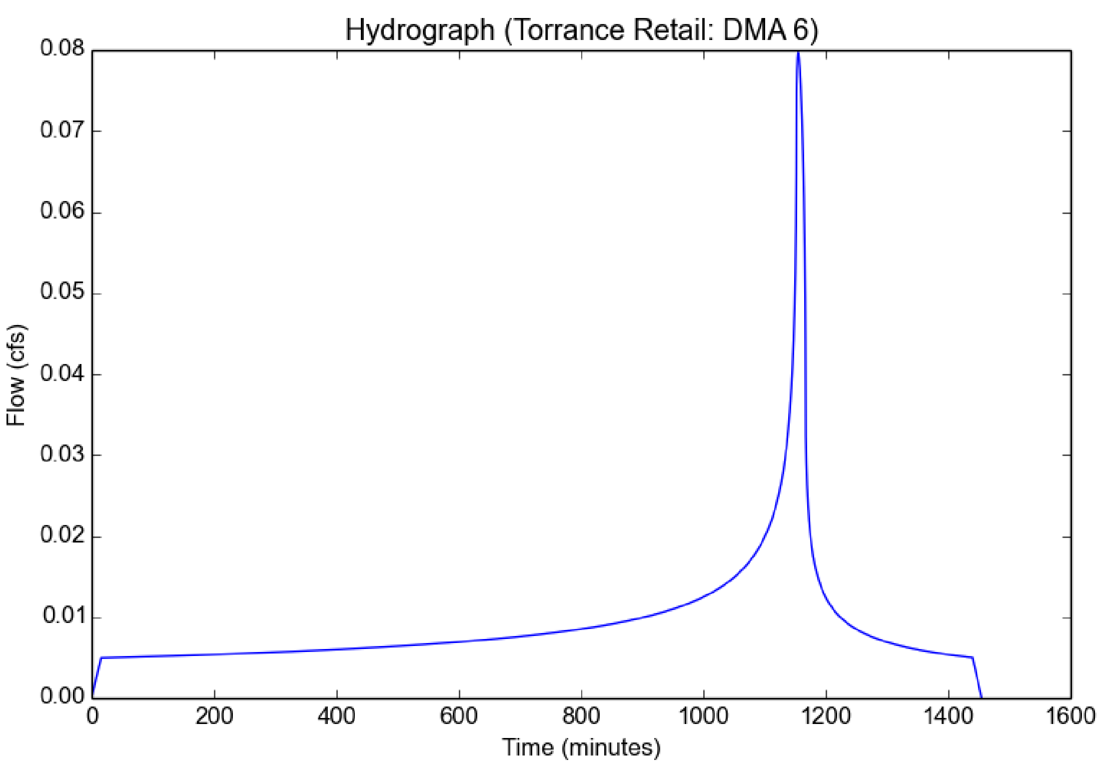
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 6_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 6
Area (ac)	0.349
Flow Path Length (ft)	180.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.761
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.3204
Undeveloped Runoff Coefficient (Cu)	0.1172
Developed Runoff Coefficient (Cd)	0.7129
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.0797
Burned Peak Flow Rate (cfs)	0.0797
24-Hr Clear Runoff Volume (ac-ft)	0.0184
24-Hr Clear Runoff Volume (cu-ft)	801.6332



Peak Flow Hydrologic Analysis

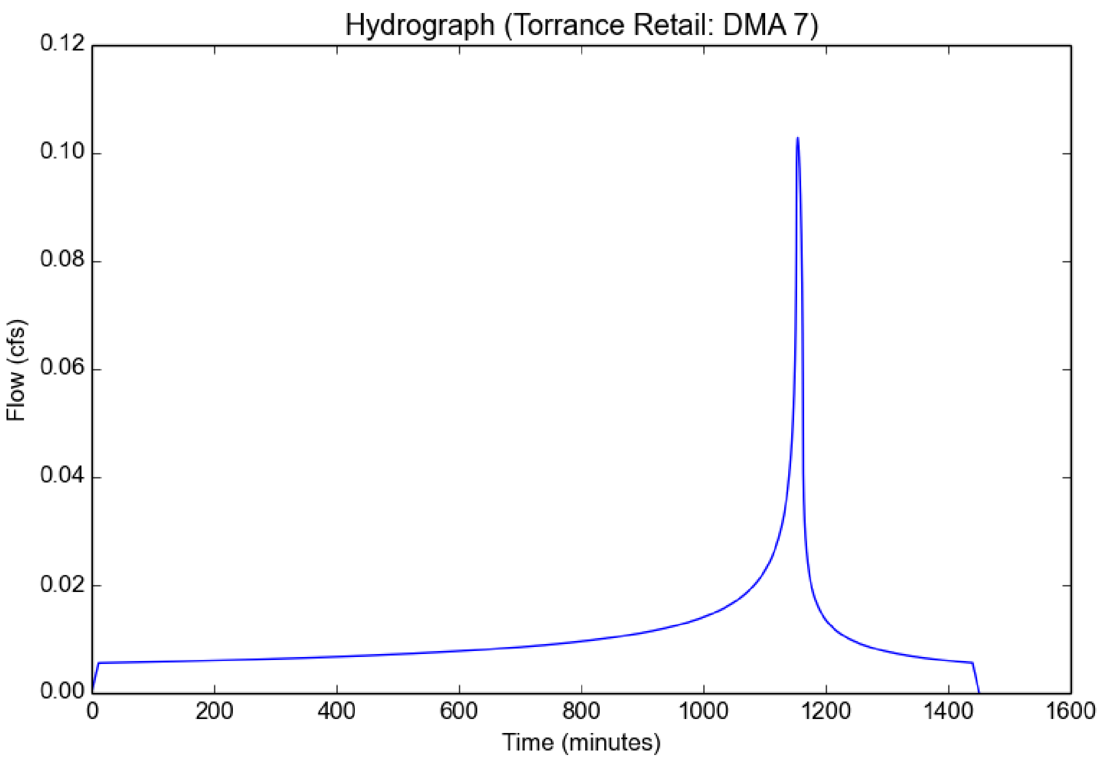
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 7_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 7
Area (ac)	0.319
Flow Path Length (ft)	133.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.959
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.3707
Undeveloped Runoff Coefficient (Cu)	0.1594
Developed Runoff Coefficient (Cd)	0.8696
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	0.1028
Burned Peak Flow Rate (cfs)	0.1028
24-Hr Clear Runoff Volume (ac-ft)	0.0206
24-Hr Clear Runoff Volume (cu-ft)	896.4104



Peak Flow Hydrologic Analysis

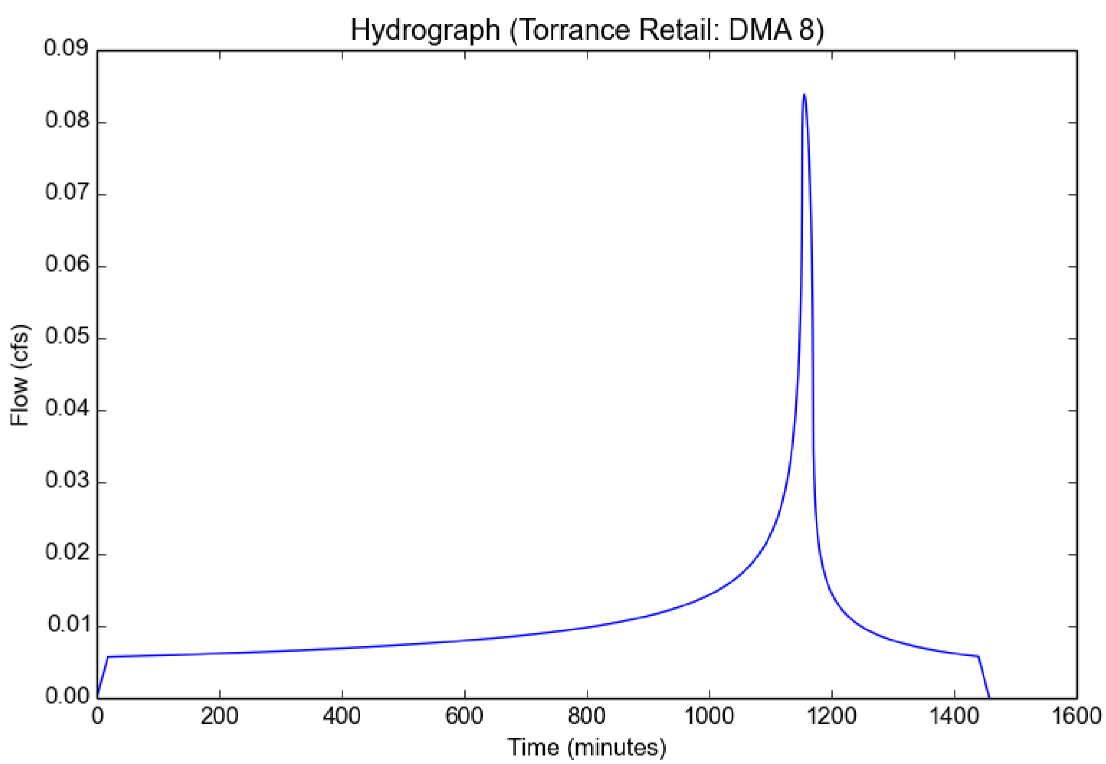
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 8_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 8
Area (ac)	0.362
Flow Path Length (ft)	260.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.859
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.2941
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.7872
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	0.0838
Burned Peak Flow Rate (cfs)	0.0838
24-Hr Clear Runoff Volume (ac-ft)	0.0212
24-Hr Clear Runoff Volume (cu-ft)	923.2949



Peak Flow Hydrologic Analysis

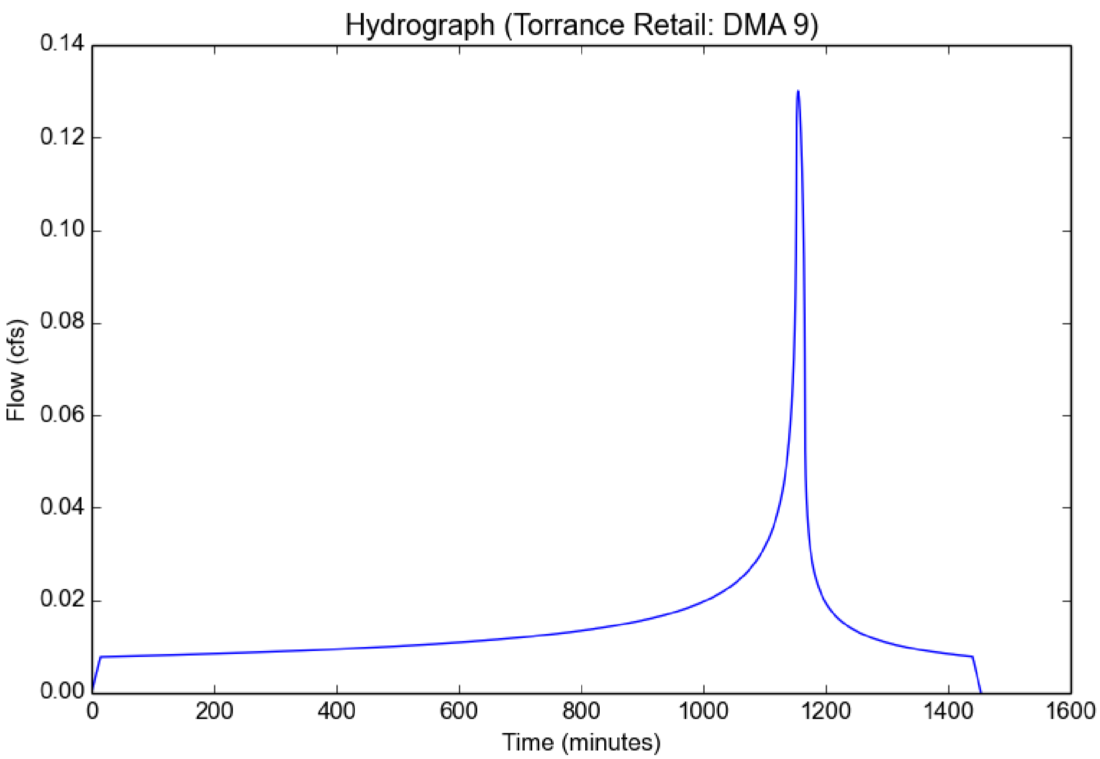
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 9_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 9
Area (ac)	0.522
Flow Path Length (ft)	185.0
Flow Path Slope (vft/hft)	0.014
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.81
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.331
Undeveloped Runoff Coefficient (Cu)	0.126
Developed Runoff Coefficient (Cd)	0.7529
Time of Concentration (min)	14.0
Clear Peak Flow Rate (cfs)	0.1301
Burned Peak Flow Rate (cfs)	0.1301
24-Hr Clear Runoff Volume (ac-ft)	0.029
24-Hr Clear Runoff Volume (cu-ft)	1265.3835



Peak Flow Hydrologic Analysis

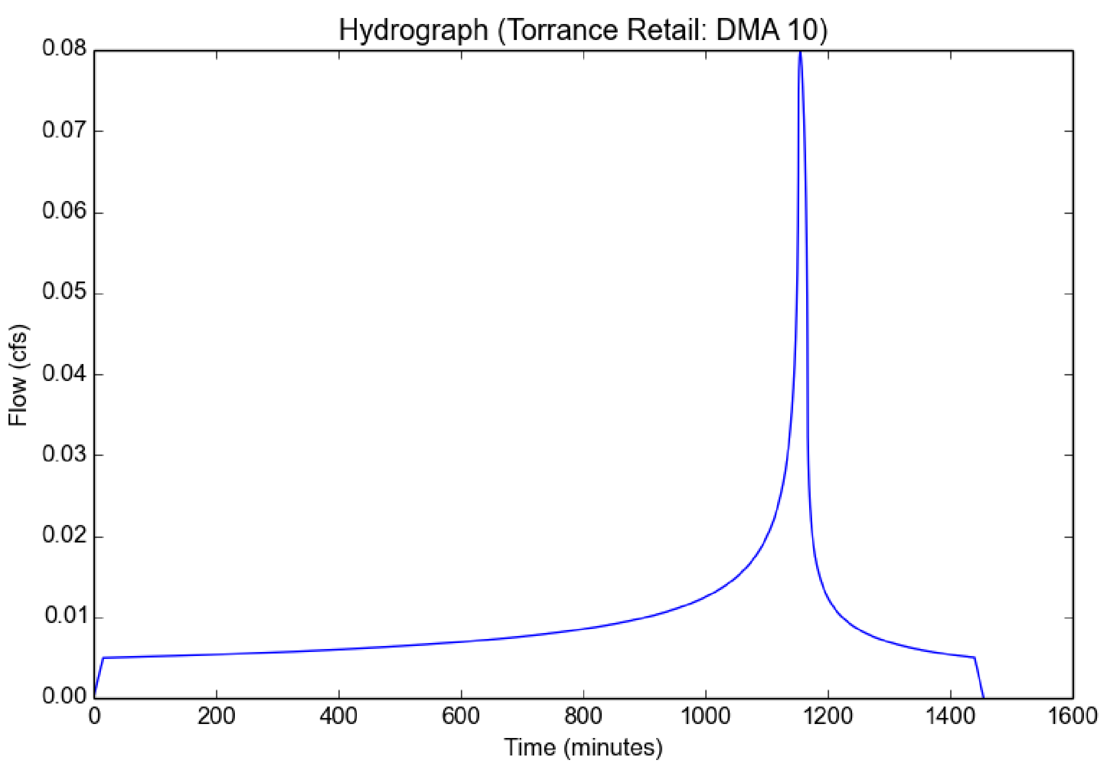
File location: M:/2018/18-935 Calbay Torrance/Reports/HM/Appendicies/Hydro-Calc/Proposed/LID/Torrance Retail - DMA 10_LID.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Torrance Retail
Subarea ID	DMA 10
Area (ac)	0.364
Flow Path Length (ft)	144.0
Flow Path Slope (vft/hft)	0.007
85th Percentile Rainfall Depth (in)	0.9
Percent Impervious	0.724
Soil Type	9
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.9
Peak Intensity (in/hr)	0.3204
Undeveloped Runoff Coefficient (Cu)	0.1172
Developed Runoff Coefficient (Cd)	0.6839
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.0798
Burned Peak Flow Rate (cfs)	0.0798
24-Hr Clear Runoff Volume (ac-ft)	0.0184
24-Hr Clear Runoff Volume (cu-ft)	801.2021



BMP Sizing Calculation Summary

DMA Designation	Tributary Area (sf)	Tributary Area (Ac)	Storm Water Quality Design Volume (SWQDv) (CF)	LID 85th Percentile Storm Flowrate (SWQDq) (CFS)	Design Flowrate (1.5 * SWQDq) (CFS)	BMP Type	Treatment Flow Provided (CFS)	BMP Size Provided
1	20,223	0.464	986	0.090	0.134	MWS-L-4-13-V	0.144	4'x13'
2	19,342	0.444	1214	0.120	0.180	MWS-L-8-8-V	0.23	8’X8’
3	27,801	0.638	1566	0.146	0.219	MWS-L-4-19-V	0.237	4'X19'
4	26,337	0.605	1466	0.141	0.212	MWS-L-8-8-V	0.23	8’X8’
5	39,779	0.913	2189	0.225	0.338	MWS-L-8-12-V	0.35	8’X12’
6	15,215	0.349	801	0.080	0.120	MWS-L-4-13-V	0.144	4'x13'
7	13,914	0.319	896	0.103	0.154	MWS-L-4-15-V	0.175	4’x15’
8	15,768	0.362	923	0.084	0.126	MWS-L-6-8-V	0.147	6'x8'
9	22,727	0.522	1265	0.130	0.195	MWS-L-8-8-V	0.23	8’X8’
10	15,840	0.364	801	0.080	0.120	MWS-L-6-8-C	0.147	6'x8'

Attachment D

Master Covenant Agreement (MCA)

RECORDING REQUESTED BY AND MAIL TO:

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

Space above this line is for Recorder's use

MAINTENANCE COVENANT FOR STANDARD URBAN STORMWATER MITIGATION (SUSMP) REQUIREMENTS

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

LEGAL DESCRIPTION

ASSESSOR'S ID # ________________ TRACT NO. ___________________ LOT NO.________________________
ADDRESS: ____
____

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

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

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

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

Owner(s):

By: ____ Date:________________________
By: ____ Date:________________________

(PLEASE ATTACH NOTARY)

Attachment E

Operations and Maintenance (O&M) Plan

Operations & Maintenance Plan for Low Impact Development Plan

Prepared for: Calbay Development, LLC

Site Address:

NW Corner of 190th St. & Western Ave.

Torrance, CA

Permit No. TBD

REQUIRED PERMITS

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

- Grading Permit: TBD

RESPONSIBLE PARTY

The owner is aware of the maintenance responsibilities of the proposed BMPs. Owner will ensure site tenant is fully aware of tenant obligation to maintain on-site storm-water quality features and tenant provides budget line-item for maintenance costs.

Owner contact below:

Name: ______________________________

Company: ______________________________

Title: ______________________________

Address 1: ______________________________

Address 2: ______________________________

Phone Number: ______________________________

Email: ______________________________

BEST MANAGEMENT PRACTICES (BMP) INSPECTION/MAINTENANCE:

SOURCE CONTROLS-

Source Control BMP	Activity	Frequency
N1. Education for Property Owner's Tenants and Occupants	Distribute appropriate materials to owners, tenants, and/or occupants via contract language, mailings, website, or meetings.	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.
	Check City website for updated educational materials.	Annually
N2. Activity Restrictions	Within the CC&R's or lease agreement, restrict the following activities: **Refer to CC&Rs** for full comprehensive list of restrictions to include (but not necessarily limited to): No assembling, manufacturing, distilling, refining, smelting, agricultural, or mining operations. Dumping, disposing, incineration or reduction of garbage. No automotive sales, leasing, storage, display or repair operations.	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.
N3/S4. Common Area Landscape Management, Efficient Landscape Design, and Efficient Irrigation	Check that fertilizer and pesticide usage is in accordance with the Integrated Pest Management Program. Adjust, if needed.	Annually
	Check the irrigation system water budget to ensure efficiency targets are being met and the system is in good condition. Adjust/repair irrigation system and controllers, if needed.	Annually prior to irrigation system activation
	Check landscaping for presence of invasive species and remove, if needed.	Annually
N11. Common Area Litter Control	Remove trash from around trash enclosure, inspect to ensure lids closed, structurally sound, and not overflowing. Repair or replace, as needed.	Monthly
	Inspect common area for litter and trash disposal violations by homeowners and reporting to the HOA or responsible party for investigation. Remove litter, as needed.	Weekly

Source Control BMP	Activity	Frequency
N12. Employee Training	Tenant shall provide training to employees and provide annual (or as necessary) refresher training thereafter to ensure employees adhere to site restrictions and are not engaged in activities which may have a negative impact to storm water. (see also N1)	Date of hire, annually thereafter
N14. Common Area Catch Basin Inspection	Remove trash and debris from catch basins and grates. Check for damage, clogging, and standing water. Repair or mitigate clogging/standing water, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
N15. Street Sweeping Private Streets and Parking Lots	Sweep curb and gutter areas using a vacuum street sweeper. Report any significant or illicit debris in curb/gutter to responsible party, as needed.	Weekly to Monthly
S1. Provide Storm Drain System Stenciling and Signage	Check that all catch basins in paved areas marked or stenciled with “No dumping-Drains to Ocean; No Descargue Basura” language. Replace/repaint markings if faded, damaged, removed, or otherwise illegible.	Annually
S3. Design and Construct Trash and Waste Storage Areas	Check that outdoor waste storage structure is consistently covered, that structural stability is sound, and that no run-on or contact of the trash with runoff is occurring. Repair leaks or damage and mitigate if trash coming into contact with stormwater, as needed.	Twice per year
	Check that trash is removed by local waste management contractor on at least a weekly basis for proper disposal.	Weekly
S5. Protect Slopes and Channels and Provide Energy Dissipation	Check slopes, channels, riprap and other conveyance or energy dissipation areas for signs of erosion or scour. Replace material, repair channels, replant vegetation, and/or redesign, as needed for signs of erosion/scour.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches

BEST MANAGEMENT PRACTICES (BMP) INSPECTION/MAINTENANCE:

Proprietary Biotreatment

Activity	Frequency
GENERAL INSPECTIONS	
Remove trash and debris	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
Identify excess erosion or scour	
Identify sediment accumulation that requires maintenance	
Inspect during storm event, when possible, to estimate treatment capacity and determine if premature bypass is occurring	
Evaluate plant health and need for corrective action	
Identify any needed corrective maintenance that will require site-specific planning or design	
OPERATION AND MAINTENANCE	

- O&M of proprietary BMPs must follow established manufacturer guidelines
  - See Site LID Plan for MWS unit sizes and locations on-site
  - See included Manufacturer Maintenance Guidelines for procedures and inspection report which is to be completed for each on-site unit and a copy provided to tenant and to owner
- O&M of proprietary BMPs must follow established manufacturer guidelines
  - See Site Grading and Drainage Plans for locations of Flexstorm inlet filters.
  - See included Manufacturer Specifications and work instructions for procedures and inspection report to be completed for on-site filters with copy to tenant and owner.

A Forterra Company

Modular Wetlands® Linear

A Stormwater Biofiltration Solution

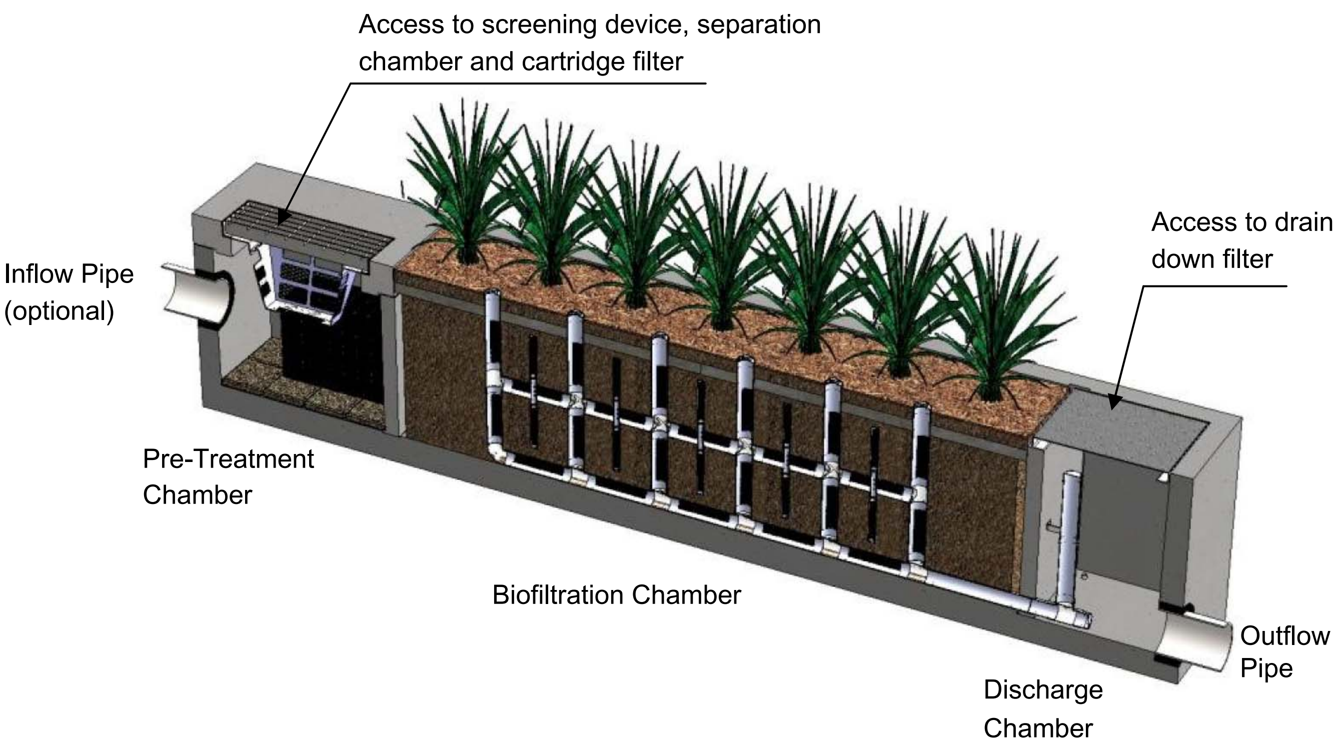
OPERATION & MAINTENANCE MANUAL

Maintenance Guidelines for Modular Wetlands Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

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

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

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

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

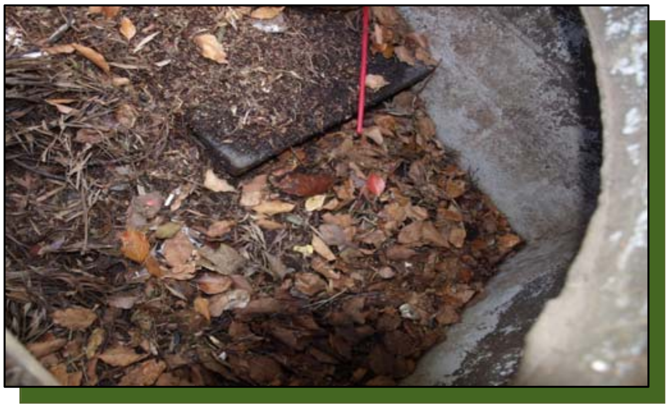
5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.



Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Report
Modular Wetlands Linear

Bio Clean
A Forterra Company

Project Name ______________________	For Office Use Only
Project Address ______________________ (city) (Zip Code)	(Reviewed By)
Owner / Management Company ______________________	(Date) Office personnel to complete section to the left.

Contact ______________________ Phone ( ) –

Inspector Name ______________________ Date ____/____/______ Time ____________ AM / PM

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

Weather Condition ______________________ Additional Notes ______________________

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): ____________ Size (22', 14' or etc.): ____________

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

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

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

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: ______________________

Bio Clean
A Forterra Company

Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name ______________________

Project Address ______________________
(city) (Zip Code)

Owner / Management Company ______________________

Contact ______________________ Phone (   )   –

Inspector Name ______________________ Date ____/____/______ Time ________ AM / PM

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

Weather Condition ______________________ Additional Notes ______________________

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

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

Comments:

<u>FLEXSTORM™ Inlet Filter Specifications and Work Instructions</u>

Product: **FLEXSTORM Inlet Filters**

Manufacturer: **Inlet & Pipe Protection, Inc** www.inletfilters.com

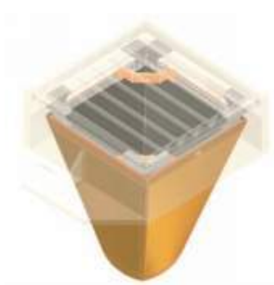
A subsidiary of **Advanced Drainage Systems (ADS)** www.ads-pipe.com

1.0 Description of Work:

1.1 The work covered shall consist of supplying, installing, and maintaining/cleaning of the FLEXSTORM Inlet Filter assembly. The purpose of the FLEXSTORM Inlet Filter system is to collect silt and sediment from surface storm water runoff at drainage locations shown on the plans or as directed by the Engineer. FLEXSTORM PURE, permanent filters, are capable of removing small particles, hydrocarbons, and other contaminants from drainage "hot spots".

2.0 Material:

2.1 The FLEXSTORM Inlet Filter system is comprised of a corrosion resistant steel frame and a replaceable geotextile sediment bag attached to the frame with a stainless steel locking band. The sediment bag hangs suspended from the rigid frame at a distance below the grate that shall allow full water flow into the drainage structure if the bag is completely filled with sediment.




2.2 The FLEXSTORM Inlet Filter frame includes lifting handles in addition to the standard overflow feature. A FLEXSTORM Removal Tool engages the lifting bars or handles to allow manual removal of the assembly without machine assistance. The frame suspension system on most rectangular designs is adjustable in ½" increments up to 5" per side should the casting or drainage structure have imperfections.



2.3 **FLEXSTORM CATCH-IT** Inlet Filters for temporary inlet protection: The FLEXSTORM CATCH-IT framing is galvanized or zinc plated for corrosion resistance. The **“FX”** Woven Polypropylene filter bag is the design standard, although the **“IL”** Nonwoven geotextile is also available if preferred by the engineer. These products are typically used for temporary inlet protection lasting 3 months (short term road work) to 5 years (residential developments).

2.4 **FLEXSTORM PURE** Inlet Filters for permanent inlet protection: The FLEXSTORM PURE framing is comprised of 304 stainless steel with a 25 year life rating. Multiple filter bags are available: **FX, FX+, PC, PC+, LL** and others. The Post Construction **“PC+”** is the design standard consisting of the **“FX”** Woven Polypropylene sediment bag lined with Adsorb-it filter fabric, which is made from recycled polyester fibers. The **“PC+”** includes a replaceable hydrocarbon skimmer pouch strapped to the bottom of the bag for advanced TPH removal.

3.0 Filter Bag Specifications and Capabilities:

3.1 Material Properties (taken from manufacturers average roll value):

FLEXSTORM FILTER BAGS	(22” depth) STD Bag P/N	(12” depth) Short Bag P/N	Clean Water Flow Rate (GPM/SqFt)	Min A.O.S. (US Sieve)
FX: Standard Woven Bag	FX	FX-S	200	40
FX+: Woven w/ Oil Skimmer	FXP	FXP-S	200	40
FXO: Woven w/ Oil Boom	FXO	FXO-S	200	40
PC: Post Construction Bag	PC	PC-S	137	140
PC+: PC w/ Oil Skimmer	PCP	PCP-S	137	140
LL: Litter and Leaf Bag	LL	LL-S	High	3.5
IL: IDOT Non-Woven Bag	IL	IL-S	145	70

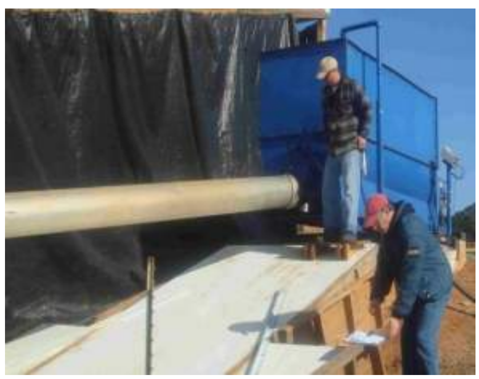
3.2 Standard Bag Sizes and Capabilities: Bag Sizes are determined by clear opening dimensions of the drainage structure. Once frame design size is confirmed, Small - XL bag ratings can be confirmed to meet design criteria. Ratings below are for standard 22” deep bags.

Standard Bag Size§	Solids Storage Capacity (CuFt)	Filtered Flow Rate at 50% Max (CFS)			Oil Retention (Oz)	
		FX	PC	IL	PC*	PCP**
Small	1.6	1.2	0.8	0.9	66	155
Medium	2.1	1.8	1.2	1.3	96	185
Large	3.8	2.2	1.5	1.6	120	209
XL	4.2	3.6	2.4	2.6	192	370

4.0 Tested Filtration Efficiency and Removal Rates

Tested Filtration Efficiency and Removal Rates: Filtration Efficiency, TSS, and TPH testing performed under large scale, real world conditions at accredited third party erosion and sediment control testing laboratory. (See Full Test Reports at www.inletfilters.com)

Inside View of Hopper Agitator



Hopper With Outlet Pipe Leading To Area Inlet

Area Inlet Simulated Showing Influent Discharge From Pipe

4.1 **FLEXSTORM “FX” Filtration Efficiency Test Results:** All testing performed in general accordance with the ASTM D 7351, *Standard Test Method For Determination of Sediment Retention Device Effectiveness in Sheet Flow Application,* with flow diverted into an area inlet. Test Soil used as sediment had the following characteristics with a nominal 7% sediment to water concentration mix. This is representative of a heavy sediment load running off of a construction site.

Soil Characteristics	Test Method	Value		Filtration Efficiency of “FX” FLEXSTORM Bag
% Gravel	ASTM D 422	2		82%
% Sand		60		
% Silt		24		
% Clay		14		
Liquid Limit, %	ASTM D 4318	34		
Plasticity Index, %		9		
Soil Classification	USDA	Sandy Loam		
Soil Classification	USCS	Silty Sand (SM)		

7.0 Maintenance Guidelines: The frequency of maintenance will vary depending on the application (during construction, post construction, or industrial use), the area of installation (relative to grade and runoff exposure), and the time of year relative to the geographic location (infrequent rain, year round rain, rain and snow conditions). The FLEXSTORM Operation & Maintenance Plan (as shown in 7.5) or other maintenance log should be kept on file.

7.1 Frequency of Inspections: Construction site inspection should occur following each ½" or more rain event. Post Construction inspections should occur three times per year (every four months) in areas with year round rainfall and three times per year (every three months) in areas with rainy seasons before and after snowfall season. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than three times per year.

7.2 General Maintenance for standard sediment bags: Upon inspection, the FLEXSTORM Inlet Filter should be emptied if the sediment bag is more than half filled with sediment and debris, or as directed by the Engineer. Remove the grate, engage the lifting bars or handles with the FLEXSTORM Removal Tool, and lift the FLEXSTORM Inlet Filter from the drainage structure. Machine assistance is not required. Dispose of the sediment or debris as directed by the Engineer. As an alternative, an industrial vacuum may be used to collect the accumulated sediment if available. Remove any caked on silt from the sediment bag and reverse flush the bag for optimal filtration. Replace the bag if the geotextile is torn or punctured to ½" diameter or greater on the lower half of the bag. If properly maintained, the Woven sediment bag will last a minimum of 4 years in the field.

7.3 Inspection and Handling of the FLEXSTORM PC / PC+ post construction sediment bag: The PC+ sediment bags will collect oil until saturated. Both the Adsorb-it filter liner and the skimmer pouch will retain oil. The volume of oils retained will depend on sediment bag size. Unlike other passive oil sorbent products, Adsorb-it filter fabric has the ability to remove hydrocarbons at high flow rates while retaining 10- 20 times its weight in oil (weight of fabric is 12.8 oz / sq yd). The average 2' x 2' PC Bag contains approx .8 sq yds, or 10 oz of fabric. At 50% saturation, the average Adsorb-it lined PC filter will retain approximately 75 oz (4.2 lbs) of oil. Once the bag has become saturated with oils, it can be centrifuged or passed through a wringer to recover the oils, and the fabric reused with 85% to 90% efficacy. If it is determined, per Maintenance Contracts or Engineering Instructions, that the saturated PC sediment bags will be completely replaced, it is the responsibility of the service technician to place the filter medium and associated debris in an approved container and dispose of in accordance with EPA regulations. Spent Adsorb-it can be recycled for its fuel value through waste to energy incineration with a higher BTU per pound value than coal. The oil skimmers start white in color and will gradually turn brown/black as they become saturated, indicating time for replacement. The average skimmer pouch will absorb approximately 62 oz (4 lbs) of oil before requiring replacement. To remove the pouch simply unclip it from the swivel strap sewn to the bottom of the bag. Dispose of all oil contaminated products in accordance to EPA guidelines. The ClearTec Rubberizer media used in the pouch, since a solidifier, will not leach under pressure and can be disposed of in most landfills, recycled for industrial applications, or burned as fuel.

7.4 Sediment Bag Replacement: When replacing a Sediment Bag, remove the bag by loosening or cutting off the clamping band. Take the new sediment bag, which is equipped with a stainless steel worm drive clamping band, and use a drill or screw driver to tighten the bag around the frame channel. Ensure the bag is secure and that there is no slack around the perimeter of the band. For Oil absorbent boom bags, simply replace the oil boom or pouch when saturated by sliding it through the mesh support sleeve.

7.5 Operation & Maintenance Plan. (Download at www.inletfilters.com or www.ads-pipe.com)

FLEXSTORM OPERATION AND MAINTENANCE PLAN

OPERATION & MAINTENANCE PLAN

Installation Instructions:

1. Remove grate from the drainage structure
2. Clean stone and dirt from ledge (lip) of drainage structure
3. Drop the FLEXSTORM inlet filter through the clear opening such that the hangers rest firmly on the lip of the structure.
4. Replace the grate and confirm it is not elevated more than 1/8", the thickness of the steel hangers.

Frequency of Inspections:

1. Inspection should occur following any rain event >½".
2. Post construction inspections should occur 4 times per year. In snowfall affected regions additional inspections should take place before and after snowfall season.
3. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than 3 times/year.

Maintenance Guidelines:

1. Empty the sediment bag if more than half filled with sediment and debris, or as directed.
2. Remove the grate, engage the lifting bars with the FLEXSTORM Removal Tool, and lift from drainage structure.
3. Dispose of sediment or debris as directed by the Engineer or Maintenance contract.
4. An industrial vacuum can be used to collect sediment.
5. Remove caked on silt from sediment bag and flush with Medium spray with optimal filtration.
6. Replace bag if torn or punctured to >½" diameter on lower half of bag.

Post Construction PC Bag Maintenance:

1. At 50% saturation the average 2'x2' Adsorb-it lined PC filter will retain approximately 75 oz (4.2 lbs) of oil and should be serviced. To recover the oils the filter can be centrifuged or passed through a wringer.
2. Oil skimmer pouches start to turn black when saturated, indicating time for replacement. Each ClearTec Rubberizer pouch will absorb ~62oz (4 lbs) of oil before needing replacement.
3. Dispose of all oil contaminated products in accordance with EPA guidelines. ClearTec Rubberizer, since a solidifier, will not leach under pressure and can be disposed of in most landfills, recycled for industrial applications, or burned as fuel.

Sediment Bag Replacement:

1. Remove the bag by loosening or cutting off clamping bag.
2. Take new sediment bag and secure worm drive clamping band to the frame channel.
3. Ensure Bag is secure and there is no slack around perimeter.

STRUCTURE ID#/LOCATION:

DATE	TASK PERFORMED	INSPECTOR

FLEXSTORM P/Ns FOR NYLOPLAST ROUND FRAME AND GRATE

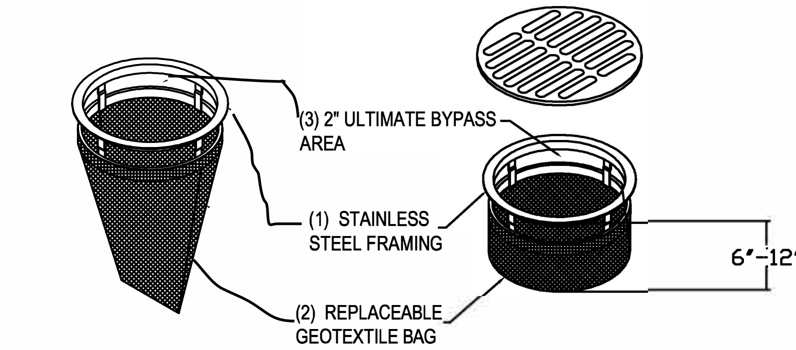
INLET TYPE NYLO: ROUND IN NYLOPLAST BASIN

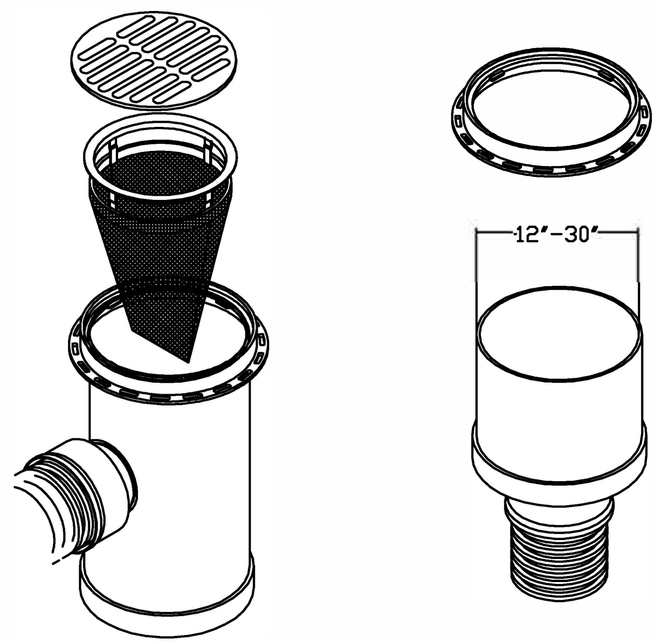
Casting Size	FX Bag		Flexstorm Ratings (Flow at 50% of max)			FX+ Bag
	ADS P/N	Bag Depth	Bag Capacity (ft³)	FX/FX+ Flow Rate (CFS)	Total Bypass (CFS)	ADS P/N
8" Drop in	6208NYFX	22"	0.2	0.9	1.3	6208NYFXP
8" Inline	6208NYFX	22"	0.2	0.9	1.3	6208NYFXP
10" Drop in	6210NYFX	22"	0.3	1.2	1.75	6210NYFXP
10" Inline	6210NYFX	22"	0.3	1.2	1.75	6210NYFXP
12" Round	6212NYFX	22"	0.3	1.4	2.0	6212NYFXP
15" Round	6215NYFX	22"	0.6	1.7	2.5	6215NYFXP
18" Round	6218NYFX	22"	0.9	2.1	3.1	6218NYFXP
24" Round	6224NYFX	22"	1.6	2.8	4.3	6224NYFXP
30" Round	6230NYFX	22"	2.8	3.6	5.7	6230NYFXP

Casting Size	PC Bag		Flexstorm Ratings (Flow at 50% of Max)			PC+ Bag
	ADS P/N	Bag Depth	Bag Capacity (ft³)	PC/PC+ Flow Rate (CFS)	Total Bypass (CFS)	ADS P/N
8" Inline	6208NYPC	22"	0.2	0.4	1.3	6208NYPCP
8" Drop In	6208NYPC	22"	0.2	0.4	1.3	6208NYPCP
10" Drop In	6210NYPC	22"	0.3	0.6	1.75	6210NYPCP
12" Round	6212NYPC	22"	0.3	0.9	2.0	6212NYPCP
15" Round	6215NYPC	22"	0.6	1.2	2.5	6215NYPCP
18" Round	~~6218NYPC~~	22"	0.9	1.4	3.1	6218NYPCP
24" Round	6224NYPC	22"	1.6	1.9	4.3	6224NYPCP
30" Round	6230NYPC	22"	2.8	2.5	5.7	6230NYPCP

STANDARD BAG DEPTH

SHORT BAG DEPTH





8" and 10" Designs

12" and Plus Designs

FLEXSTORM INLET FILTERS™ PURE

ALL PRODUCTS MANUFACTURED BY INLET & PIPE PROTECTION, INC
A DIVISION OF ADS, INC.
WWW.INLETFILTERS.COM
(866) 287-8655 PH
(630) 355-3477 FX
INFO@INLETFILTERS.COM

SIZE	FRAME TYPE	DWG NO	REV
C	NY	NYLOPLAST	A
SCALE		SHEET 1 OF 1	

RECORDKEEPING

All records must be made available for review upon request.

Owner/Site manager to identify “on site water supervisor.” This person shall be responsible for installation, operation, maintenance, hazard prevention, guideline implementation, and future cross-connection inspections. (Supervisor should be provided copies of site construction plans, LID report, this O & M manual, contractor and vendor provided literature for the systems.)

Name: ______________________________

Company: ______________________________

Title: ______________________________

Address 1: ______________________________

Address 2: ______________________________

Phone Number: ______________________________

Email: ______________________________

Overall Site Inspection & Maintenance Log

Routine and Major Maintenance: MWS Units & Flexstorm Filters

Location: Basin A along Fairhaven Basin B along Crescent

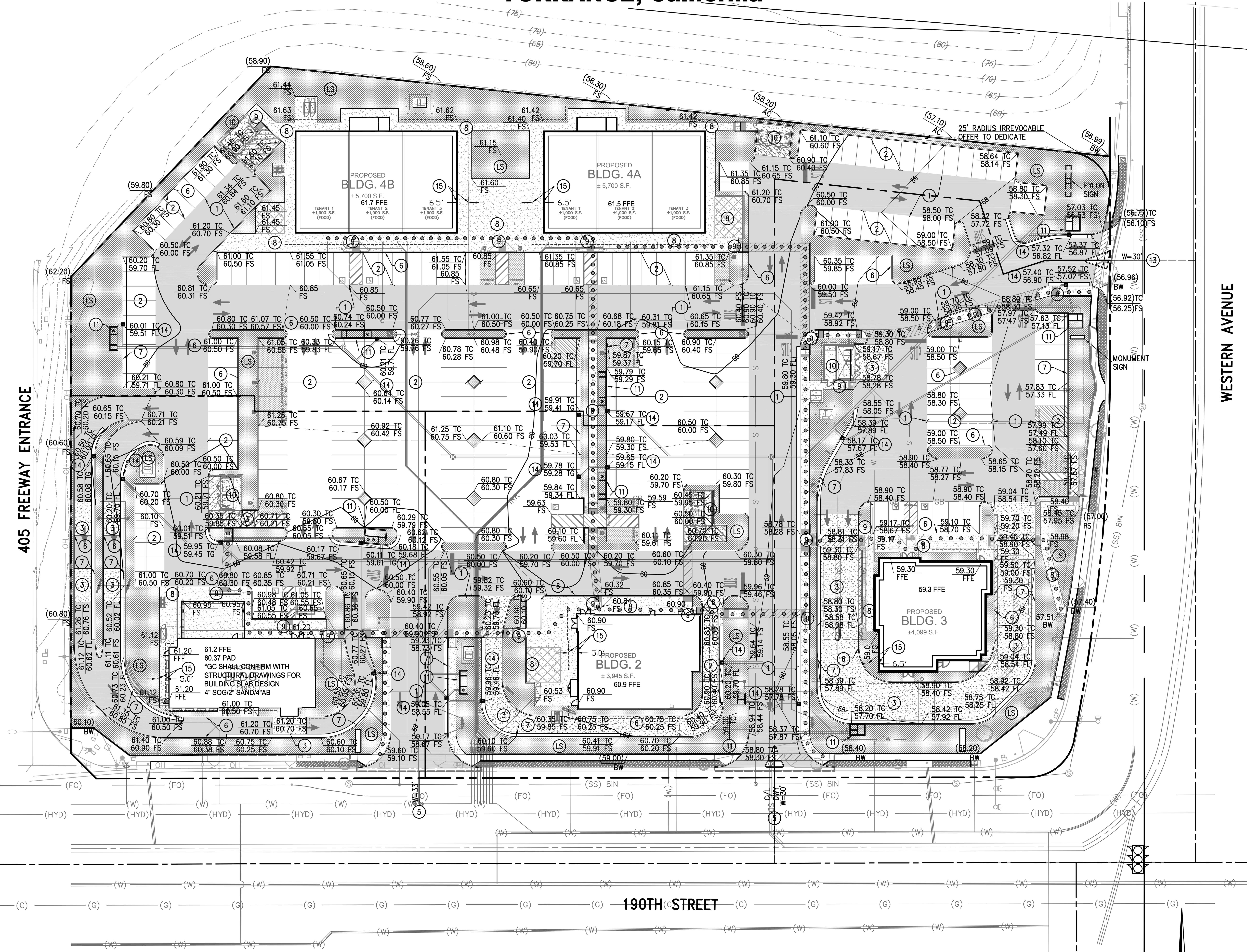
Inspection Date	Note MWS units & catch basin filter inserts not inspected	Maintenance Performed	Maintenance Personnel	Comments

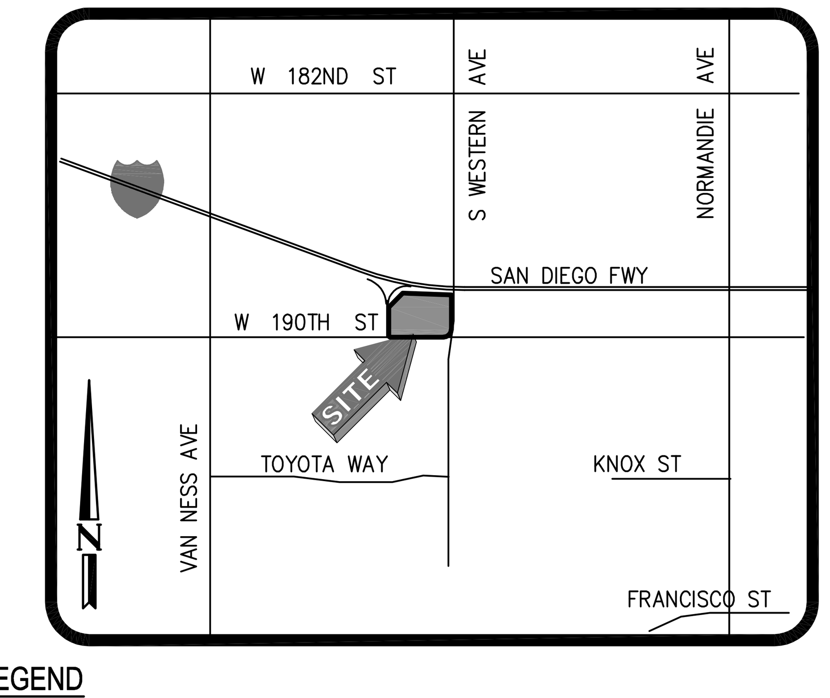
Attachment F

Plans

CONCEPTUAL GRADING & UTILITY PLANS

PROPOSED TORRANCE CENTER
NWC WESTERN AVENUE AND 190TH STREET
TORRANCE, California





LEGEND

- LANDSCAPE
- PATH OF TRAVEL
- PROPERTY LINE
- LIMIT OF WORK

CONCEPTUAL GRADING NOTES

1. CONSTRUCT HD AC PAVING PER GEO-TECHNICAL RECOMMENDATIONS
2. CONSTRUCT LD PARKING STALL AC PAVING PER GEO-TECH RECOMMENDATIONS
3. CONSTRUCT PCC PAVEMENT PER GEO-TECH RECOMMENDATIONS
4. CONSTRUCT DRIVEWAY PER CALTRANS STD PLAN A87A
5. CONSTRUCT DRIVEWAY PER CITY OF TORRANCE STD NO. T105
6. CONSTRUCT 6" (TYPE A1-6) CONCRETE CURB PER SPPWC STD. PLAN 120-2
7. CONSTRUCT 6" (TYPE A2-6) CONCRETE CURB & GUTTER PER SPPWC STD PLAN 120-2
8. CONSTRUCT 4" PCC WALK OVER 6" AB CONFIRM SCORING, COLOR, & FINISH WITH ARCHITECTURAL/LANDSCAPE PLANS
9. CONSTRUCT CURB RAMP 8% MAX. RUN SLOPE
10. CONSTRUCT COVERED TRASH ENCLOSURE W/REIN.. PCC SLAB PER ARCHITECTURAL PLANS
11. INSTALL MWS SIZE PER STORM DRAIN PLANS
12. CONSTRUCT U-CHANNEL OR CURB-O-LET UNDER WALK PIPE
13. CONSTRUCT MODIFIED TORRANCE DRIVEWAY WITH FLUSH COLOR DIFFERENTIATED PORK-CHOP ISLAND & PEDESTRIAN PASS THROUGH. ALL PAVERS AND PEDESTRIAN WALK TO BE FULLY TRAFFIC RATED FOR EMERGENCY VEHICLE ACCESS.
14. CONSTRUCT ADS NYLOPLAST (OR APPROVED EQUAL) CATCH BASIN WITH SEDIMENT FILTER BAG AND OIL ABSORBENT BOOM. SUMP TO BE IN-FILLED WITH CONCRETE WITH SMOOTH TROWEL FLOW LINE TO OUTLET.
15. APPROXIMATE LIMIT OF BUILDING PAD OVEREXCAVATION AND RECOMPACTION REFER TO SITE GEO-TECHNICAL REPORT AND BUILDING STRUCTURAL PLANS FOR FOOTINGS

GENERAL NOTES:

1. GC SHALL AT MINIMUM FOLLOW AND IMPLEMENT BMP RECOMMENDATIONS AS OUTLINED BY CASQA FOR DEMOLITION WORK.
2. GC TO OBTAIN NECESSARY ENCROACHMENT PERMIT FOR ANY/ALL WORK IN THE PUBLIC RIGHT-OF-WAY.
3. ALL WORK IN THE PUBLIC RIGHT-OF-WAY ON 190TH ST TO CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (CURRENT EDITION) AND AS AMENDMENTS AND SPECIFICATIONS BY CITY OF TORRANCE.
4. WORK ON WESTERN AVE PUBLIC RIGHT-OF-WAY PER CALTRANS SPECIFICATIONS.
5. GC TO PROVIDE NECESSARY TRAFFIC CONTROL/MANAGEMENT PLAN FOR PERMITS.
6. GC TO COORDINATE WITH PUBLIC WORKS DEPARTMENT FOR FIELD WALK TO IDENTIFY LIMITS OF DEMOLITION IN THE PUBLIC RIGHT-OF-WAY PRIOR TO COMMENCING ANY DEMOLITION WORK IN PUBLIC ROW.
7. GC SHALL VERIFY WITH LANDSCAPE PLANS REGARDING DISPOSITION OF TREES AND PLANT MATERIAL PRIOR TO REMOVING AND DISPOSING.
8. SIGNING, STRIPING, AND PAVEMENT MARKING SHOWN HEREON ARE FOR REFERENCE; SEE ARCHITECTURAL PLANS FOR DETAILS.
9. SEE ARCHITECTURAL PLANS FOR SITE LIGHTING.
10. DETECTABLE WARNINGS SHALL BE FEDERAL YELLOW, APPROVED FOR USE BY CALTRANS OR STATE DSA. WET-SET IN CONCRETE ARMORCAST
11. PROPOSED UTILITY CONNECTIONS SHOWN HEREON TO BE WITHIN 3' OF BUILDING.
12. ALL NON-METALLIC UNDERGROUND CONDUIT AND PIPE SHALL BE INSTALLED WITH CHRISTY'S (OR APPROVED EQUAL) DETECTABLE TAPE.
13. PRIVATE WATER AND SEWER PIPE INSTALLATION SHALL MAINTAIN:
    - 13.1. 1' HORIZONTAL SEPARATION (WALL TO WALL)
    - 13.2. WATER CROSSES OVER SEWER WITH MIN. 1' VERTICAL SEPARATION

ESTIMATE OF EARTHWORK QUANTITIES:

	TOTAL* CY
SITE CUT	6000
SITE FILL	2000
NET CUT (EXPORT)	4000

* EARTHWORK QUANTITIES SHOWN ARE FOR PERMITTING PURPOSES ONLY. CONTRACTOR IS RESPONSIBLE FOR OBTAINING THEIR OWN QUANTITIES FOR BIDDING AND PRICING PURPOSES.

LID INFORMATION:

LID AREA:	216,948 SF	4.98 AC
PERVIOUS:	38,698 SF	0.89 AC 17.8%
IMPERVIOUS:	178,248 SF	4.09 AC 82.2%

0.9" 85TH PERCENTILE STORM

FLOW BASED TREATMENT VIA AREA MWS UNITS

INFILTRATION NOT FEASIBLE 1.5 FACTOR DCV

160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860

dRC Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning

JEPTHA BRANDER R.C.E. 33987 DATE

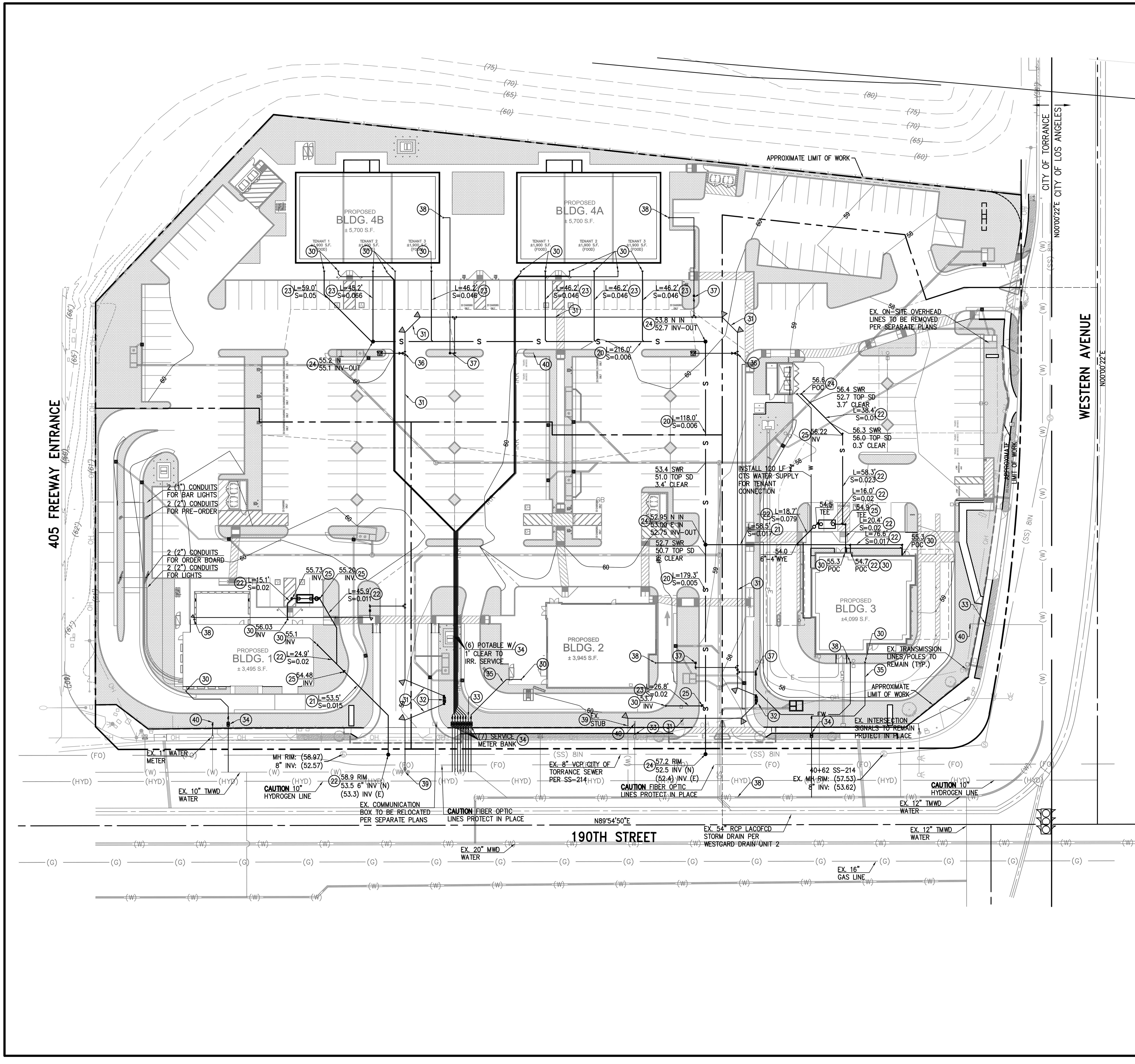
NOT FOR CONSTRUCTION

NO.	REVISION:	DATE:

PROJECT: CALBAY TORRANCE 190TH ST & CITY OF TORRANCE

DRAWING NAME: CONCEPTUAL GRADING

ISSUE:	CG
DATE:	2021/09/20
CHECKED: JB	DRAWN: JS
DRAWING FILE:	18935CG100
PROJECT NO.:	18-935
SHEET NUMBER:	1
OF 4	SHEETS
SCALE:	AS SHOWN



CONCEPTUAL UTILITY NOTES

20 — INSTALL 8" SDR-35 SANITARY SEWER MAIN. TRENCH & BEDDING PER CITY OF TORRANCE STD. T204.
21 — INSTALL 6" SDR-35 SANITARY SEWER MAIN. TRENCH & BEDDING PER CITY OF TORRANCE STD. T204.
22 — INSTALL 4" SDR-35 SANITARY SEWER TRENCH & BEDDING STD. T204.
23 — INSTALL 4" LATERAL PER SPPWC STD. 222-2
24 — INSTALL POUR-OVER SEWER MANHOLE PER SPPWC STD. 200-3.
25 — INSTALL SEWER CLEANOUT PER SPPWC STD. 204-2.
30 — BUILDING POC. SEE MEP PLANS FOR CONTINUATION.
31 — INSTALL 8" C-900 PVC WATER MAIN WITH BENDS, FITTINGS & THRUST BLOCKS AS REQUIRED. TRENCH & BEDDING PER CITY OF TORRANCE STD. T701. BACKFILL & PAVEMENT REPAIR PER CITY OF TORRANCE STD. T116-2.
32 — INSTALL 8" DCDA PER CITY OF TORRANCE STD. T710.
33 — INSTALL 1" WATER METER PER CITY OF TORRANCE STD. T703 WITH 1.5" BACKFLOW PREVENTER
34 — INSTALL 1 ½" METER WITH 2" SERVICE AND BACKFLOW PREVENTER PER STD. T704.
35 — INSTALL 2" CTS HDPE SUPPLY PIPE PER SDR-9 AWWA C-901 JM EAGLE (OR EQUAL). TRENCH & BEDDING PER CITY OF TORRANCE STD. T701. BACKFILL & PAVEMENT REPAIR PER CITY OF TORRANCE STD. T116-2.
36 — INSTALL FIRE HYDRANT PER CITY OF TORRANCE STD. T705.
37 — CONNECT TO ONSITE FIRE MAIN INSTALL FDC AND PIV AT LOCATIONS SHOWN. 6" C-900 PVC WATER MAIN WITH BENDS, FITTINGS & THRUST BLOCKS AS REQUIRED. TRENCH & BEDDING STD. T701. BACKFILL PER STD. T116-2.
38 — BUILDING POC FOR FIRE RISER CONNECTION. SEE MEP/ARCHITECTURAL PLANS FOR CONTINUATION.
39 — CONNECT TO EXISTING TORRANCE WATER MAIN PER STD T 723 WITH ISOLATION VALVES AT POC
40 — POC FOR LANDSCAPE IRRIGATION SEE L/S PLANS

GENERAL NOTES:

1. GC TO OBTAIN NECESSARY ENCROACHMENT PERMIT FOR ANY/ALL WORK IN THE PUBLIC RIGHT-OF-WAY.
2. ALL WORK IN THE PUBLIC RIGHT-OF-WAY TO CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (CURRENT EDITION) AND AS AMENDMENTS AND SPECIFICATIONS BY CITY OF TORRANCE.
3. GC TO PROVIDE NECESSARY TRAFFIC CONTROL/MANAGEMENT PLAN FOR PERMITS.
4. GC SHALL POTHOLE AND VERIFY SIZE, DEPTH, MATERIAL OF PROPOSED UTILITY CONNECTIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES PRIOR TO COMMENCING UTILITY CONSTRUCTION.
5. PROPOSED UTILITY CONNECTIONS SHOWN HEREON TO BE WITHIN 3' OF BUILDING.
6. GREASE INTERCEPTORS SHOWN HEREON TO BE SIZED, PERMITTED BY TENANT. CUT-IN INSTALLATION, SAMPLE BOX AND TOPPING SLABS BY TENANT
7. FIRE SPRINKLER RISER CONNECTIONS PER SEPARATE PLANS/PERMIT
8. ALL NON-METALLIC UNDERGROUND CONDUIT AND PIPE SHALL BE INSTALLED WITH CHRISTY'S (OR APPROVED EQUAL) DETECTABLE TAPE.
9. PRIVATE WATER AND SEWER PIPE INSTALLATION SHALL MAINTAIN:
   9.1. 1' HORIZONTAL SEPARATION (WALL TO WALL)
   9.2. WATER CROSSES OVER SEWER WITH MIN. 1' VERTICAL SEPARATION
10. MANHOLE ACCESS SHALL BE LOCKABLE (SECURABLE TO DETER UNAUTHORIZED ACCESS)

UTILITY COMPANY CONTACTS:

COMPANY	CONTACT	PHONE
UNDERGROUND SERVICE ALERT		811
SOUTHERN CALIFORNIA GAS	PHIL JENKS	310-687-2023
SOUTHERN CALIFORNIA EDISON DIST.	CHAD MINTON	310-783-9437
SOUTHERN CALIFORNIA EDISON TRANS.	WALLACE ZIMMERMAN	714-973-5409
LA COUNTY SANITATION DISTRICT	JON GANZX	562-908-4288
LADWP (WATER)	SHAHRAM FADAKAR	213-367-5659
LADWP (SEWER)	RACHEL BASS	310-575-8612
SUNEYSYS	ROBERT SANTOS	951-278-0400
AIR PRODUCTS & CHEMICALS	JODY ARNER	610-481-1707
EXXON MOBILE	RUTH CRONINO-FRUITT	310-212-1761
VERIZON	MOLSES MARTINEZ	818-898-2352
AT&T TRANSMISSION	MARIA GUZMAN	213-787-9996
AT&T DISTRIBUTION	MEREDITH HOUSTON	310-515-4370
CITY OF TORRANCE STORM DRAIN	MIKE WOOLSEY	310-781-6905
CITY OF TORRANCE SANITATION (TRASH)	TONY MULLIKIN	310-781-6904
CITY OF TORRANCE WATER	RAMON TEJEDA	310-618-6263
CITY OF TORRANCE TRAFFIC	RICH HALL	310-781-6940
CITY OF TORRANCE STREETSCAPE	LUIS OCHOA	310-781-6940

DRC Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning
160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860
JEPTHA BRANDER
R.C.E. 33987
DATE

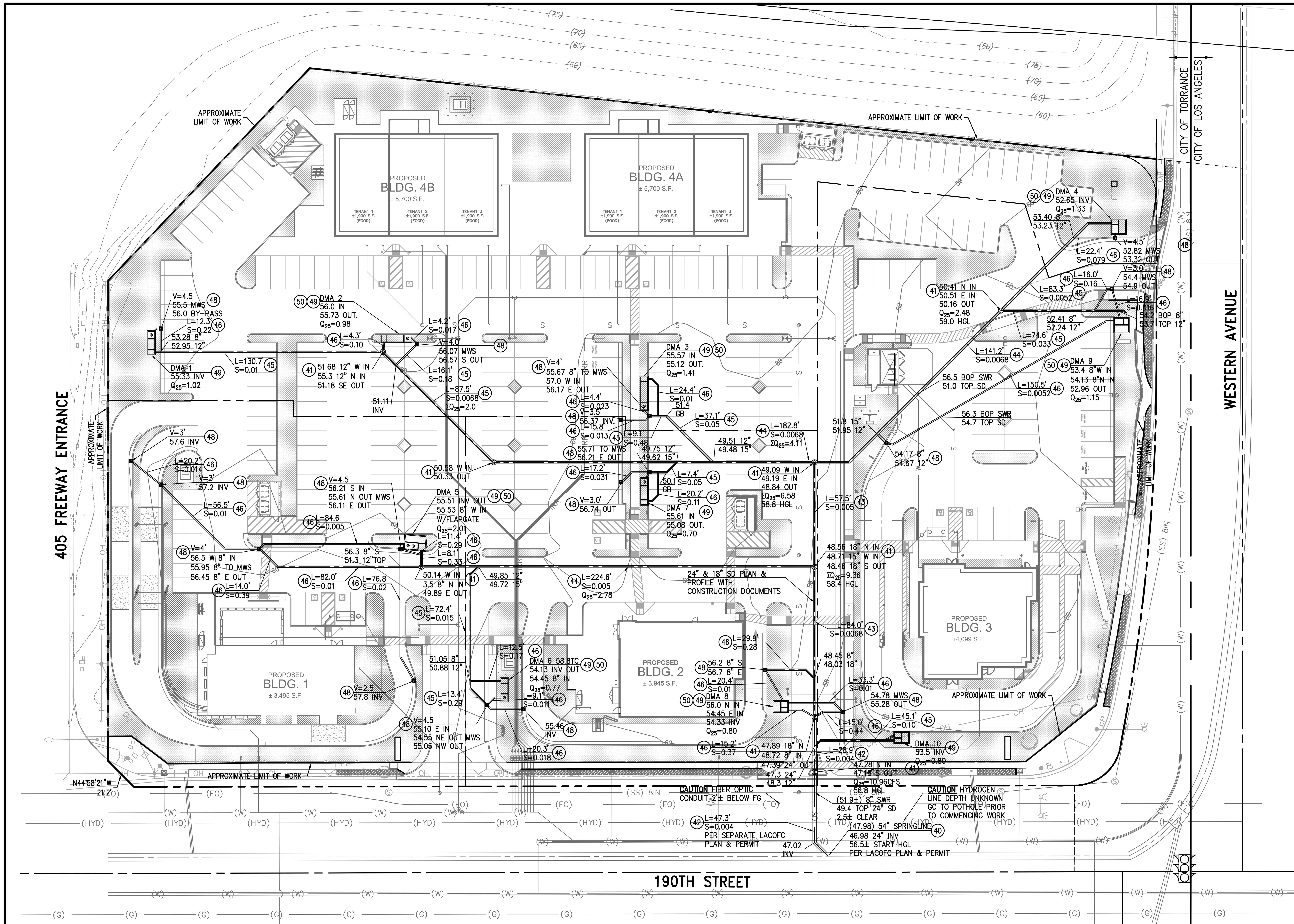
NOT FOR CONSTRUCTION

NO.	REVISION:	DATE:

PROJECT: CALBAY TORRANCE 190TH ST & CITY OF TORRANCE

DRAWING NAME: CONCEPTUAL UTILITY

ISSUE:	CG
DATE:	2021/09/20
CHECKED: JB	DRAWN: JS
DRAWING FILE:	18935CG100
PROJECT NO.:	18-935
SHEET NUMBER:	2
OF 4 SHEETS	
SCALE:	AS SHOWN



CONCEPTUAL STORM DRAIN NOTES

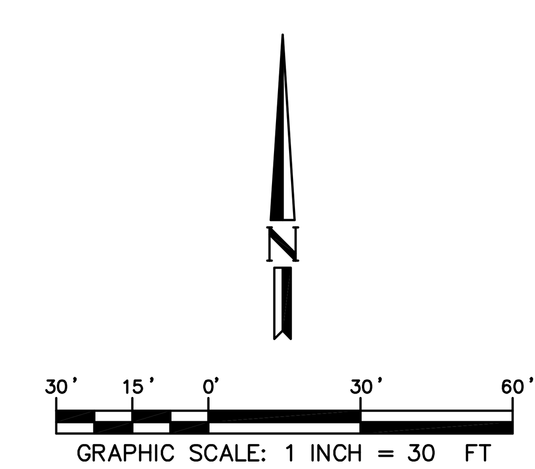
40 — CONNECT TO EXISTING STORM DRAIN WITH JUNCTION STRUCTURE PER SPPWC STD. 340-2
41 — CONSTRUCT MANHOLE PER SPPWC STD. 321-2
42 — INSTALL 24" RCP SD PIPE WITH SOIL TIGHT JOINTS TRENCHING AND BEDDING PER CITY OF TORRANCE STANDARD T302
43 — INSTALL 18" RCP SD PIPE WITH SOIL TIGHT JOINTS TRENCHING AND BEDDING PER CITY OF TORRANCE STANDARD T302
44 — INSTALL 15" HDPE SD PIPE WITH SOIL TIGHT JOINTS TRENCHING AND BEDDING PER CITY OF TORRANCE STANDARD T302
45 — INSTALL 12" HDPE SD PIPE WITH SOIL TIGHT JOINTS TRENCHING AND BEDDING PER CITY OF TORRANCE STANDARD T302
46 — INSTALL 8" PVC SD PIPE WITH SOIL TIGHT JOINTS TRENCHING AND BEDDING PER CITY OF TORRANCE STANDARD T302
47 — CONSTRUCT SD CLEANOUT
48 — CONSTRUCT CURB OPENING GRATED INLET 2'X2' BY ADS WITH NYLOPLAST BASIN AND FLEXSTORM FILTER INSERT W/OIL BOOM. SUMP TO BE IN-FILLED WITH CONCRETE AND SMOOTH TROWEL TO OUTLET SEE GRADING FOR GRATE ELEVATION
49 — INSTALL MWS UNIT PER TABLE HEREON
50 — INSTALL ALUMINUM OR HDPE WALL MOUNT FLAP GATE TO INLET PIPE

GENERAL NOTES:

1. GC TO OBTAIN NECESSARY ENCROACHMENT PERMIT FOR ANY/ALL WORK IN THE PUBLIC RIGHT-OF-WAY.
2. ALL WORK IN THE PUBLIC RIGHT-OF-WAY TO CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (CURRENT EDITION) AND AS AMENDMENTS AND SPECIFICATIONS BY CITY OF TORRANCE.
3. GC TO PROVIDE NECESSARY TRAFFIC CONTROL/MANAGEMENT PLAN FOR PERMITS.
4. GC SHALL POTHOLE AND VERIFY SIZE, DEPTH, MATERIAL OF PROPOSED UTILITY CONNECTIONS AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES PRIOR TO COMMENCING UTILITY CONSTRUCTION.
5. ALL NON-METALLIC UNDERGROUND CONDUIT AND PIPE SHALL BE INSTALLED WITH CHRISTY'S (OR APPROVED EQUAL) DETECTABLE TAPE.
6. PRIVATE WATER AND STORM DRAIN INSTALLATION SHALL MAINTAIN:
   6.1. 1' HORIZONTAL SEPARATION (WALL TO WALL)
   6.2. WATER CROSSES OVER STORM DRAIN WITH MIN. 1' VERTICAL SEPARATION

MWS UNIT CHART

DMA	MODEL (SIZE)	QLID CFS	BY-PASS Q_{25}CFS	PARCEL
DMA 1	MWS-L-4-13-V	0.134	1.022	4
DMA 2	MWS-L-8-8-V	0.180	0.978	4
DMA 3	MWS-L-8-12-V	0.22	1.405	4
DMA 4	MWS-L-8-8-V	0.21	1.331	4
DMA 5	MWS-L-8-12-V	0.34	2.011	1
DMA 6	MWS-L-4-13-V	0.12	0.769	2
DMA 7	MWS-L-4-15-V	0.15	0.703	2
DMA 8	MWS-L-6-8-V	0.13	0.797	2
DMA 9	MWS-L-8-8-V	0.20	1.149	3
DMA 10	MWS-L-6-8-C	0.12	0.801	3



160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860

DRC Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning

JEPTHA BRANDER R.C.E. 83987 DATE

NOT FOR CONSTRUCTION

NO.:	REVISION:	DATE:

PROJECT: **CALBAY TORRANCE 190TH ST & CITY OF TORRANCE**

DRAWING NAME: **CONCEPTUAL STORM DRAIN**

ISSUE:	CG
DATE:	2021/09/20
CHECKED: JB	DRAWN: JS
DRAWING FILE:	18935CG100
PROJECT NO.:	18-935
SHEET NUMBER:	3
OF 4 SHEETS	
SCALE:	AS SHOWN

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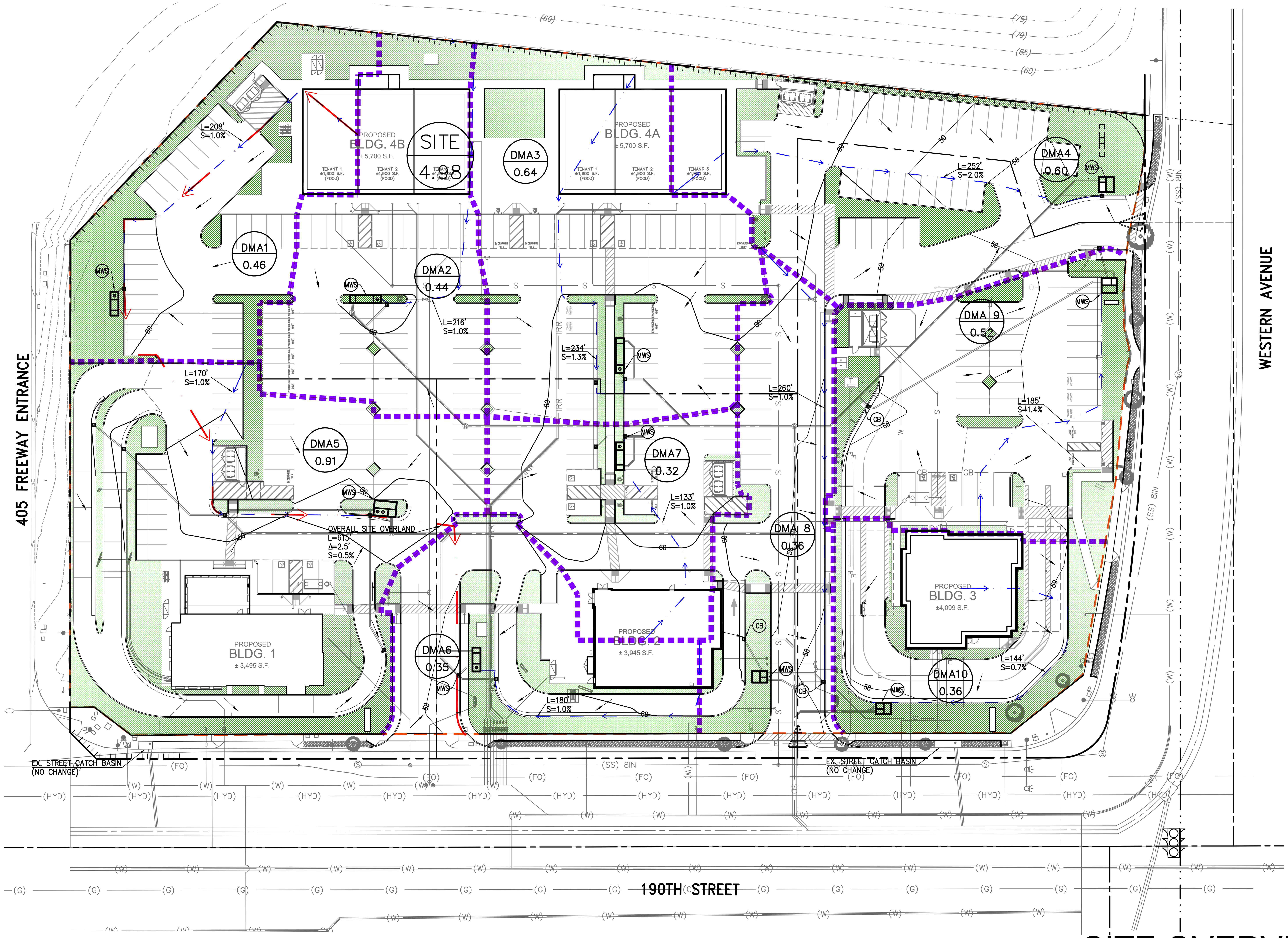

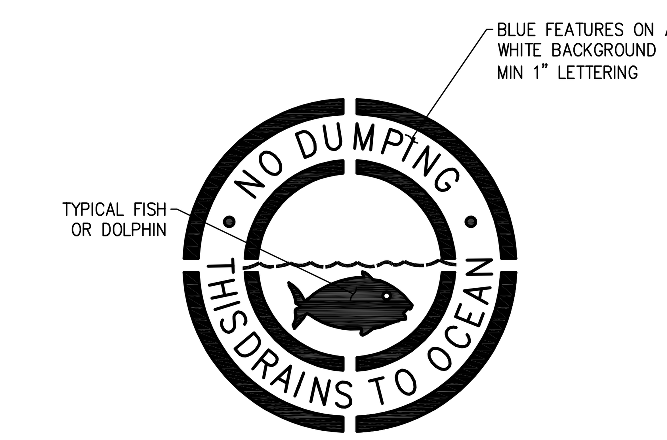

NOTE:
- ALL STORM DRAIN INLETS (CATCH BASINS) THAT DISCHARGE INTO AN EXISTING OR PROPOSED STORM DRAIN SHALL BE MARKED (STENCILED OR PLACARD AFFIXED) WITH THE ABOVE NOTATION TO DISCOURAGE ILLEGAL DUMPING OF POLLUTANTS.
- CURB CUTS FOR SITE DRAINAGE SHALL BE STENCILED AT OPENING WITH THE ABOVE MARKING WITH TRAFFIC RATED PAINT
- THE ABOVE MARKING MAY VARY, GC SHOULD CONFIRM ACCEPTABILITY AND/OR USE LOCAL AGENCY PREFERRED NPDES STENCIL.

NPDES STENCIL CB
N.T.S.

LID MWS UNIT CHART

DMA	AREA (ACRES)	PERVIOUS (%)	IMPERVIOUS (%)	LID FLOW REQUIRED	1.5 LID FLOW	MODEL	TREATMENT FLOW PROVIDED	NORTHING/ EASTING	
DMA 1	0.46	30.5	69.5	0.090	0.134	MWS-L-4-13-V	0.144		
DMA 2	0.44	7.0	93.0	0.120	0.180	MWS-L-8-8-V	0.230		
DMA 3	0.64	11.1	88.9	0.146	0.22	MWS-L-4-19-V	0.237		
DMA 4	0.60	19.0	81.0	0.141	0.21	MWS-L-8-8-V	0.230		
DMA 5	0.91	20.0	80.0	0.225	0.34	MWS-L-8-12-V	0.346		
DMA 6	0.35	23.9	76.1	0.080	0.12	MWS-L-4-13-V	0.144		
DMA 7	0.32	4.1	95.9	0.103	0.15	MWS-L-4-15-V	0.175		
DMA 8	0.36	14.1	58.9	0.084	0.13	MWS-L-6-8-V	0.147		
DMA 9	0.52	19.0	81.0	0.130	0.20	MWS-L-8-8-V	0.230		
DMA 10	0.36	27.7	72.3	0.080	0.12	MWS-L-6-8-C	0.147		

LEGEND

- DRAINAGE AREA BOUNDARY
- SUBAREA BOUNDARY
- STORM DRAIN LINE
- SITE OVERFLOW PATH
- SUBAREA FLOW PATH
- XX X.XX — SUBAREA ACREAGE
- APPROXIMATE OVERLAND FLOW
- MWS — MODULAR WETLAND SYSTEM
- CB — CATCH BASIN

MWS & CATCH BASINS SHALL BE STENCILED WITH APPROVED NPDES MARKING "NO DUMPING DRAINS TO OCEAN"

SITE OVERVIEW

XX X.XX	4.98 AC	TOTAL SITE AREA	
	4.09 AC	PR. IMPERVIOUS AREA	82.2%
	0.89 AC	PERVIOUS AREA	17.8%

30' 0' 30' 60' 90'
GRAPHIC SCALE: 1"=30'

N

NOT FOR CONSTRUCTION

DRC Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning
160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860
GREGORY R. COOKE R.C.E. 39478 DATE

NO. | REVISION: | DATE:

PROJECT: W 190TH & WESTERN AVE COMMERCIAL RETAIL CENTER TORRANCE, CA

DRAWING NAME: LID SITE PLAN

ISSUE: EXHIBIT
DATE: 2021/09/20
CHECKED: DRC DRAWN: DRC
DRAWING FILE: .
PROJECT NO.: 18-935
SHEET NUMBER: 4
OF 4 SHEETS
SCALE: AS SHOWN