AVA PACIFIC BEACH

Drainage Report

3823, 3863, 3913 Ingraham Street &
3952 Jewell Street
San Diego, California 92109

D-SHEET NO.: XXXXX-D
PROJECT NO.: PRJ-1059329
APN: 424-471-13 through 16

April 2022

Project Applicant:
Avalon Bay Communities, Inc
2050 Main Street #1200
Irvine, CA 92614

Prepared By:

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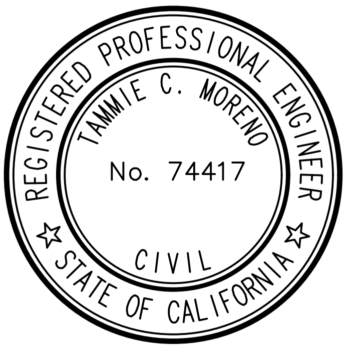
This Drainage Report has been prepared by Kimley-Horn and Associates, Inc. under the direct supervision of the following Registered Civil engineer. The undersigned attests to the technical data contained in this study, and to the qualifications of technical specialists providing engineering computations upon which the recommendations and conclusions are based.

Tammie Moreno, PE #74417 August 7, 2023

Registered Civil Engineer Date



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1 PROJECT DESCRIPTION

1.1 PROJECT DESCRIPTION

The AVA Pacific Beach project consists of the improvement of a multifamily apartment complex in Pacific Beach. The 14.77-acre parcel is bounded by Ingraham Street to the west, La Playa Ave to the south, Jewell Street to the east, and Fortuna Ave to the north. See Figure 1-1 for the Vicinity Map. The project consists of the construction of 3 new buildings. Also included in the project are public utility services for the new buildings, along with the design of storm water drainage system infrastructure to support the entire site and satisfy the current City of San Diego Storm Water and drainage design requirements.

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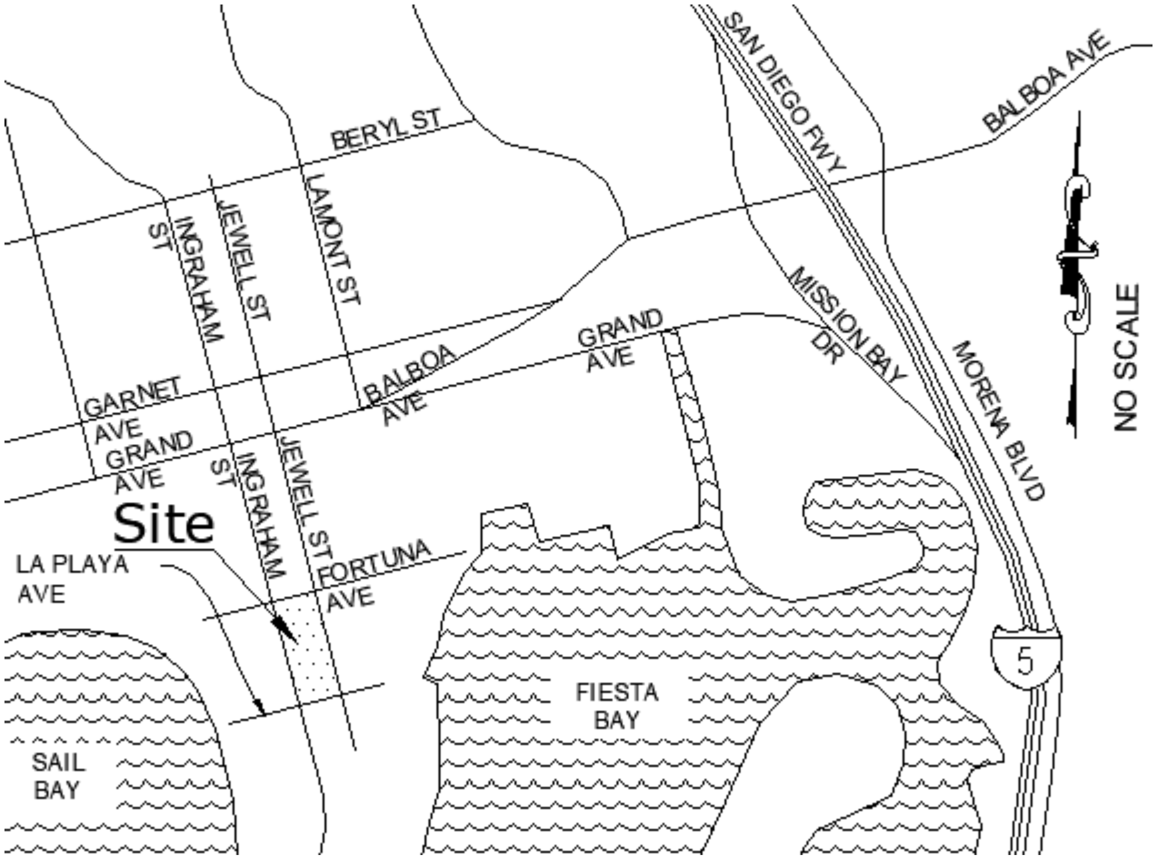

Figure 1–1 Vicinity Map

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2 PROJECT SETTING

2.1 TOPOGRAPHY

The project slopes generally from the northwest to the southeast to the existing stormdrain system on the corner of La Playa Avenue and Jewell St continuing northeast down La Playa then draining into Mission Bay. Ultimately, the water will end up in the Pacific Ocean.

2.2 PRECIPITATION

Storm intensity values were taken from the San Diego County Hydrology Manual, 2003. The rainfall intensity duration curve was used for all hydrologic analysis for the storm drain facilities evaluated. See **Appendix A** for precipitation Isopluvial maps.

2.3 SOIL TYPES

The condition and type of soil are major factors affecting infiltration and runoff. The Natural Resources Conservation Service (NRCS) has classified soils into four general categories for comparing infiltration and runoff rates. The categories are based on properties that influence runoff, such as water infiltration rate, texture, natural discharge and moisture condition. The runoff potential is based on the amount storm water runoff at the end of a long duration storm that occurs after the soil is saturated.

Soil types were determined using the description of the soil given in the geotechnical report dated October 19, 2021 by NMG Geotechnical Inc as **Appendix B**. Soils encountered were primarily poorly graded sands to silt sands, and the report found high infiltration rates on site. One boring found infiltration rates to be 28.8 inches per hour. Due to these descriptions, it was determined that the project site consists of mostly soil type A which is soils having a very high infiltration rate (low runoff potential) when thoroughly wet. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission. Specific percolation rates were performed, and the results demonstrated high infiltration rates.

2.4 CLEAN WATER ACT

The project site does not consist of, nor will this project disturb any Waters of the United States. Therefore, the site is not subject to the Regional Water Quality Control Board requirements under the Federal Clean Water Act Sections 401 or 404.

2.5 GROUNDWATER

Based on the Preliminary Geotechnical Evaluation dated October 19, 2021 by NMG Geotechnical Inc., groundwater was encountered in borings located 32 and 33.5 feet below the surface. The depth of the water highly depends on tidal influence and can vary between 2-3 feet daily. Groundwater elevations may also fluctuate seasonally.

2.6 FEMA MAPS

A FEMA map was generated on February 17, 2022 at the site which can be seen in Appendix C. The flood area is classified as Zone X and is an area of minimal flood hazard.

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3 HYDROLOGIC ANALYSIS

3.1 ASSUMPTIONS

Topographic survey information, aerial photographs and site observations were used to delineate the watershed boundary and drainage sub-basins for the project. This information was used in the preparation of the hydrologic calculations.

3.2 MAP SOURCES

Topography for the project area was based on a survey performed by Calvada Surveying Inc in October 2021.

3.3 METHODOLOGY

The Rational Method was used to analyze the hydrology for the project. This methodology is typically used for small basins less than 0.5 square miles in size because a uniform rainfall distribution is assumed for the entire duration. Parameters for precipitation, intensity, runoff coefficients and times of concentration were based on the San Diego County Hydrology Manual. A conservative 5 minute Time of Concentration (Tc) was utilized for all drainage basins in both the existing and proposed conditions. Runoff calculations were prepared for the 50 year and 100 year storm event for the in accordance with the San Diego County Hydrology Manual. Intensity duration chart calculations used for both 50 and 100 year storms can be seen in **Appendix A.** Excerpts from the Manual are also contained in **Appendix A**.

3.3.1 RUNOFF COEFFICIENT

The existing and proposed land use for the site is multifamily residential. The site's impervious area is comprised of building roofs, asphalt pavement and concrete walkways and patios. The runoff coefficient was calculated using the equation from section 3.1.2 in the County of San Diego Hydrology Manual:

$$C = 0.9 * (\%Impervious) + C_p * (1 - \%Impervious)$$

The pervious coefficient runoff value (C_p) was found using Table 3-1 of the County of San Diego Hydrology Manual; included in **Appendix A**. For undisturbed natural terrain with soil type A, C_p is shown as being 0.20. The percent of impervious land was also calculated for both existing and proposed conditions based on site plans and used in the equation above. Using all this information, the runoff coefficients for both existing and proposed conditions were calculated. **Tables 3-1** and **3-2** summarize the runoff coefficients for the existing and proposed conditions respectively.

Table 3–1 Existing Conditions Runoff Coefficient

Drainage Area (DA)	Basin Area AC	Basin Area SF	Impervious Area SF	Pervious Area SF	Percent Impervious %	Runoff C -
Discharge to Location 1						
A-1	3.04	132,450	96,750	35,700	73.0%	0.71
A-2	2.03	88,300	87,300	1,000	98.9%	0.89
A-3	0.7	30,400	25,650	4,750	84.4%	0.79
A-4	2.28	99,100	82,600	16,500	83.4%	0.78
A-5	4.86	211,700	185,200	26,500	87.5%	0.81
A-6	1.86	80,900	64,800	16,100	80.1%	0.76
O-1	0.50	21,836	17,469	4,367	80.0%	0.76
Summary	15.27	664,686	559,769	104,917	84.2%	0.79

Table 3–2 Proposed Conditions Runoff Coefficient

Drainage Area (DA)	Basin Area AC	Basin Area SF	Impervious Area SF	Pervious Area SF	Percent Impervious %	Runoff C -
Discharge to Location 1						
A-1	3.04	132,422	96,722	35,700	73.0%	0.71
A-2	2.24	97,574	75,974	21,600	77.9%	0.75
A-3	0.7	30,492	24,392	6,100	80.0%	0.76
A-4	2.07	90,169	74,419	15,750	82.5%	0.78
A-5	4.73	206,039	180,109	25,930	87.4%	0.81
A-6	1.99	86,684	69,584	17,100	80.3%	0.76
O-1	0.50	21,836	17,469	4,367	80.0%	0.76
Summary	15.27	665217	538670	126547	81.0%	0.77

3.3.2 EXISTING SITE HYDROLOGY

The project site is currently developed and consists of multiple multi-family residences, asphalt parking areas, concrete walkways, and landscaping. The existing site slopes from the northwest corner towards the southeast corner. There is approximately 18 feet of fall across the site from the high side to the low side.

The existing watershed has been delineated and is presented on the attached **Existing Condition Hydrology Map**. The existing site drains to 1 discharge point and collects a small portion of off-site flows that are generated from the existing multi-family houses to the northwest of the project area. The tributary offsite area is conservatively assumed to be 80 percent impervious. The on-site drainage basins are designated A-1, A-2, A-3, A-4, A-5, and A-6; the offsite drainage basin is designated O-1.

Table 3–3 Existing Conditions Hydrology

Drainage Area (DA)	Runoff Coefficient	Area (acres)	50Yr Intensity (in/hr)	100Yr Intensity (in/hr)	T_c (min)	Q_{50} (CFS)	Q_{100} (CFS)
Discharge to Location 1							
A-1	0.71	3.04	4.7	5.2	5	10.2	11.2
A-2	0.89	2.03	4.7	5.2	5	8.5	9.4
A-3	0.79	0.70	4.7	5.2	5	2.6	2.9
A-4	0.78	2.28	4.7	5.2	5	8.4	9.3
A-5	0.81	4.86	4.7	5.2	5	18.6	20.5
A-6	0.76	1.86	4.7	5.2	5	6.6	7.4
O-1	0.76	0.50	4.7	5.2	5	1.8	2.0
Summary	0.79	15.27	4.7	5.2	5	56.7	62.7

3.3.3 HYDROLOGY-PROPOSED CONDITIONS

Proposed hydrologic calculations have been prepared for the project. Tributary areas were delineated based on proposed grading and storm drain layout for the project and peak flows will be mitigated to existing flows prior to discharging from the site (see Section 4.1.1).

The onsite watershed has been delineated and is presented on the attached Proposed Condition Hydrology Map. The onsite drainage basins are designated A-1 through A-6 and the offsite drainage basin which drains to the project area is designated O-1. The proposed project will route runoff from all drainage areas to Discharge Location 1, matching the existing condition.

Table 3–4 Proposed Conditions Hydrology

Basin	Runoff Coefficient	Area (acres)	50Yr Intensity (in/hr)	100Yr Intensity (in/hr)	T_c (min)	Q_{50} (CFS)	Q_{100} (CFS)
Discharge to Location 1							
A-1	0.71	3.04	4.7	5.2	5	10.2	11.2
A-2	0.75	2.24	4.7	5.2	5	7.8	8.7
A-3	0.76	0.70	4.7	5.2	5	2.5	2.8
A-4	0.78	2.07	4.7	5.2	5	7.6	8.4
A-5	0.81	4.73	4.7	5.2	5	18.0	20.0
A-6	0.76	1.99	4.7	5.2	5	7.1	7.9
O-1	0.76	0.50	4.7	5.2	5	1.8	2.0
Summary	0.77	15.27	4.7	5.2	5	55.0	60.9

4 RESULTS

4.1 RESULTS

Runoff from Basins A-1, A-2, A-3, A-4, A-5, A-6, and O-1 will maintain the same discharge location in the proposed condition. Ultimately the peak flow rate will decrease with the increase in pervious area added to the site. As a result of this peak flow rate reduction, no adverse impacts to the downstream storm drain system are anticipated.

Table 4–1 Peak Flow Summary

Discharge Location	Existing			Proposed			Peak Flow Change	
	Area (ac)	Q_{50} (CFS)	Q_{100} (CFS)	Area (ac)	Q_{50} (CFS)	Q_{100} (CFS)	Net Change 50-Yr (cfs)	Net Change 100-Yr (cfs)
1	15.27	56.7	62.7	15.3	55.0	60.9	-1.7	-1.8

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EXHIBITS

EXISTING CONDITION HYDROLOGY MAP

PROPOSED CONDITION HYDROLOGY MAP

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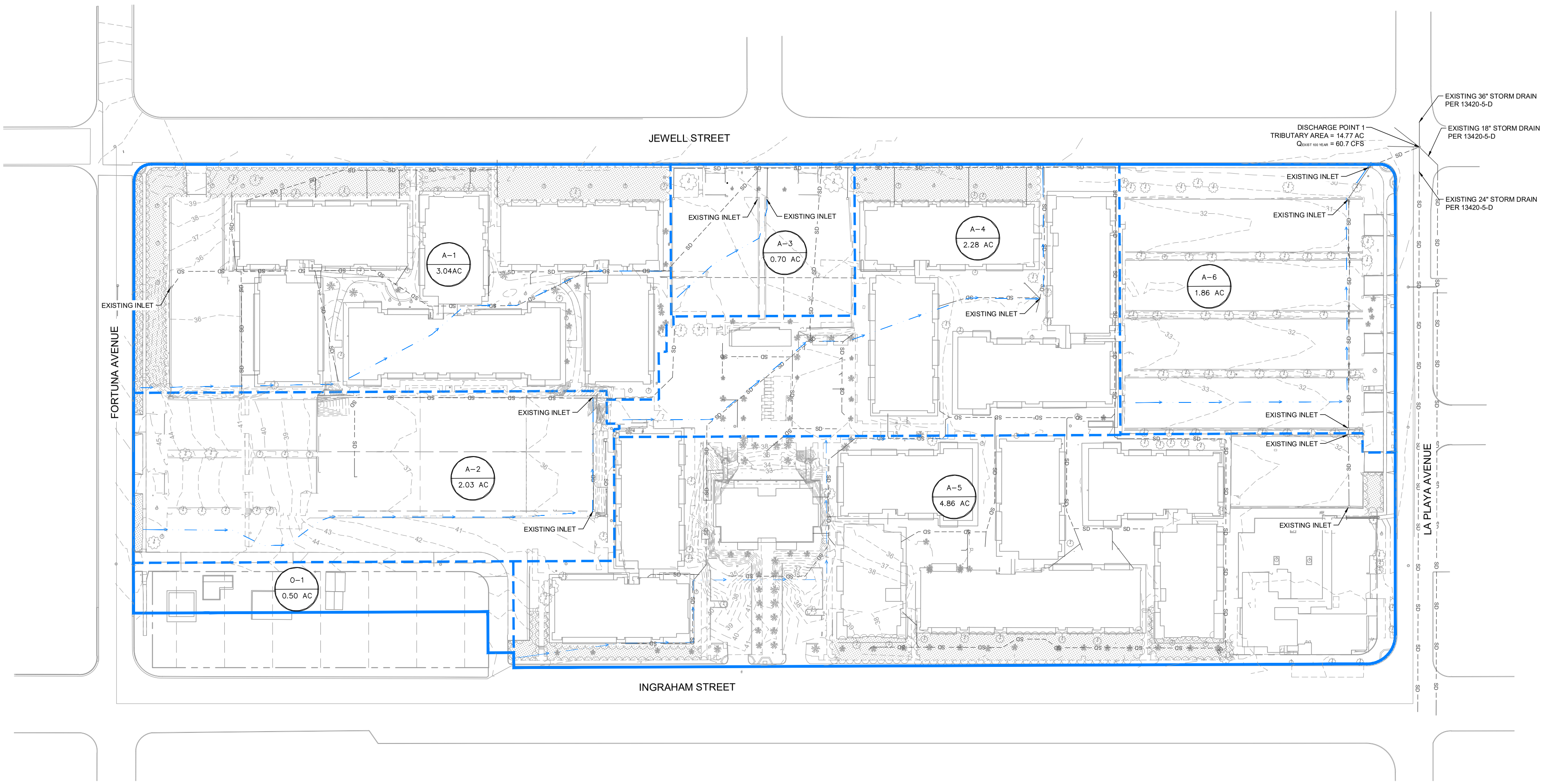


NORTH

GRAPHIC SCALE IN FEET

0 25 50 100

LEGEND

- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- FLOW PATH
- SD — EXISTING STORM DRAIN
- X–X / X.XX AC — DRAINAGE AREA (AC)

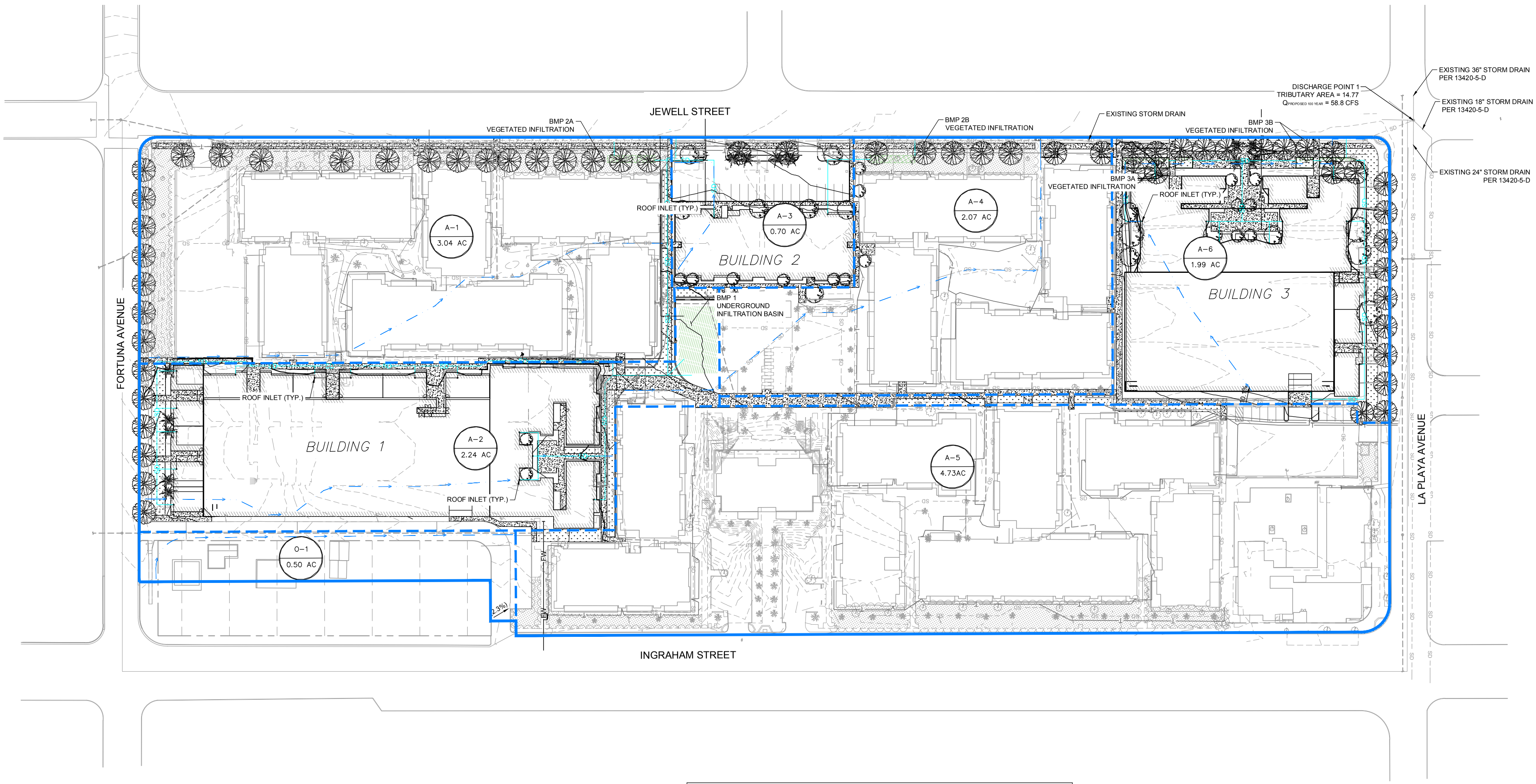
DRAINAGE AREA (DA)	BASIN AREA	BASIN AREA	IMPERVIOUS AREA	PERVIOUS AREA	PERCENT IMPERVIOUS	RUNOFF C
	AC	SF	SF	SF	%	-
DISCHARGE TO LOCATION 1						
A-1	3.0400	132,450	96,750	35,700	0.7%	0.71
A-2	2.0300	88,300	87,300	1,000	1.0%	0.89
A-3	0.7000	30,400	25,650	4,750	0.8%	0.79
A-4	2.2800	99,100	82,600	16,500	0.8%	0.78
A-5	4.8600	211,700	185,200	26,500	0.9%	0.81
A-6	1.8600	80,900	64,800	16,100	0.8%	0.76
O-1	0.501286	21,836	17,469	4,367	0.8%	0.76
SUMMARY	15.27	664,686	559,769	104,917	0.8%	0.79

Kimley»Horn

FEBRUARY 2023

EXISTING CONDITIONS HYDROLOGY EXHIBIT

AVA PACIFIC BEACH



PROPOSED CONDITIONS RUNOFF COEFFICIENT

Drainage Area (DA)	Basin Area	Basin Area	Impervious Area	Pervious Area	Percent Impervious	Runoff C
	AC	SF	SF	SF	%	-
Discharge to Location 1						
A-1	3.04	132,422	96,722	35,700	73.0%	0.71
A-2	2.24	97,574	75,974	21,600	77.9%	0.75
A-3	0.7	30,492	24,392	6,100	80.0%	0.76
A-4	2.07	90,169	74,419	15,750	82.5%	0.78
A-5	4.73	206,039	180,109	25,930	87.4%	0.81
A-6	1.99	86,684	69,584	17,100	80.3%	0.76
O-1	0.50	21,836	17,469	4,367	80.0%	0.76
Summary	15.27	665217	538670	126547	81.0%	0.77

LEGEND

MAJOR BASIN BOUNDARY
MINOR BASIN BOUNDARY
FLOW PATH
SD EXISTING STORM DRAIN
SD PROPOSED STORM DRAIN
X–X X.XX AC DRAINAGE AREA (AC)

NORTH

GRAPHIC SCALE IN FEET
0 25 50 100

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FEBRUARY 2023

PROPOSED CONDITIONS HYDROLOGY EXHIBIT

AVA PACIFIC BEACH

APPENDICES

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APPENDIX A

COUNTY HYDROLOGY MANUAL EXCERPTS

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SECTION 3
RATIONAL METHOD AND MODIFIED RATIONAL METHOD

3.1 THE RATIONAL METHOD

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. The RM is recommended for analyzing the runoff response from drainage areas up to approximately 1 square mile in size. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 1 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section 3.4); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Section 4).

The RM can be applied using any design storm frequency (e.g., 100-year, 50-year, 10-year, etc.). The local agency determines the design storm frequency that must be used based on the type of project and specific local requirements. A discussion of design storm frequency is provided in Section 2.3 of this manual. A procedure has been developed that converts the 6-hour and 24-hour precipitation isopluvial map data to an Intensity-Duration curve that can be used for the rainfall intensity in the RM formula as shown in Figure 3-1. The RM is applicable to a 6-hour storm duration because the procedure uses Intensity-Duration Design Charts that are based on a 6-hour storm duration.

3.1.1 Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (T_c), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

$$Q = C\ I\ A$$

Where:
- Q = peak discharge, in cubic feet per second (cfs)
- C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)
- I = average rainfall intensity for a duration equal to the T_c for the area, in inches per hour (Note: If the computed T_c is less than 5 minutes, use 5 minutes for computing the peak discharge, Q)
- A = drainage area contributing to the design location, in acres

Combining the units for the expression CIA yields:

$$\left(\frac{1\,\text{acre} \times \text{inch}}{\text{hour}}\right)\left(\frac{43{,}560\,\text{ft}^2}{\text{acre}}\right)\left(\frac{1\,\text{foot}}{12\,\text{inches}}\right)\left(\frac{1\,\text{hour}}{3{,}600\,\text{seconds}}\right) \Rightarrow 1.008\,\text{cfs}$$

For practical purposes the unit conversion coefficient difference of 0.8% can be ignored.

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Unlike the MRM (discussed in Section 3.4) or the NRCS hydrologic method (discussed in Section 4), the RM does not create hydrographs and therefore does not add separate subarea hydrographs at collection points. Instead, the RM develops peak discharges in the main line by increasing the T_c as flow travels downstream.

Characteristics of, or assumptions inherent to, the RM are listed below:

- The discharge flow rate resulting from any I is maximum when the I lasts as long as or longer than the T_c.

- The storm frequency of peak discharges is the same as that of I for the given T_c.

- The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in Section 4.1.2.4).

- The peak rate of runoff is the only information produced by using the RM.

3.1.2 Runoff Coefficient

Table 3-1 lists the estimated runoff coefficients for urban areas. The concepts related to the runoff coefficient were evaluated in a report entitled *Evaluation, Rational Method "C" Values* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

The runoff coefficients are based on land use and soil type. Soil type can be determined from the soil type map provided in Appendix A. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table 3-1, as adjustments to these values may be appropriate based on site-specific characteristics. In any event, the impervious percentage (% Impervious) as given in the table, for any area, shall govern the selected value for C. The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\%\ \text{Impervious}) + C_p \times (1 - \%\ \text{Impervious})$$

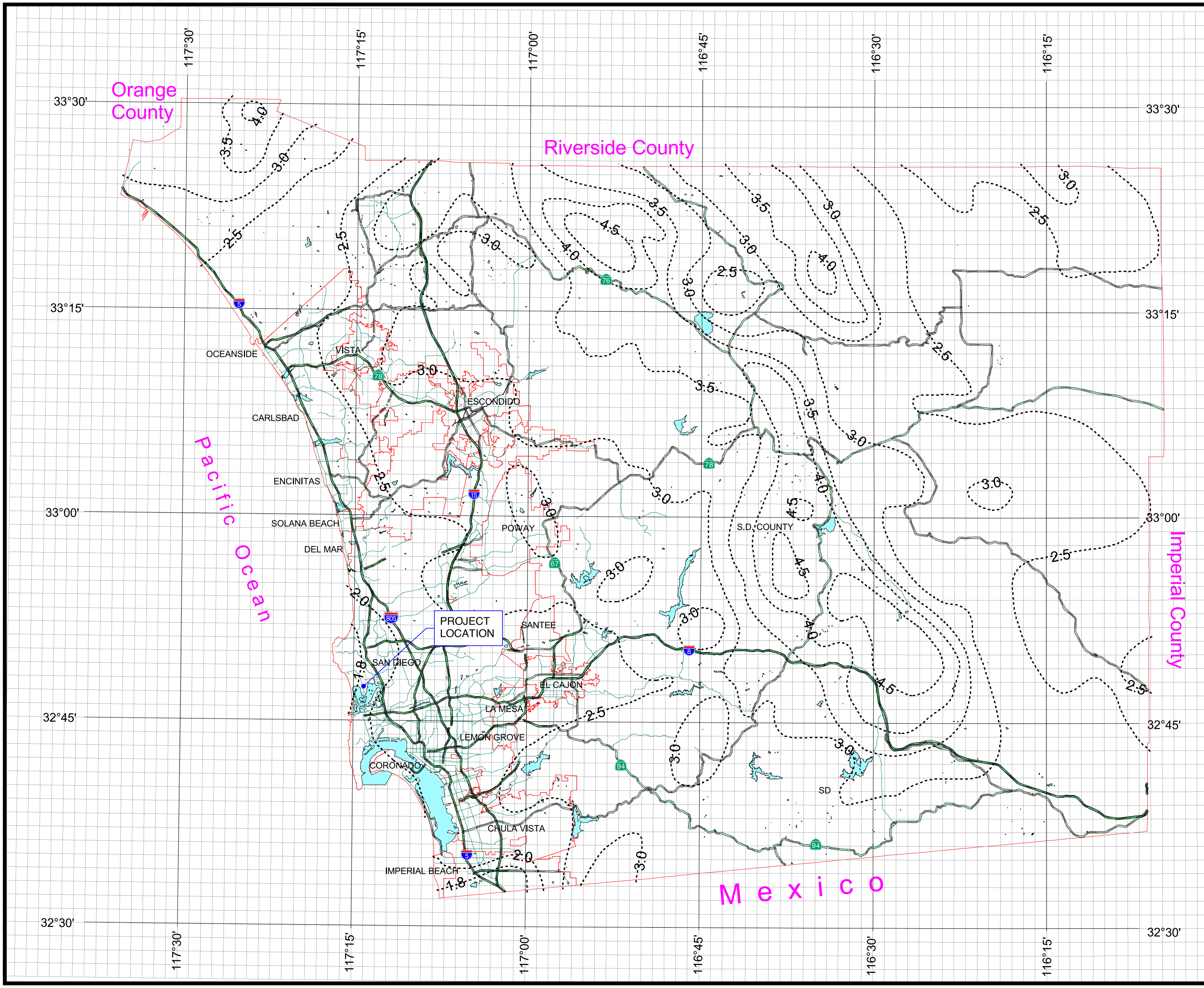
Where: C_p = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can be determined from the soil type map provided in Appendix A.

The values in Table 3-1 are typical for most urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the local agency.

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

------- Isopluvial (inches)

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N W E S

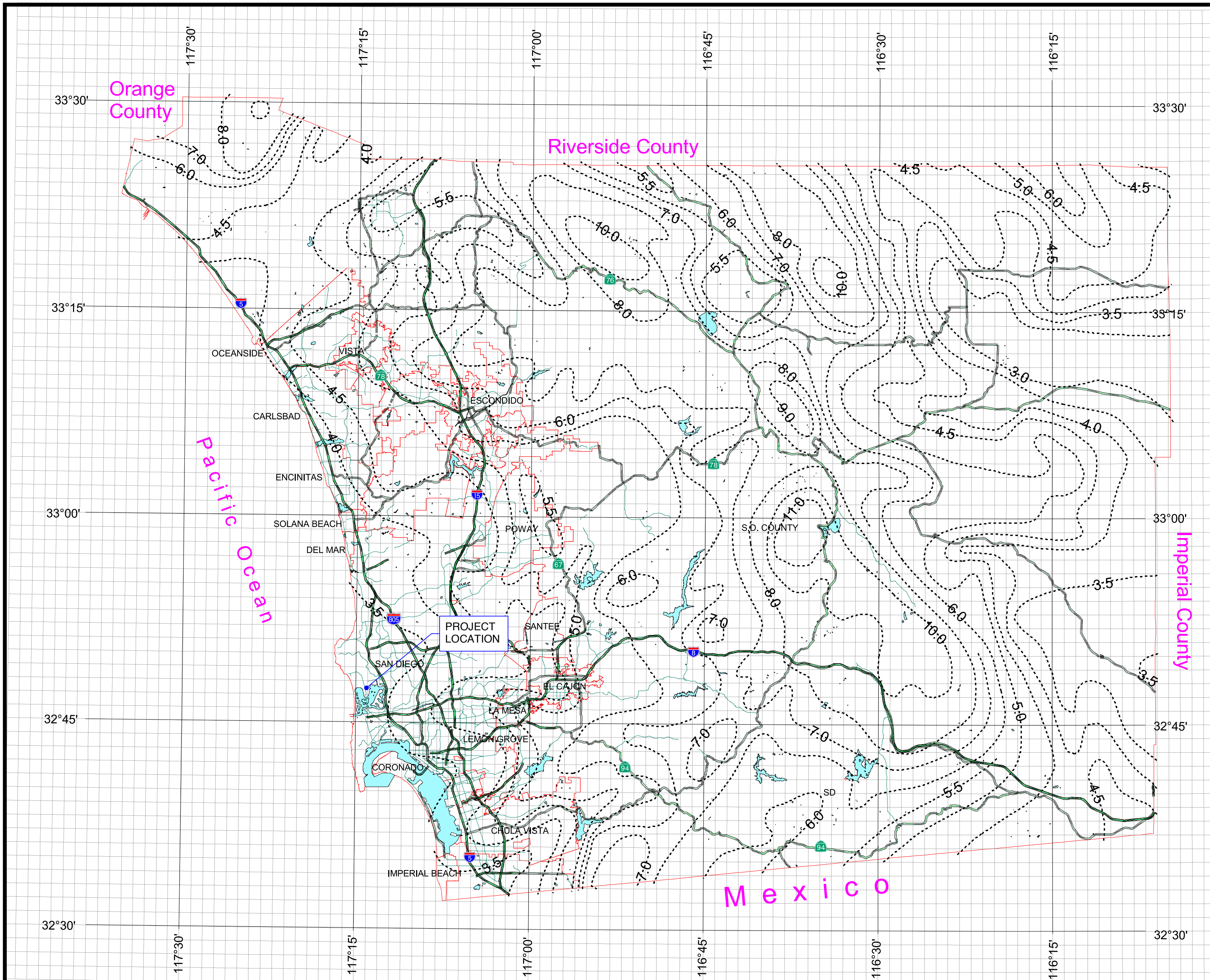
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

3.30 Isopluvial (inches)



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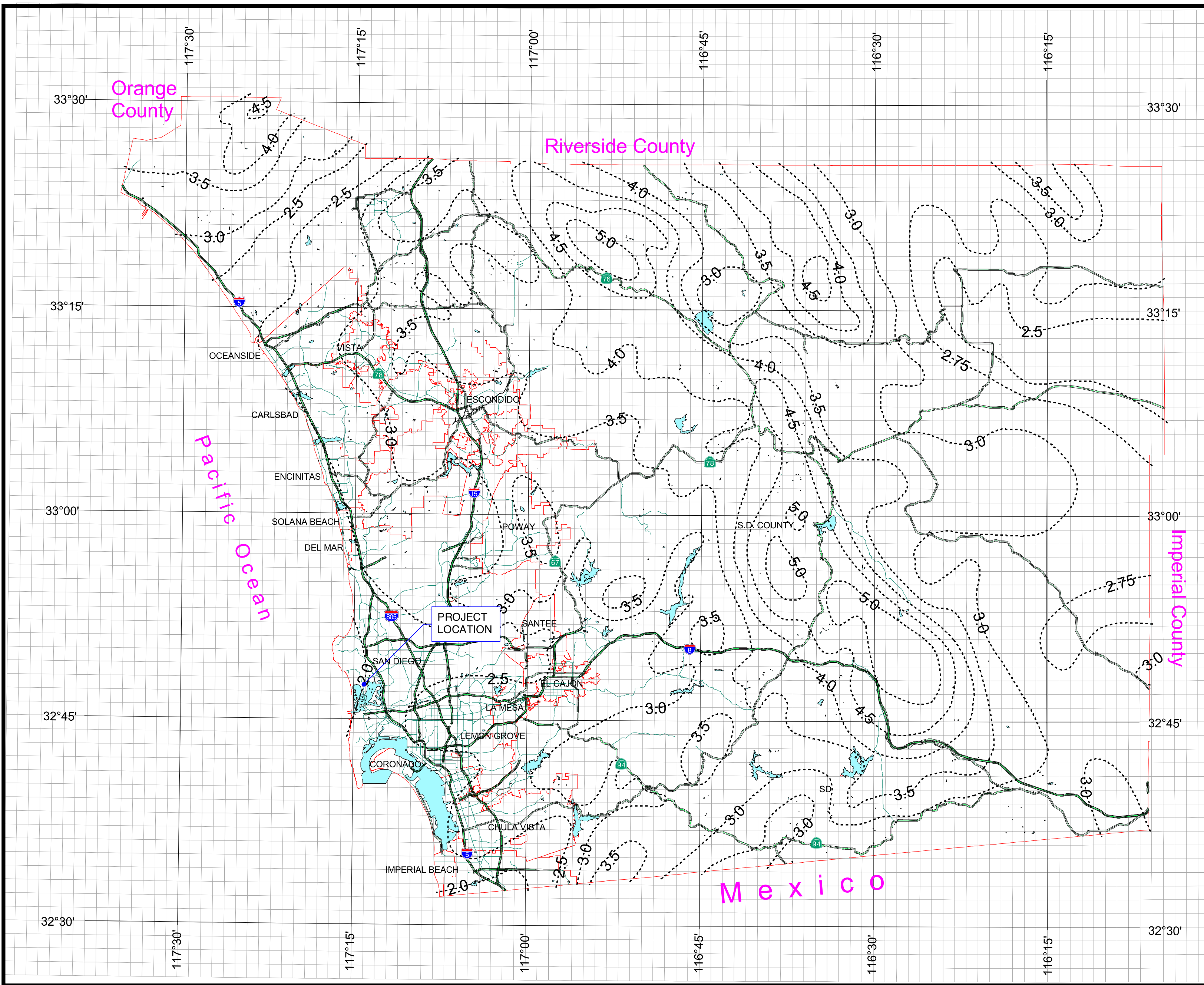
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

2.0	Isopluvial (inches)

DPW GIS Department of Public Works Geographic Information Services

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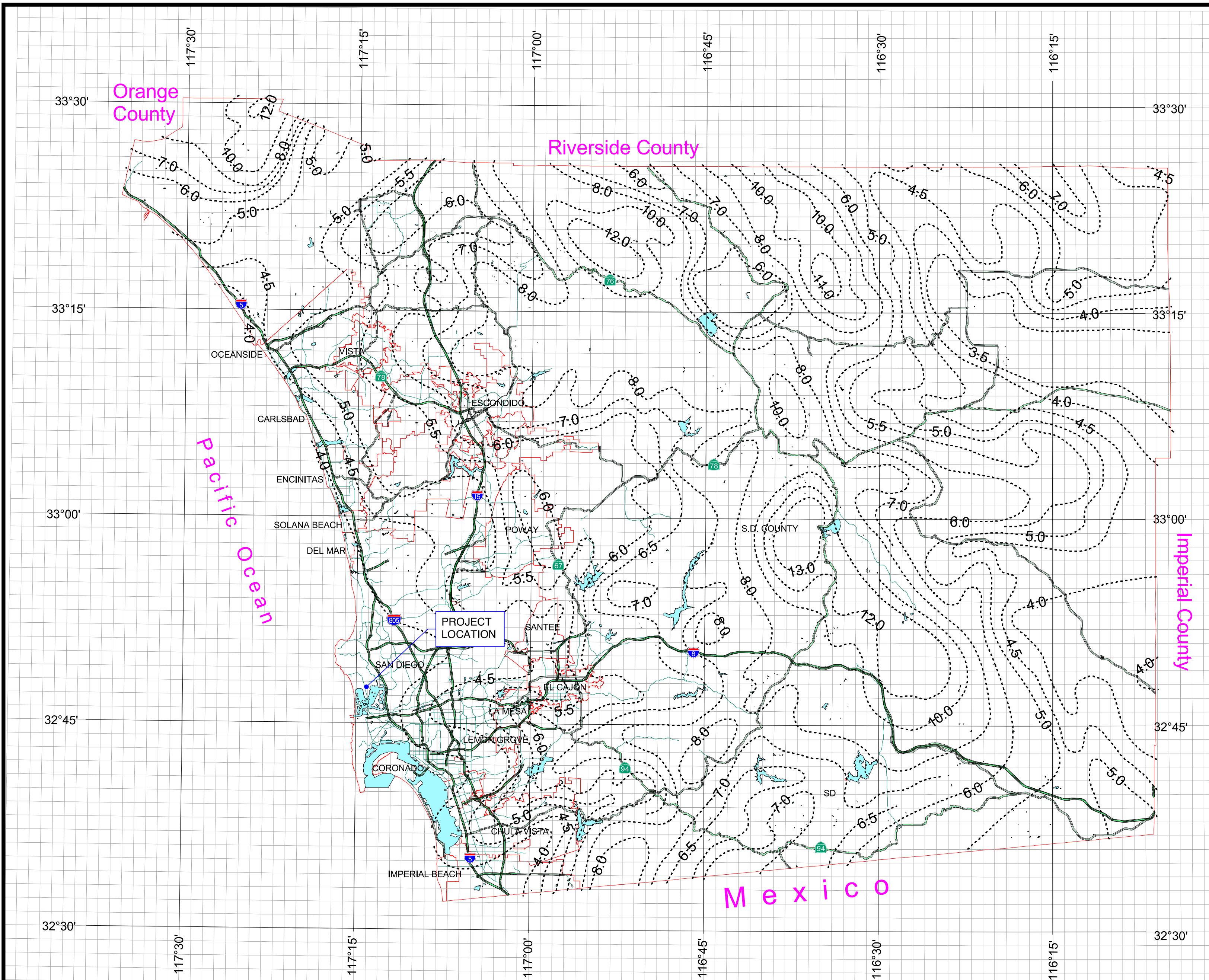
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

3.5 Isopluvial (inches)

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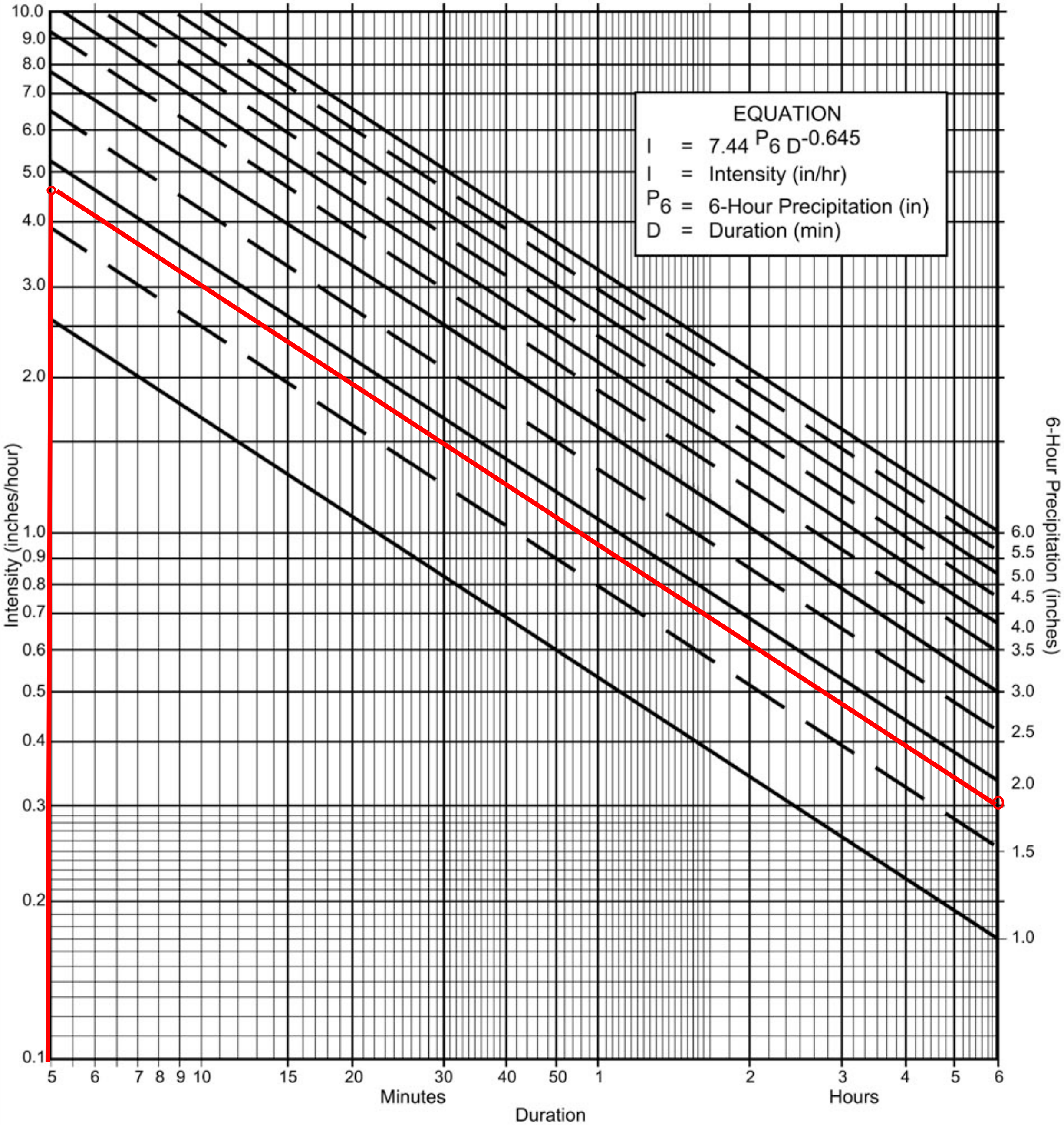
N S E W

3 0 3 Miles



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _ 50 _ year

(b) P_6 = 1.85 in., P_{24} = 3.3 $\frac{P_6}{P_{24}}$ = 0.56 %(2)

(c) Adjusted $P_6^{(2)}$ = _______ in.

(d) t_x = 5 _ min.

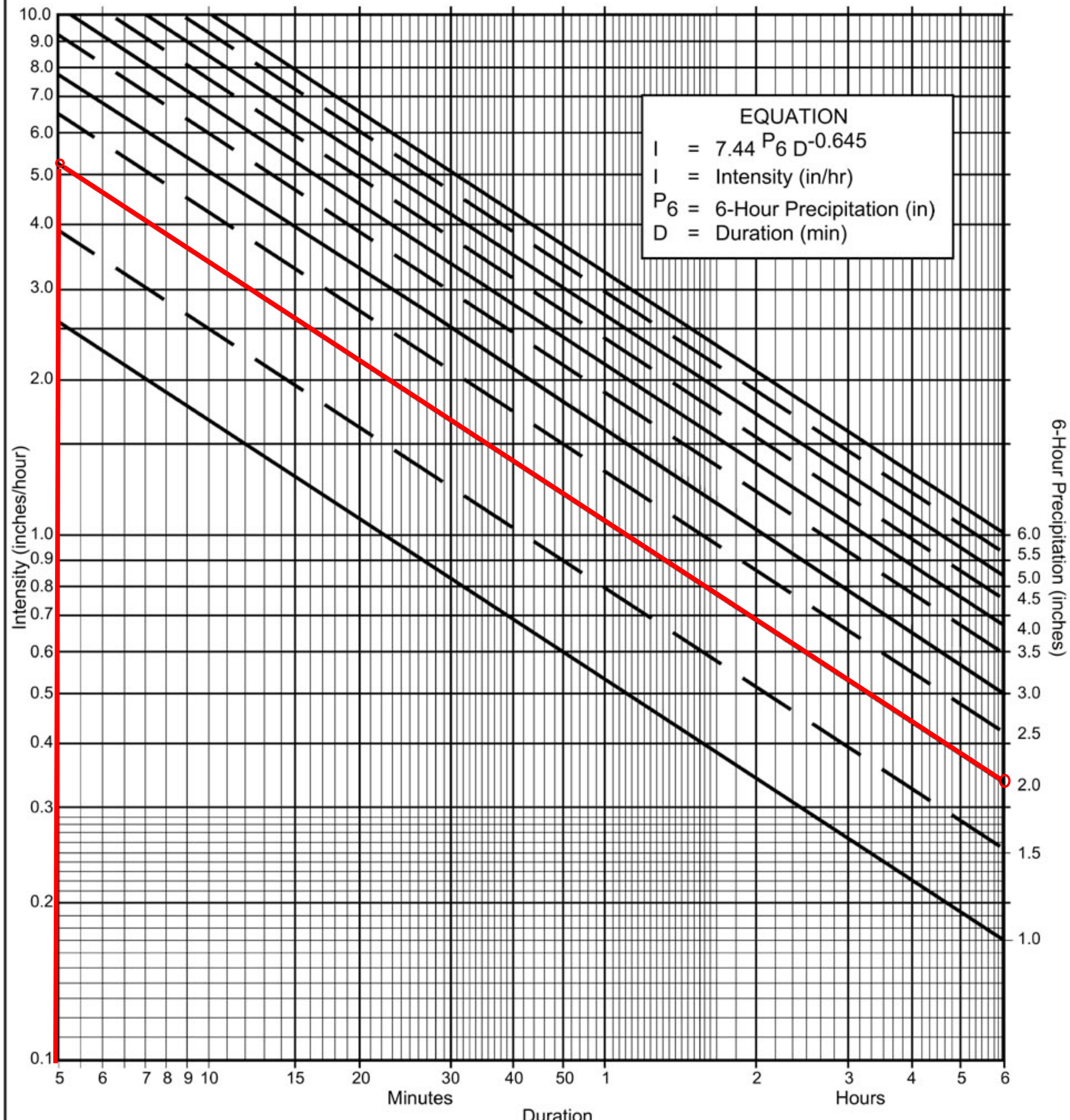
(e) I = 4.7 _ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE **3-1**



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _ 100 _ year

(b) P_6 = _ 2 _ in., P_{24} = _ 3.5 _, $\frac{P_6}{P_{24}}$ = _ 0.57 _ %(2)

(c) Adjusted P_6(2) = _______ in.

(d) t_x = _ 5 _ min.

(e) I = _ 5.2 _ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
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150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
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360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE **3-1**

APPENDIX B

SOILS REPORT

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October 19, 2021

Project No. 21010-01

To: Avalon Bay Communities, Inc.
11111 Santa Monica Boulevard, Suite 850
Los Angeles, California 90025

Attention: Ms. Sofia Zamora

Subject: Geotechnical Investigation and Preliminary Design Recommendation Report for Proposed Expansion Development at AVA Pacific Beach Apartments, 3883 Ingraham Street, San Diego, California

In accordance with your authorization, NMG Geotechnical, Inc. (NMG) has performed a geotechnical site investigation at the site for the expansion of the Pacific Beach Apartments at 3883 Ingraham Street. The purpose of this investigation was to evaluate the geotechnical site conditions in light of the proposed expansion development to provide preliminary geotechnical recommendations for the project design, grading and construction.

The scope of work for this investigation included review of the existing data, including published geologic maps and reports; coordination with onsite personnel; procurement of a boring permit through the County of San Diego; excavation, logging and sampling of six hollow-stem-auger borings; percolation testing of onsite soils; laboratory testing; preparation of preliminary design parameters for grading and construction of the residential development; and preparation of this report. This report presents a summary of the geotechnical conditions, conclusions and recommendations for remedial earthwork, and preliminary recommendations for the residential development.

Based on our findings, we conclude that the proposed expansion of the apartment development is feasible from a geotechnical viewpoint provided it is designed and constructed in accordance with the recommendations presented in this report and the future plan review reports.

If you have any questions regarding this report, please contact our office. We appreciate the opportunity to provide our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

Lynne Yost, CEG 2317
Principal Geologist

Shahrooz "Bob" Karimi, RCE 54250
Principal Engineer

LY/SBK/je

Distribution: (1) Addressee (E-Mail)
(1) Mr. Mark Janda, Avalon Bay (E-Mail)

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1.0 INTRODUCTION

1.1 Purpose and Scope of Work

NMG Geotechnical, Inc. (NMG) has performed a geotechnical subsurface investigation and prepared this geotechnical report for the proposed expansion of the existing apartment development. The purpose of our study was to evaluate the geotechnical site conditions in light of the proposed grading and improvements in order to provide geotechnical recommendations for the project design, grading and construction.

Our scope of work was as follows:

- Acquisition and review of available geologic and geotechnical maps, and data for the subject site and surrounding area. A list of references is included in Appendix A.
- Review of historic satellite/aerial photographs dating back to 1953.
- Notification and coordination with Dig Alert and onsite representatives to identify and locate existing underground utilities.
- Acquisition of a well/exploratory boring permit through the County of San Diego.
- Excavation, sampling and visual logging of six hollow-stem-auger borings, ranging in depth from 5 to 51.4 feet below ground surface (bgs). The approximate locations of the exploratory borings are depicted on the Boring Location Map (Figure 2) and the geotechnical boring logs are included in Appendix B.
- Percolation testing in three of the hollow-stem-auger borings ranging in depth from 5 to 10 feet bgs to evaluate infiltration potential at the site. Percolation test data is provided in Appendix E.
- Analytical testing of the drummed onsite soils prior to transport to an offsite disposal site. Laboratory test results are included in Appendix C.
- Laboratory testing of selected soil samples, including in situ moisture and density, direct shear, consolidation and collapse potential, maximum dry density and optimum moisture content, grain-size distribution, Atterberg limits, and hydrometer. Corrosion evaluation (pH, resistivity, sulfate and chloride content) were performed by an outside laboratory. Laboratory test results, including the corrosion evaluation, are included in Appendix C.
- Evaluation of faulting, seismicity and settlement in accordance with the 2019 California Building Code (CBC).
- Geotechnical evaluation and analysis of the compiled data with respect to the proposed improvements and soil engineering parameters for design of foundations, slabs, retaining structures and pavement improvements.
- Preparation of this report, including our findings, conclusions, and recommendations for the subject project.

1.2 Site Location, Existing Conditions and Site History

The subject site is an existing apartment complex located at 3883 Ingraham Street in the Pacific Beach neighborhood in the city of San Diego, California (Figure 1). The site is bounded by Ingraham Street on the west, Fortuna Street on the north, Jewell Street on the east, and La Playa Avenue on the south. The site consists of several large, occupied apartment buildings surrounded by at-grade surface parking, a recreation site and a partially subterranean parking structure with tennis courts atop the structure. The perimeter of the site consists of public sidewalks, landscape improvements and paved roadways. A small string of single-family homes is located along Ingraham Street near the intersection of Fortuna Avenue, and a three-level apartment building is located at the intersection of Ingraham Street and La Playa Avenue.

Based on our review of available aerial photographs, reports, and our prior work at the site, the history of the site is as follows:

- In 1953, the site originally consisted of barracks and/or row housing, presumably for local military personnel.
- Between 1953 and 1964, the structures had been demolished leaving only concrete slabs with exterior walkways and mature trees.
- Between 1966 and 1978, most of the site had been constructed to its current condition, with aesthetic improvements made over the last several years.
- Also, between 1966 and 1978, a fuel station had been constructed at the corner of Ingraham Street and La Playa Avenue. This station was demolished in 2012 and replaced with a three-level apartment building.

1.3 Proposed Improvements

Based on review of the Yield Study site plan prepared by TCA, dated April 15, 2021, the proposed project consists of demolition of the existing partially subterranean parking structure and the surface parking areas located south of Jewel Street, and southwest of Jewel Street and Playa Avenue. Improvements will include construction of two four-level parking structures, three three-story apartment buildings, and additional surface parking. The apartment structures are planned to be modular structures with building floors that are slightly raised and anchored into concrete slabs below the floor.

1.4 Field Exploration

A subsurface exploration was conducted on September 8 and 9, 2021. Exploration consisted of excavation, visual logging and sampling of six hollow-stem-auger borings (H-1 through H-3 and P-1 through P-3) drilled to depths of 5.0 to 51.4 feet bgs. Borings P-1 through P-3 were used to evaluate the feasibility of storm water infiltration at the subject site. The approximate boring locations are depicted on Figure 2 and the geotechnical logs are included in Appendix B.

The boring locations were staked and cleared with Dig Alert. The hollow-stem-auger borings were geotechnically logged and sampled to their total depths. Sampling of the borings included collection of drive samples using the modified California ring sampler and bulk samples. Drive samples were obtained from the exploratory borings with a 2.5-inch inside-diameter, split-barrel sampler. The sampler was driven with a 140-pound automatic-trip safety hammer, free-falling 30 inches. The bulk and drive samples were used to assess soil types beneath the site, to obtain relatively undisturbed samples for laboratory testing, and to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on the geotechnical boring logs). In accordance with well/boring permit requirements of the County of San Diego, the borings deeper than 20 feet bgs were backfilled with concrete grout and the excess soils were drummed and disposed of offsite.

Percolation testing was performed in three borings (P-1 through P-3) on September 9, 2021 in general conformance with the 2018 City of San Diego Storm Water Standards.

1.5 Laboratory Testing

Laboratory tests performed on representative samples included:

- Moisture content and dry density;
- Grain-size distribution (sieve);
- Consolidation;
- Direct Shear;
- Expansion Index;
- Maximum Density; and
- Corrosivity.

Laboratory tests were conducted in general conformance with applicable ASTM test standards. Laboratory test results are presented in Appendix C, except for in-situ moisture and dry density results which are included on the geotechnical boring logs (Appendix B). Analytical testing of boring spoils was performed by an outside laboratory prior to disposal. The analytical test results are included in Appendix C.

2.0 GEOTECHNICAL FINDINGS

2.1 Geological Setting and Earth Units

The site is located within the Peninsular Range geomorphic province of southern California and is underlain by the Pleistocene-age Bay Point Formation. This formation consists of marine and nonmarine, poorly consolidated, fine and medium-grained, pale brown fossiliferous sandstone (Kennedy, 1975). This unit includes marine terrace deposits, valley fill deposits and locally river terrace deposits. Later mapping by the State shows the site as underlain by older paralic deposits (Kennedy and Tan, 2008) consisting of poorly sorted, moderately permeable, reddish-brown fine to medium grained fossiliferous sand and silty sand, which is essentially chrono-stratigraphically equivalent to the Bay Point Formation.

Based on our subsurface exploration, there is up to 4 feet of existing artificial fill (**Map Symbol: Afu**) underlying the proposed parking structure and surface parking lot in the southwest portion of the subject site. The fill generally consists of silty sand with cobbles, which was likely placed during the original grading of the site. Our request for available geotechnical reports related to the site through the City and County of San Diego has not resulted in locating the as-graded geotechnical report(s) documenting the compaction of fill materials at the site.

The majority of the site is directly underlain by the Bay Point Formation (**Map Symbol: Qbp**). The formation generally consists of strong brown to pale yellowish-gray brown fine sand with trace silt in the upper five feet. The sand is medium dense to hard, damp to saturated, and is locally micaceous and fossiliferous, with some gravel lenses. Rounded gravel and cobbles were also locally encountered.

2.2 Geotechnical Soil Characteristics

The following includes a summary of the subsurface geotechnical conditions based on the laboratory test results performed on collected samples during this investigation.

Soil Properties: Grain-size distribution tests were conducted on two samples in the upper 5 feet. The two samples have fines contents (passing No. 200 sieve) of 22 and 28 percent (USCS Classification of SM). In general, the soils encountered during our limited exploration were classified as poorly graded sands to silty sands (USCS Classification of SP and SM).

Maximum Dry Density and Optimum Moisture Content: Two samples from the upper 5 feet were tested for maximum density and optimum moisture content. The testing indicates that the soils have maximum dry densities of 125.0 and 130.5 pounds per cubic foot (pcf) at optimum moisture contents of 8.0 and 7.5 percent, respectively.

Expansion Potential: A soil sample collected from the upper 5 feet indicated "very low" expansion potential with an expansion index of 0.

Consolidation: Consolidation tests were performed on five relatively undisturbed samples from the upper 20 feet. Overall consolidations ranged from approximately 2 to 4 percent.

Direct Shear: Direct shear testing was performed on four samples from the upper 7.5 feet.

The results of the testing on the two relatively undisturbed samples indicate ultimate friction angles of 30 and 37 degrees with zero cohesion. Peak values for the same samples showed friction angles of 32 and 40 degrees with zero cohesion.

Direct shear testing on two remolded samples compacted to approximately 90 percent relative compaction indicated ultimate friction angles of 30 and 31 degrees with zero cohesion. Peak values for the same samples showed friction angles of 31 and 33 degrees at cohesions of 250 and 150 psf, respectively.

Corrosivity: Two samples from the upper 5 feet were also tested for soluble sulfate and corrosivity. The soluble sulfate exposure of the samples are classified as "S0" per Table 19.3.1.1 of ACI-318-14. Corrosion testing indicates the samples are both moderately corrosive to ferrous metals.

2.3 Groundwater

Groundwater was encountered during our investigation in Borings H-1 and H-3 at 32 and 33.5 feet below existing ground surface, respectively. The depth of the groundwater generally coincides with sea level elevations. We anticipate that the groundwater may fluctuate on the order of 2 to 3 feet due tidal influences. Groundwater monitoring at an adjacent site between August 1991 and July 1998 shows that groundwater near the site ranged from approximately 30 to 34 feet bgs in the 1990s (URS, 2011).

2.4 Percolation Testing and Infiltration Feasibility

Percolation testing was performed onsite on September 9, 2021, in general accordance with the 2018 City of San Diego Storm Water Standards. The Borehole Percolation Test Method for Sandy Soils was utilized, as described by the technical guidelines, for Borings P-1 through P-3, which were drilled to depths of 5 to 10 feet (see Figure 2 for locations). All three borings passed the Sandy Soil Criteria and were tested by the Sandy Soil Method. A 2-inch-diameter perforated pipe was installed in the borings and backfilled with clean graded sand to prevent the borings from caving during percolation testing.

The first 50 minutes were used to confirm the sandy soil criteria applied for the site, after the required pre-soaking periods. The final measurements at the end of the testing period were used to calculate the tested infiltration rate. The field test data sheets are provided in Appendix E.

Infiltration rates were calculated based on the results of the final measurement during the testing period using the Porchet Method (Inverse Borehole Method) as outlined by the city standard. The percolation test results are summarized below. The rates provided below do not include factor-of-safety. A minimum factor-of-safety of 3 should be applied to the tested infiltration rate.

PERCOLATION TEST RESULTS			
Boring No.	***Total Depth (feet)***	***Percolation Rate (in./hr.)***	***Tested Infiltration Rate (in./hr.)***
P-1	10	763.2	28.8
P-2	5	147.6	9.1
P-3	10	234.0	9.4

2.5 Regional Faulting and Seismicity

Regional Faults: The site is not located in a mapped fault rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act (CGS, 2018) and no evidence of active faulting was observed during out site exploration. Also, based on mapping by the State (CGS, 2010 and 2021), and the City of San Diego (2008), there are no active faults mapped at the site. Therefore, the potential for primary ground rupture is considered slight to nil at the site.

Seismicity: Properties in southern California are subject to seismic hazards of varying degrees depending upon the proximity, degree of activity, and capability of nearby faults. These hazards can be primary (i.e., directly related to the energy release of an earthquake such as surface rupture and ground shaking) or secondary (i.e., related to the effect of earthquake energy on the physical world, which can cause phenomena such as liquefaction and ground lurching). Since there are no active faults at the site, the potential for primary ground rupture is considered very low. The primary seismic hazard for this site is ground shaking due to a future earthquake on one of the major regional active faults listed below.

Using the USGS deaggregation computer program (USGS, 2021) and the site coordinates of 32.7906 degrees north latitude and 117.2371 degrees west longitude, the closest active faults to the site are the Rose Canyon Fault approximately 2.8 kilometers east of the site, and the Coronado Bank Fault approximately 19.8 kilometers to the west of the site.

Secondary Seismic Hazards: The site is not mapped by the City of San Diego Seismic Safety Study in a potential liquefaction zone and is mapped as having favorable geologic structure (City of San Diego, 2008), as depicted on Figure 4. The site is underlain by very dense sands of the Bay Point Formation and groundwater is on the order of 30 feet deep. Thus, the potential for liquefaction at the subject site is considered very low to nil.

The potential for secondary seismic hazards, such as tsunami and seiche, are considered very low to nil, as the site is located above sea level at an elevation of approximately 30 feet above mean sea level (msl) and outside of the mapped tsunami inundation zones (CGS, 2009), as shown on Figure 6. The site is not located adjacent to a confined body of water; therefore, the potential for seismic hazard of a seiche (an oscillation of a body of water in an enclosed basin) is considered very low to nil.

2.6 Settlement and Foundation Considerations

In general, the anticipated settlements depend upon the loads from the buildings, the type of building foundations and the geotechnical properties of the supporting soils.

Based on our knowledge of the subsurface conditions, the relatively minor amount of additional fill (1 to 4 feet) to be placed across the site, and the anticipated structural column loads of up to 600 kips for the parking structures, we anticipate a total settlement of up to 1 inch. The differential settlement is anticipated to be on the order of ½-inch over a 40-foot span.

As previously discussed, the site is underlain with granular soils that are considered dense to very dense. Based on our analysis, the near-surface granular soils may be subject to settlement during a large earthquake on the adjacent controlling fault. The anticipated seismic settlement of the granular soils may be on the order of 1 inch following the remedial removals at the site.

NMG should further evaluate the settlement potential at the site once the final development and foundation plans are available.

2.7 Existing Pavement

During our exploration, we drilled through the existing pavement in six locations. The existing pavement section ranges from 3.5 to 5 inches of asphalt concrete overlying native soils.

3.0 CONCLUSION AND RECOMMENDATIONS

3.1 General Conclusion and Recommendation

Based on the results of our study, construction of the proposed improvements, as described herein, is considered geotechnically feasible provided the recommendations in this report are implemented during design, grading and construction. Additional geotechnical evaluation may be needed once the precise grading and foundation plans are prepared.

The recommendations in this report are considered minimum and may be superseded by more restrictive requirements of others. In addition to the following recommendations, General Earthwork and Grading Specifications are provided in Appendix F.

3.2 Protection of Existing Improvements and Utilities

Existing buildings, improvements and utilities adjacent to the proposed improvements that are to be protected in-place should be located and visually marked prior to demolition and grading operations. Excavations adjacent to improvements to be protected in-place or any utility easement should be performed with care so as not to destabilize the adjacent ground. Utility lines that are to be abandoned (if any) should be removed and the excavation should be backfilled and compacted in accordance with the recommendations provided herein.

Excavations deeper than 4 feet will need to be laid back at a minimum of 1.5H:1V inclination. The shallower excavations, 4 feet or less, may consist of near-vertical excavation; however, this will need to be assessed in the field based on the actual conditions. The excavations should be performed in accordance with Cal/OSHA requirements. The contractor's qualified person should verify compliance with Cal/OSHA requirements.

Stockpiling of soils (more than 5 feet in height) near existing structures and over utility lines that are to remain in-place (if any) should not be allowed without review by the geotechnical consultant and the structure/utility line owner(s).

3.3 Grading Recommendations

Following demolition and prior to grading, the site should be cleared of deleterious materials (including vegetation, concrete, and any existing utility pipelines) and disposed of offsite.

Remedial grading beneath the proposed buildings and parking structures should consist of removal and recompaction of the soils in the upper 2 to 3 feet below existing grade. For the at-grade parking lots, we anticipate the remedial grading to generally consist of removal and recompaction of the upper 1 to 2 feet below existing grade. Additional removals may be necessary for the areas associated with the demolition/removal of existing utility lines, trees, etc. The removal bottoms should be reviewed and approved by the geotechnical consultant prior to fill placement.

The excavation bottoms should be scarified a minimum of 6 inches, moisture-conditioned as needed, and recompacted in-place prior to placement of fill materials. Onsite soil materials are considered suitable to be used as compacted fill materials. Fill materials should be mixed and placed in maximum 8-inch-thick loose lifts, moisture-conditioned to slightly above optimum moisture content, and compacted to a minimum of 90 percent relative compaction (per ASTM D1557).

3.4 Settlement

The amount of settlement will depend upon the type of foundation(s) and the foundation loads. Our preliminary settlement analyses indicates the total consolidation (static) settlement will be less than 1 inch using a bearing capacity of 4,000 psf at ground level for column footings and column loads of up to 600 kips. The differential settlement is anticipated to be on the order of ½-inch over a 40-foot span. Seismic settlement is anticipated to be on the order of 1 inch.

NMG should be provided with the foundation plans once available in order to further evaluate the potential for post-construction settlement of the proposed buildings and associated improvements. The parameters provided herein will then be confirmed/updated based on the planned foundations layout and loads.

3.5 Preliminary Foundation Recommendations

The proposed apartment structures are anticipated to be modular buildings with slightly raised floors, which are anchored into the concrete slabs on the building pads. The design of concrete slabs should be in accordance with the modular building manufacturers' recommendations. At minimum, the concrete slabs should be 4 inches thick and reinforced with No. 3 rebars at 24 inches on-center, or equivalent wire mesh. The concrete slabs should have thickened edges to a minimum depth of 12 inches below lowest adjacent grade.

The concrete slabs for the at-grade level of the parking structures should be a minimum of 5 inches thick and reinforced with No. 4 rebars at 18 inches on-center. The thickness of concrete slabs should be increased to 6 inches where heavy truck (i.e., trash, recycle, moving trucks) traffic is anticipated.

At minimum, slab subgrade soils should be moisture-conditioned to a minimum of 110 percent of the optimum moisture content to a depth of 6 inches immediately prior to placement of concrete. Presaturation of the soil may be necessary to achieve this moisture content.

Allowable Bearing Capacity: The recommended allowable bearing capacity for footings of structures may be calculated based on the following equation:

$$q_{all} = 600\ D + 300\ B + 600 \leq 3{,}000 \text{ psf}$$

where:
D = embedment depth of footing, in feet
B = width of footing, in feet
q_{all} = allowable bearing capacity, in psf

The allowable bearing pressure may be increased to a maximum of 4,000 psf for column footings. The allowable bearing pressure may be increased by one-third for wind and seismic loading. The coefficient of resistance of 0.35 against sliding is considered appropriate. For the isolated footing, we recommend a minimum width of 18 inches and a minimum embedment of 24 inches below lowest adjacent grade.

3.6 Interior Slab Moisture Mitigation

In addition to geotechnical and structural considerations, the project owner should also consider moisture mitigation when designing and constructing slabs-on-grade. The intended use of the interior space, type of flooring, and the type of goods in contact with the floor may dictate the need for, and design of, measures to mitigate potential effects of moisture emission from and/or moisture vapor transmission through the slab. Typically, for human occupied structures, a vapor retarder or barrier has been recommended under the slab to help mitigate moisture transmission through slabs.

The most recent guidelines by the American Concrete Institute (ACI 302.1R-04) recommends that the vapor retarder be placed directly under the slab (no sand layer). However, the location of the vapor retarder may also be subject to the builder's past successful practice. Specifying the strength of the retarder to resist puncture and its permeance rating is important. These qualities are not necessarily a function of the retarder thickness.

The vapor retarder, when used, should be installed in accordance with standards such as ASTM E1643 and/or those specified by the manufacturer.

Concrete mix design and curing are also significant factors in mitigating slab moisture problems. Concrete with lower water/cement ratios results in denser, less permeable slabs. They also "dry" faster with regard to when flooring can be installed (reduced moisture emissions quantities and rates). Rewetting of the slab following curing should be avoided since this can result in additional drying time required prior to flooring installation. Proper concrete slab testing prior to flooring installation is also important.

Also, the concrete mix design and the type and location of the vapor retarder should be determined in coordination with all parties involved in the finished product, including the project owner, architect, structural engineer, geotechnical consultant, concrete subcontractors, and flooring subcontractors.

3.7 Lateral Earth Pressures for Permanent Retaining Structures

Recommendations for lateral earth pressures for retaining walls and structures with approved onsite drained soils are as follows:

Lateral Earth Pressures		
Equivalent Fluid Pressure (psf/ft.)		
Conditions	***Level***	***2:1 Slope***
Active	40	65
At Rest	60	85
Passive	360	180 (if sloping in front of wall)

These parameters are based on a soil internal friction angle of 30 degrees and soil unit weight of 120 pcf. The above parameters do not apply for backfill that is highly expansive.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, the at-rest pressure should be used. Passive pressure is used to compute lateral soils resistance developed against lateral structural movement. The passive pressures provided above may be increased by one-third for wind and seismic loads. The passive resistance is taken into account only if it is ensured that the soil against the embedded structure will remain intact with time. Future landscaping/planting and improvements adjacent to the retaining walls should also be taken into account in the design of the retaining walls. Excessive soil disturbance, trenches (excavation and backfill), future landscaping adjacent to footings and over-saturation can adversely impact retaining structures and result in reduced lateral resistance.

For sliding resistance, the friction coefficient of 0.35 may be used at the concrete and soil interface. The coefficient of friction may also be increased by one-third for wind and seismic loading. The retaining walls will need to be designed for additional lateral loads if other structures or walls are planned within a 1H:1V projection.

The seismic lateral earth pressure for walls retaining more than 6 feet of soil and level backfill conditions may be estimated to be an additional 19 pcf for active and at-rest conditions. The earthquake soil pressure has a triangular distribution and is added to the static pressures. For the active and at-rest conditions, the additional earthquake loading is zero at the top and maximum at the base. The seismic lateral earth pressure does not apply to walls retaining less than, or equal to, 6 feet of soil (2019 CBC Section 1803.5.12).

Drainage behind walls retaining more than 30 inches should also be provided in accordance with the attached Figure 7. Specific drainage connections, outlets and avoiding open joints should be considered for the retaining wall design.

3.8 Seismic Design Guidelines

The following table summarizes the seismic design criteria for the subject site. The seismic design parameters are developed in accordance with ASCE 7-16 and 2019 CBC (Appendix D). Please note that considering the proposed structures and the anticipated structural periods, site-specific ground hazard analysis was not performed for the site. The seismic design coefficient, C_s, should be determined per the parameters provided below and using equation 12.8-2 of ASCE 7-16.

Selected Seismic Design Parameters from 2019 CBC/ASCE 7-16	*Seismic Design Values*	*Reference*
Latitude	32.7906 North	
Longitude	117.2371 West	
Controlling Seismic Source	Rose Canyon Fault	USGS, 2021
Distance to Controlling Seismic Source	1.8 mi	USGS, 2021
Site Class per Table 20.3-1 of ASCE 7-16	D	
Spectral Acceleration for Short Periods (Ss)	1.35 g	SEA/OSHPD, 2021
Spectral Accelerations for 1-Second Periods (S1)	0.47 g	SEA/OSHPD, 2021
Site Coefficient F_a, Table 11.4-1 of ASCE 7-16	1	SEA/OSHPD, 2021
Site Coefficient F_v, Table 11.4-2 of ASCE 7-16	1.8	
Design Spectral Response Acceleration at Short Periods (S_{DS}) from Equation 11.4-3 of ASCE 7-16	0.90 g	SEA/OSHPD, 2021
Design Spectral Response Acceleration at 1-Second Period (S_{D1}) from Equation 11.4-4 of ASCE 7-16	0.56 g	
T_S, S_{D1}/ $S_{DS,}$ Section 11.4.6 of ASCE 7-16	0.62 sec	
T_L, Long-Period Transition Period	8 sec	SEA/OSHPD, 2021
Peak Ground Acceleration (PGA_M) Corrected for Site Class Effects from Equation 11.8-1 of ASCE 7-16	0.675 g	SEA/OSHPD, 2021
Seismic Design Category, Section 11.6 of ASCE 7-16	D	

3.9 Exterior Concrete

The following table provides our recommendations for varying expansion characteristics of subgrade soils. Additional considerations are also provided after the table. We recommend that the "**Low**" category be used during design and construction.

Typical Recommendations for Residential Concrete Flatwork/Hardscape					
	Expansion Potential (Index)				
Recommendations	***Very Low (< 20)***	***Low (20 – 50)***	***Medium (51 – 90)***	***High (91 – 130)***	***Very High (> 130)***
Slab Thickness (Min.)*:* Nominal thickness except where noted.	4"	**4"**	4"	4"	4" Full
Subbase; thickness of sand or gravel layer below concrete	N/A	**N/A**	Optional	2" – 4"	2" – 4"
Presaturation; degree of optimum moisture content (opt.) and depth of saturation	Pre-wet Only	**1.1 x opt. To 6"**	1.2 x opt. to 12"	1.3 x opt. to 18"	1.4 x opt. to 24"
Joints; maximum spacing of control joints. Joint should be ¼ of total thickness	10'	**10'**	8'	6'	6'
Reinforcement**:** rebar or equivalent welded wire mesh placed near mid-height of slab	N/A	**N/A**	Optional (WWF 6 x 6 – W1.4 x W1.4)	No. 3 rebar, 24" o.c. both ways or equivalent wire mesh	No. 3 rebar, 24" o.c. both ways
Restraint**:** Slip dowels across cold joints; between sidewalk and curb	N/A	**N/A**	Optional	Across cold joints	Across cold joints (and into curb)

Additional measures, such as thickened concrete edges/footings, subdrains and/or moisture barriers, should be considered for areas requiring enhanced concrete performance and where planter or natural areas with irrigation are located adjacent to the concrete improvements. The site should be provided with proper surface drainage and irrigation to avoid excessive wetting of the subgrade soil adjacent to concrete hardscape. Concrete that will be subject to heavy loading from cars/trucks or other heavy objects will require thicker slabs and/or sub-base (see Section 3.12).

These recommendations should be verified and modified as necessary, in the event that conditions at the completion of grading differ from our assumptions described herein.

3.10 Cement Type and Corrosivity

Based on laboratory testing, soluble sulfates exposure in the onsite soils may be classified as "S0" per Table 19.3.1.1 of ACI-318-14. Structural concrete elements in contact with soil include footings and building slabs-on-grade.

3.11 Asphalt Concrete Pavement Design

Final structural pavement sections should be based on R-value testing after the completion of grading and the anticipated traffic volumes. For budgetary purposes, the pavement sections at the site may consist of 3 inches of Asphaltic Concrete (AC) over 6 inches of Aggregate Base (AB) for parking areas and 4.2 inches of AC over 6 inches of AB for drive areas.

Pavement should be placed in accordance with the requirements of Sections 301 and 302 of the Standard Specifications of Public Works Construction (the Greenbook).

Prior to construction of pavement sections, the subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in-place to a minimum of 90 percent relative compaction (per ASTM D1557). Subgrade should be firm prior to AB placement.

Aggregate base materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of any deleterious materials. Aggregate base materials should be placed in 6- to 8-inch-thick loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM D1557). Asphalt concrete should also be compacted to a minimum relative compaction of 95 percent.

3.12 Vehicular PCC Pavements

If trash enclosures or truck loading areas are to be constructed at the site, we recommend 5 inches of PCC reinforced with No. 3 rebar at 24 inches on-center, both ways, over 4 inches of AB, over compacted subgrade. Alternatively, the section may consist of 6 inches of PCC reinforced with No. 3 rebar at 24 inches on-center, both ways, over compacted subgrade.

The subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in-place to a minimum of 90 percent relative compaction (per ASTM D1557). If concrete is to be placed directly over the subgrade, the subgrade materials in the upper 6 inches should be compacted to a minimum of 95 percent relative compaction (per ASTM D1557).

Aggregate base materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of deleterious materials. Aggregate base materials should be placed in 6- to 8-inch-thick loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM D1557).

3.13 Groundwater

Based on our geotechnical exploration at the site and review of the existing data, groundwater is generally deep, on the order of 30 bgs. Groundwater is not expected to be encountered during grading and construction for the proposed improvements.

3.14 Infiltration Systems

Based on our exploration and analysis as described herein, we conclude that onsite storm water infiltration is geotechnically feasible. The infiltration rates presented in Section 2.4 may be used for design of infiltration systems near the test borings and at a depth representative of our testing. A minimum factor-of-safety of 3 should be applied to the tested infiltration rates presented in Section 2.4.

Infiltration systems should be constructed per the recommendations outlined in the County and/or City of San Diego guidelines. Special care should be taken so as to limit disturbance to native soils utilized as the infiltration surface in a manner that may affect infiltration performance. We recommend that infiltration systems have a minimum setback from foundations of at least 15 feet.

Proper and routine maintenance should be provided for systems, in accordance with manufacturer recommendations. The geotechnical consultant should review the proposed infiltration system plan/WQMP once it is available and provide additional recommendations, if necessary.

3.15 Utility Installation and Trench Backfill

Excavations should be performed in accordance with the requirements set forth by Cal/OSHA Excavation Safety Regulations (Construction Safety Orders, Section 1504, 1539 through 1547, Title 8, California Code of Regulations). In general, due to the friable nature of the onsite soils, they may classified as Type "C." Cal/OSHA regulations indicate that, for workers in confined conditions, the steepest allowable slopes in Type "C" soil are 1.5:1 (horizontal to vertical), for excavations less than 20 feet deep. Where there is no room for these layback slopes, we anticipate that shoring will be necessary. Excavations should be reviewed periodically by the contractor's qualified person to confirm compliance with Cal/OSHA requirements. Additional recommendations may be provided, as needed.

Onsite soils should be suitable for use as trench backfill. Backfill materials should be compacted to a minimum of 90 percent relative compaction (per ASTM D1557). Select granular backfill, such as clean sand (SE 30 or better), may be used in lieu of native soils, but should also be compacted/densified with water jetting and flooding.

Trenches excavated next to structures and foundations should also be properly backfilled and compacted to provide full lateral support and reduce settlement potential.

3.16 Surface Drainage, Landscaping and Irrigation

Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture-related problems and differential movements from soil heave/settlement.

Surface drainage should be carefully taken into consideration during grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Buildings should have roof gutter systems and the run-off should be directed to parking lot/street gutters by area drain pipes or by sheet flow over paved areas. Paved areas should be provided with adequate drainage devices, gradients, and curbing to prevent run-off flowing from paved areas onto adjacent unpaved areas.

Construction of planter areas immediately adjacent to structures should be avoided if possible. If planter boxes are constructed adjacent to or near buildings, the planters should be provided with controls to prevent excessive penetration of the irrigation water into the foundation and flatwork subgrades. Provisions should be made to drain excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Raised planter boxes may be drained with weepholes. Deep planters (such as palm tree planters) should be drained with below-ground, water-tight drainage lines connected to a suitable outlet. Moisture and root barriers should also be considered.

3.17 Geotechnical Review of Future Plans

The future precise grading plan should be reviewed by the geotechnical consultant. Additional geotechnical analysis may be necessary for building foundation design in relation to potential settlements. NMG should also review the structural and foundation plans and issue a report documenting our review and confirming that the parameters used for design are in accordance with our recommendations provided herein and the future grading plan review report.

3.18 Geotechnical Observation and Testing during Grading and Construction

Geotechnical observation and testing should be performed by the geotechnical consultant during the following phases of grading and construction:

- During site preparation and clearing;
- During demolition/earthwork operations, including remedial removals and fill placement;
- Upon completion of any foundation excavation prior to placement of reinforcement or pouring concrete;
- During slab and hardscape subgrade preparation, prior to placement of reinforcement or pouring of concrete;
- During construction of structural pavement sections;
- During placement of backfill for utility trenches and retaining walls (if any); and
- When any unusual soil conditions are encountered.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, Avalon Bay Communities, Inc., within the specific scope of services requested by them for the subject project in the city of San Diego, California. This report or its contents should not be used or relied upon for other projects or purposes or by other parties without the written consent of NMG and the involvement of a geotechnical professional. The means and methods used by NMG for this study are based on local geotechnical standards of practice, care, and requirements of governing agencies. No warranty or guarantee, express or implied is given.

The findings, conclusions, and recommendations herein are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can vary from point to point, can be very different in between points, and can also change over time. Our conclusions and recommendations are subject to verification and/or modification during excavation and construction when more subsurface conditions are exposed.

NMG's expertise and scope of services did not include assessment of potential subsurface environmental contaminants or environmental health hazards.

SITE LOCATION MAP

AVA PACIFIC BEACH APARTMENTS
CITY OF SAN DIEGO, CALIFORNIA

Project Number: 21010-01 By: SBK/LY
Project Name: AvalonBay/ Pacific Beach
Date:10/19/2021 Figure 1

NMG

P:\2021\21010-01 Avalon-Pacific Beach\Drafting\GIS\21010-01 SiteLocation.mxd

Legend

Locations are Approximate

- **H-3 TD=31.5'** Boring Location Showing Total Depth (3 Total)
- **P-3 TD=10'** Percolation Test Location Showing Total Depth (3 Total)

0 100 200 Feet

1 inch = 200 feet

N

BORING LOCATION MAP

AVA PACIFIC BEACH APARTMENTS
CITY OF SAN DIEGO, CALIFORNIA

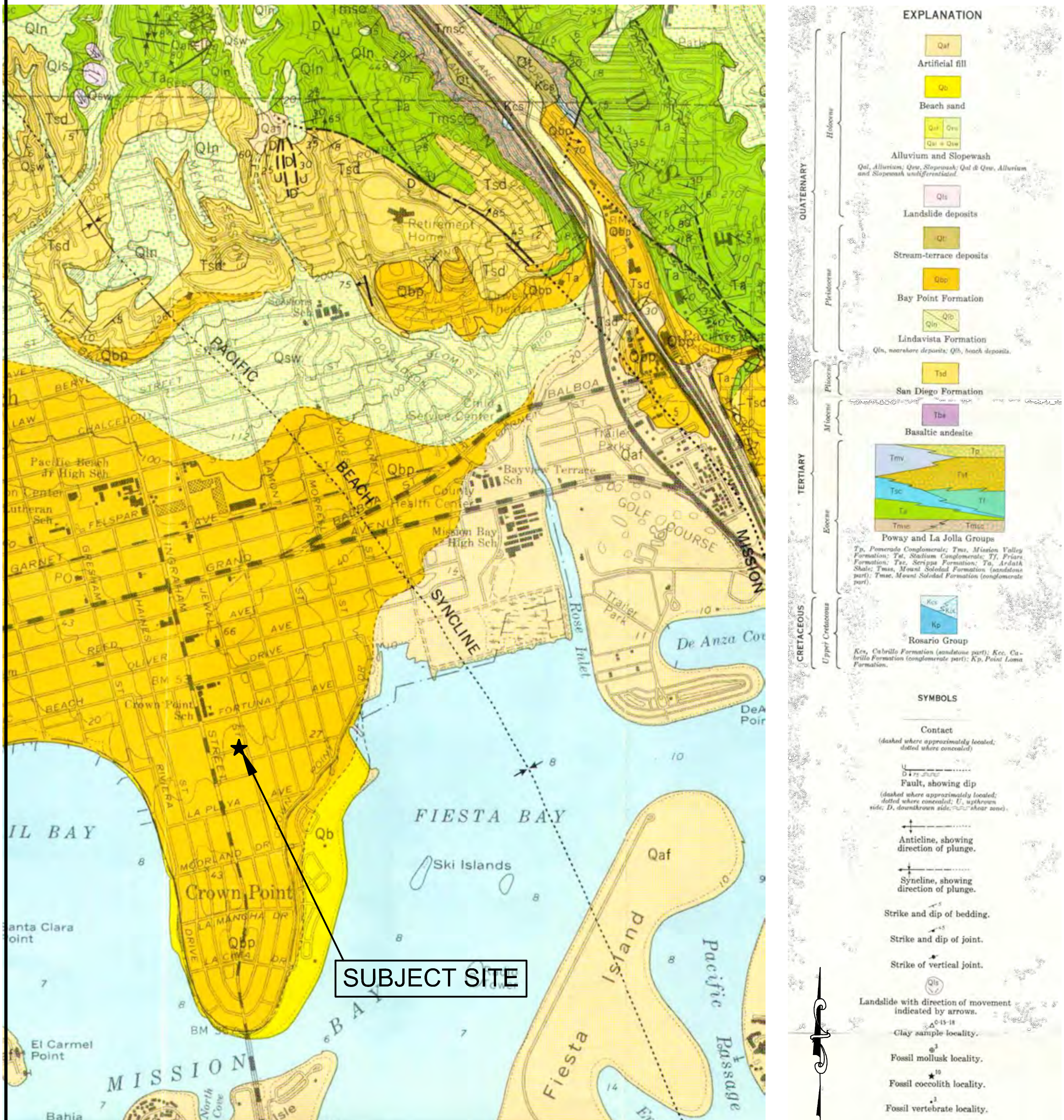
Project Number: 21010-01 By: SBK/LY

Project Name: AvalonBay/Pacific Beach

Date:10/19/2021 Figure 2

NMG

P:\2021\21010-01 Avalon-Pacific Beach\Drafting\GIS\21010-01 BoringLocation.mxd

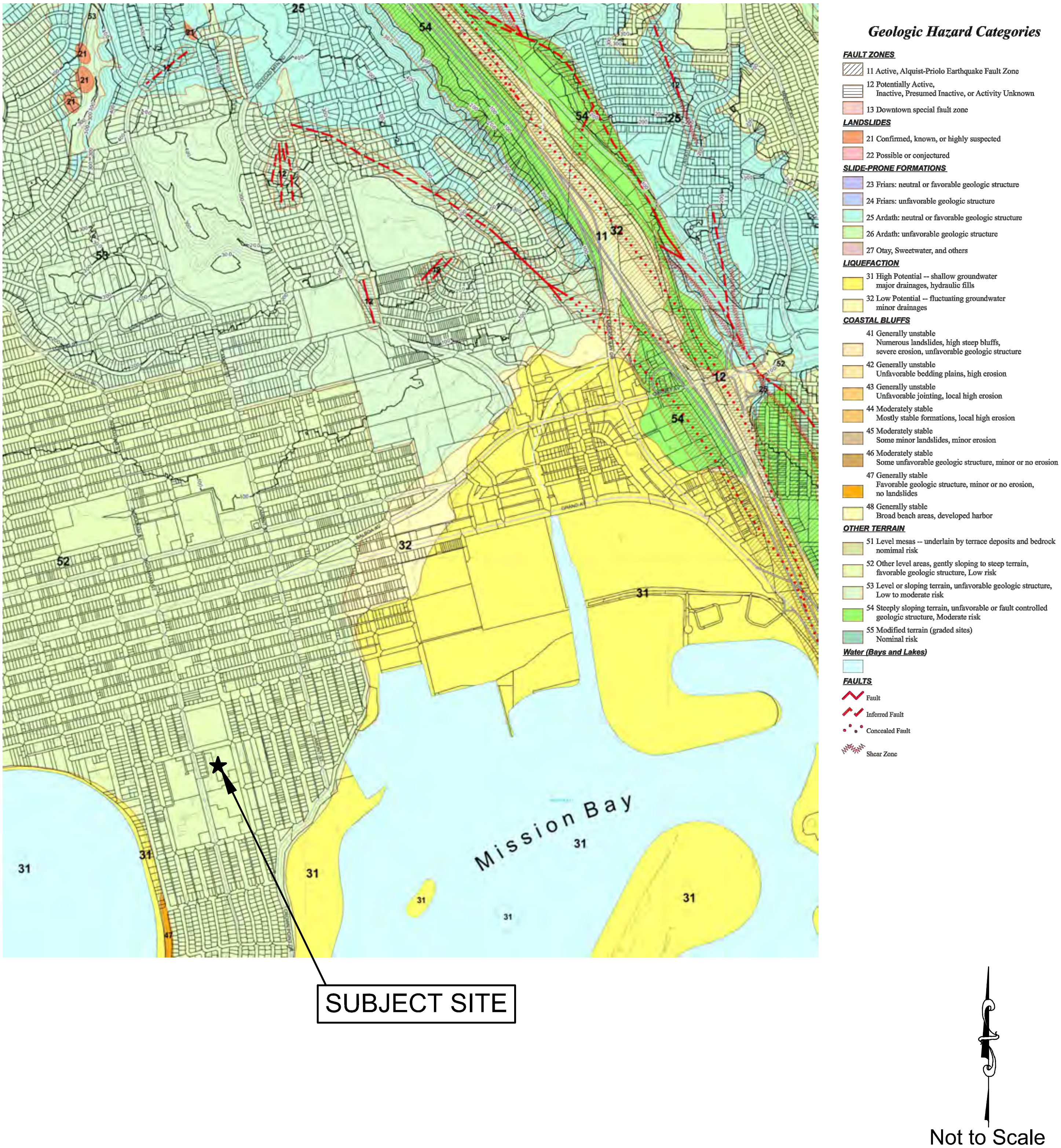


REGIONAL GEOLOGY MAP

Source: Kennedy, 1975, CDMG Bulletin 200

FIGURE 3

AVA PACIFIC BEACH APARTMENTS CITY OF SAN DIEGO, CALIFORNIA	Project Number: 21010-01 By:SBK/LY Project Name:AvalonBay/ Pacific Beach Date: 10/19/2021	NMG Geotechnical, Inc.



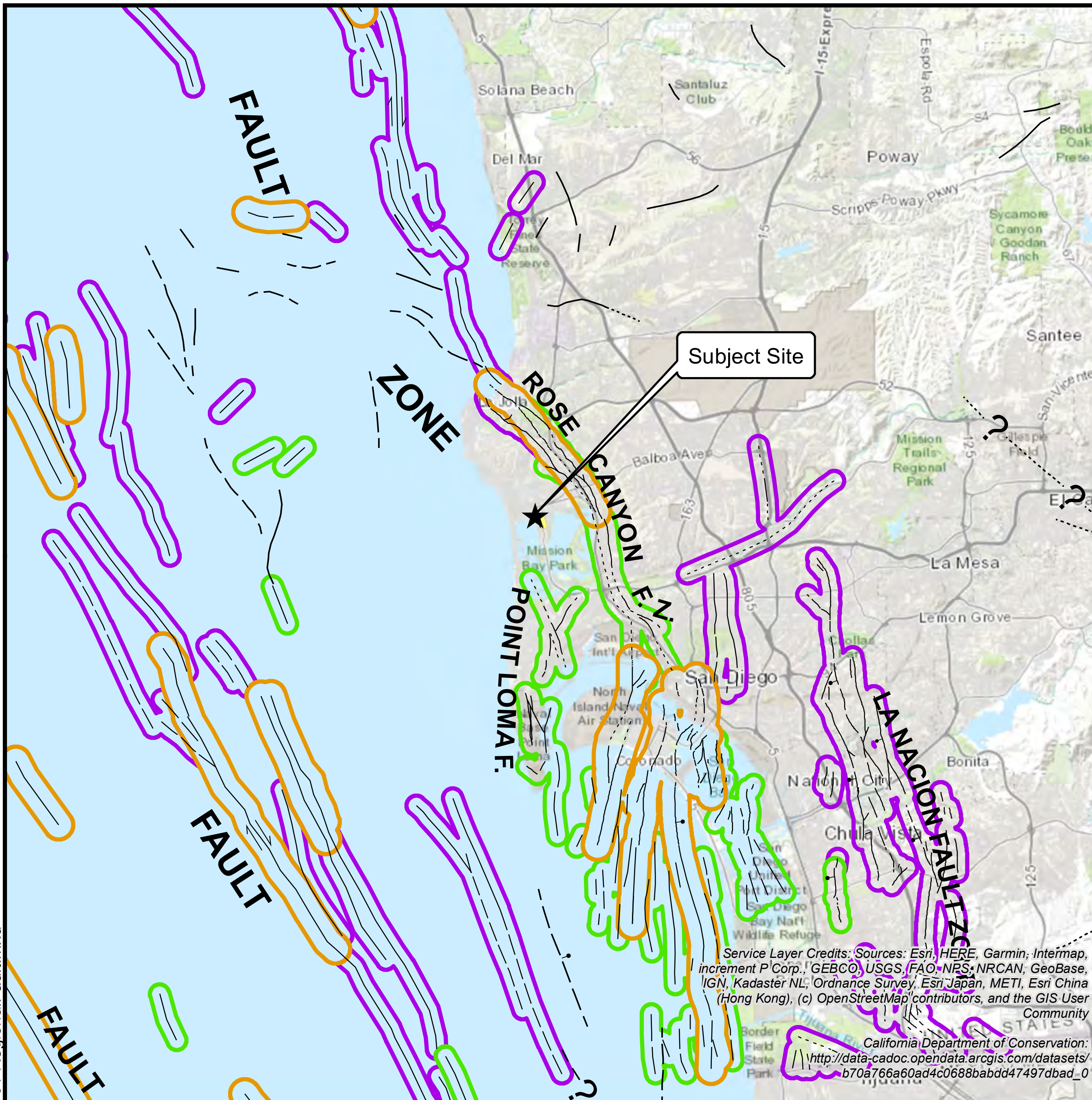
GEOLOGIC HAZARDS AND FAULTS MAP

FIGURE 4

AVA PACIFIC BEACH APARTMENTS
CITY OF SAN DIEGO, CALIFORNIA

Project Number: 21010-01 By:SBK/LY
Project Name:AvalonBay/ Pacific Beach
Date: 10/19/2021

NMG Geotechnical, Inc.



Legend

Faults

—— Certain

– — Approximately Located

······ Concealed

Recency of Movement

Historic

Holocene

Late Quaternary

Quaternary

0 2.5 5 Miles

N

1 inch = 5 miles

REGIONAL FAULT MAP

Base: California Geological Survey, Fault Activity Map of California, 2010

AVA PACIFIC BEACH APARTMENTS

CITY OF SAN DIEGO, CALIFORNIA

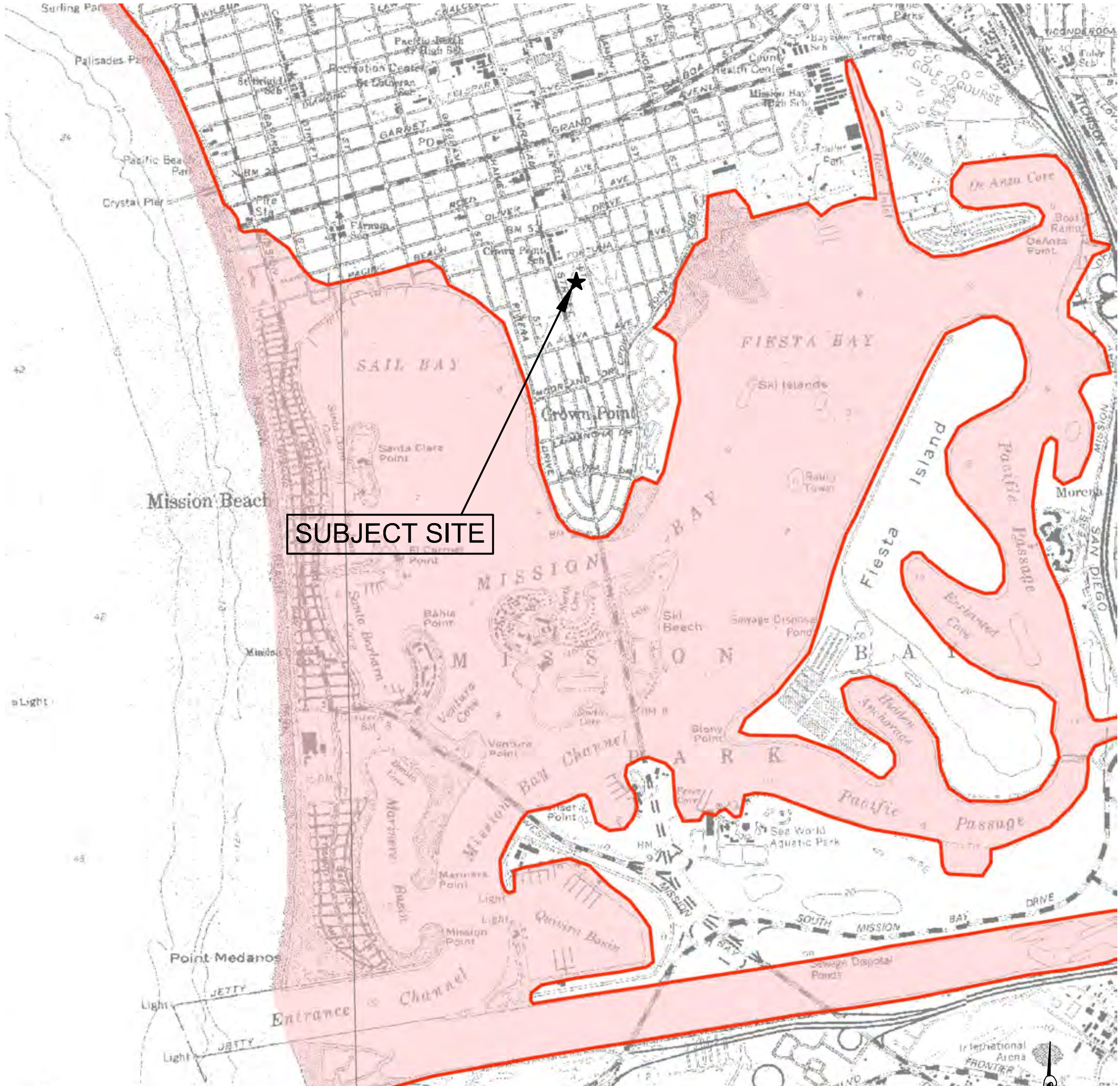
Project Number: 21010-01 By: SBK/LY

Project Name: AvalonBay/ Pacific Beach

Date:10/19/2021 Figure 5

NMG

P:\2021\21010-01 Avalon-Pacific Beach\Drafting\GIS\21010-01 RegionalFault.mxd



MAP EXPLANATION

- Tsunami Inundation Line
- Tsunami Inundation Area

Not to Scale

TSUNAMI INUNDATION MAP

Source: California Geological Survey 6/1/2009

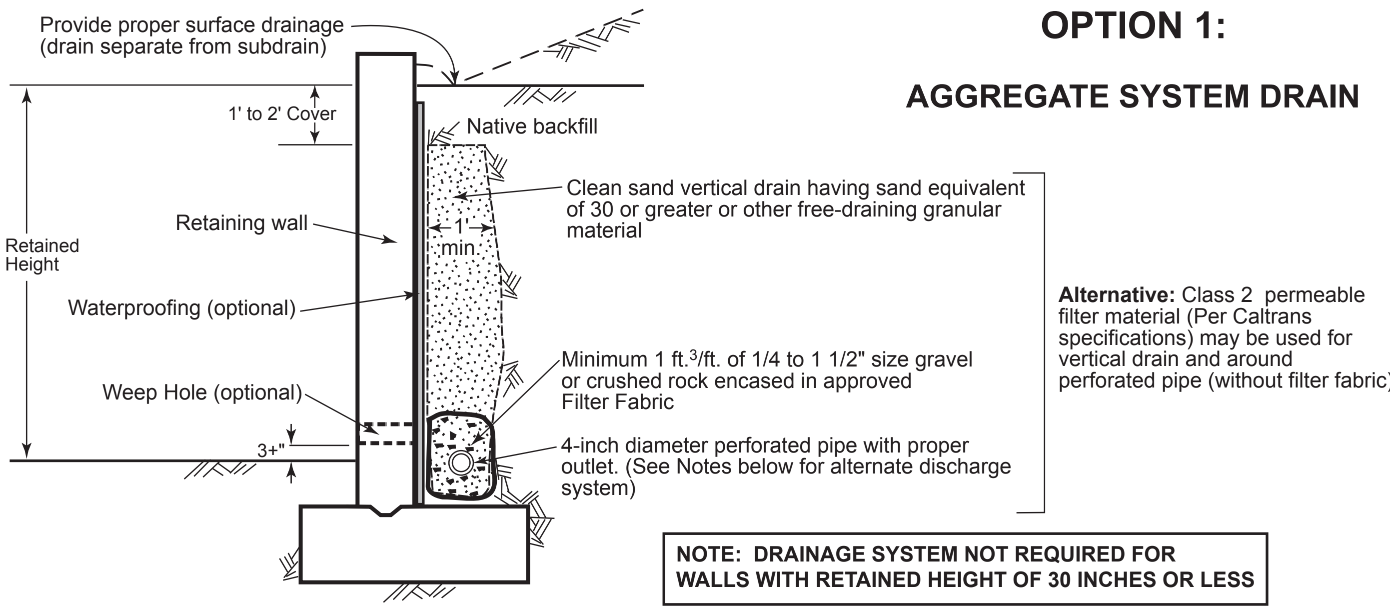
FIGURE 6

AVA PACIFIC BEACH APARTMENTS CITY OF SAN DIEGO, CALIFORNIA	Project Number: 21010-01 By:SBK/LY Project Name:AvalonBay/ Pacific Beach Date: 10/19/2021	NMG Geotechnical, Inc.

Drawing: P:\2021\21010-01 Avalon-Pacific Beach\Drafting_WIP\21010-01 Hazard Figure.dwg Layout: 6 Last Saved: Mon Oct 18, 2021 - 1:20pm Last Plotted: Mon Oct 18, 2021 - 1:36pm By: jschneider

OPTION 1:

AGGREGATE SYSTEM DRAIN

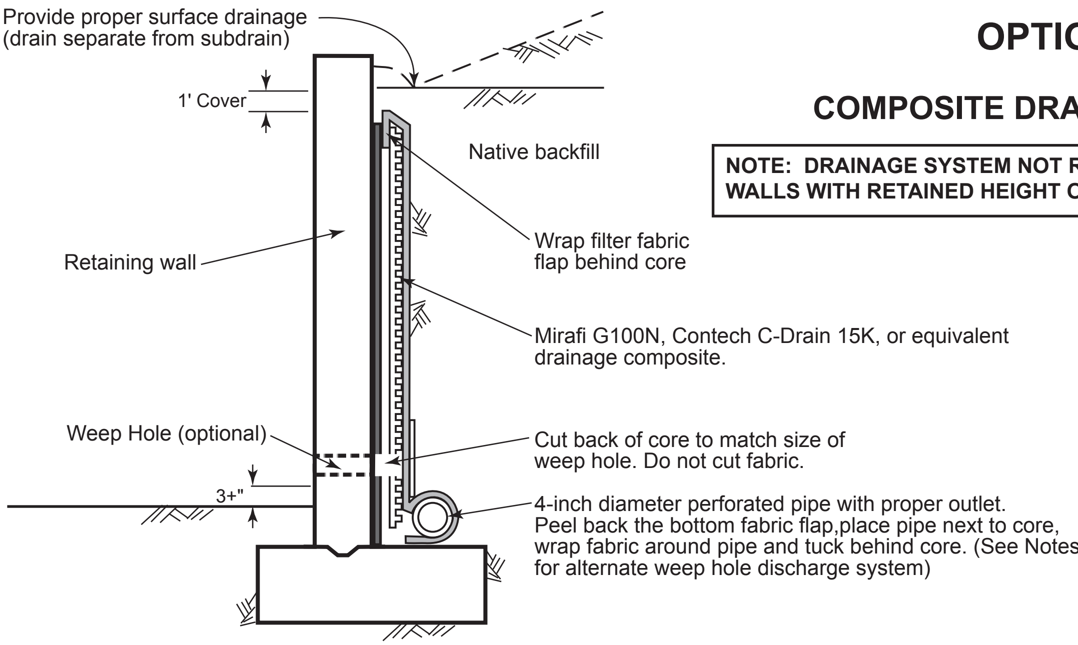


NOTE: DRAINAGE SYSTEM NOT REQUIRED FOR WALLS WITH RETAINED HEIGHT OF 30 INCHES OR LESS

OPTION 2:

COMPOSITE DRAINAGE SYSTEM

NOTE: DRAINAGE SYSTEM NOT REQUIRED FOR WALLS WITH RETAINED HEIGHT OF 30 INCHES OR LESS



NOTES:

1. PIPE TYPE SHOULD BE PVC OR ABS, SCHEDULE 40 OR SDR35 SATISFYING THE REQUIREMENTS OF ASTM TEST STANDARD D1527, D1785, D2751 , OR D3034.
2. FILTER FABRIC SHALL BE APPROVED PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL.
3. DRAIN PIPE SHOULD HAVE A GRADIENT OF 1 PERCENT MINIMUM.
4. WATERPROOFING MEMBRANE MAY BE REQUIRED FOR A SPECIFIC RETAINING WALL (SUCH AS A STUCCO OR BASEMENT WALL).
5. WEEP HOLES MAY BE PROVIDED FOR LOW RETAINING WALLS (LESS THAN 3 FEET IN HEIGHT) IN LIEU OF A VERTICAL DRAIN AND PIPE AND WHERE POTENTIAL WATER FROM BEHIND THE RETAINING WALL WILL NOT CREATE A NUISANCE WATER CONDITION. IF EXPOSURE IS NOT PERMITTED, A PROPER SUBDRAIN OUTLET SYSTEM SHOULD BE PROVIDED.
6. IF EXPOSURE IS PERMITTED, WEEP HOLES SHOULD BE 2-INCH MINIMUM DIAMETER AND PROVIDED AT 25-FOOT MAXIMUM SPACING ALONG WALL. WEEP HOLES SHOULD BE LOCATED 3+ INCHES ABOVE FINISHED GRADE.
7. SCREENING SUCH AS WITH A FILTER FABRIC SHOULD BE PROVIDED FOR WEEP HOLES/OPEN JOINTS TO PREVENT EARTH MATERIALS FROM ENTERING THE HOLES/JOINTS.
8. OPEN VERTICAL MASONRY JOINTS (I.E., OMIT MORTAR FROM JOINTS OF FIRST COURSE ABOVE FINISHED GRADE) AT 32-INCH MAXIMUM INTERVALS MAY BE SUBSTITUTED FOR WEEP HOLES.
9 THE GEOTECHNICAL CONSULTANT MAY PROVIDE ADDITIONAL RECOMMENDATIONS FOR RETAINING WALLS DESIGNED FOR SELECT SAND BACKFILL.

RETAINING WALL DRAINAGE DETAIL

NMG
Geotechnical, Inc.

3/21 RETAINING WALL DRAINAGE.ai

FIGURE 7

APPENDIX A

APPENDIX A

REFERENCES

California Geological Survey (CGS), 2009, Tsunami Inundation Mao for Emergency Planning, San Diego Bay, June 1, 2009.

California Geological Survey (CGS), 2010, Fault Activity Map of California and Adjacent Areas (Scale 1: 750,000), Geologic Data Map No. 6, Compiled and Interpreted by Charles W. Jennings and William A. Bryant. https://maps.conservation.ca.gov/cgs/fam/app/

California Geological Survey (CGS), 2018, Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners 2018 for Assessing Fault Rupture Hazards in California, Special Publication 42, Revised 2018.

California Geological Survey (CGS), 2021, Earthquake Zones of Required Investigation, La Jolla Quadrangle, Official Map Released September 23, 2021.

City of San Diego, 2008, Seismic Safety Study, Geologic Hazards and Faults, Grid Tile No. 25, dated April 3, 2008.

City of San Diego, 2018, Storm Water Standards, Effective Date: January 3, 2018.

Kennedy, Michael P., 1975, Geology of the La Jolla Quadrangle, San Diego County, California, San Diego Metropolitan Area, California Division of Mines and Geology, Bulletin 200, Plate 2A.

Kennedy, Michael P. and Tan, Siang S., 2008, Geologic Map of the San Diego 30' x 60' Quadrangle, California, Regional Map Series Published by the California Geological Survey.

Structural Engineers Association/Office of Statewide Health Planning and Development (SEA/OSHPD), 2021, U.S. Seismic Design Maps, web site address: https://seismicmaps.org

URS, 2011, Report of UST Removal and Soil Sampling Former 76 Station No. 6251, 3805 Ingraham Street, San Diego, California, Project No. 29879876, dated January 3, 2011.

U.S. Geological Survey (USGS), 2021, Unified Hazard Tool, NSHM 2008 Dynamic Deaggregation Program; web site address: https://earthquake.usgs.gov/hazards/interactive/

APPENDIX B

SOIL CLASSIFICATION CHART

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

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

Sampler and Symbol Descriptions

- ■ Modified California sample (D-#)
- ◪ Standard Penetration Test (S-#)
- ▯ Shelby tube sample (T-#)
- ▩ Large bulk sample (B-#)
- ☒ Small bulk sample (SB-#)
- ▽ Approximate depth of groundwater during drilling
- ▼ Approximate depth of static groundwater

Note: Number of blows required to advance driven sample 12 inches (or length noted).

Laboratory and Field Test Abbreviations

AL	Atterberg limits (plasticity)
CC	Chemical Testing incl. Soluble Sulfate
CN	Consolidation
DS	Direct Shear
EI	Expansion Index
GS	Grain Size Analysis (Sieve, Hydro. and/or -No. 200)
MD	Maximum Density and Optimum Moisture
RV	Resistance Value (R-Value)
SE	Sand Equivalent
UU	Unconsolidated Undrained Shear Strength

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System and include color, moisture, and relative density or consistency. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate. Bedrock descriptions are based on visual classification and include rock type, moisture, color, grain size, strength, and weathering.
2. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were drilled. They are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.

Date(s) Drilled	9/9/21	Logged By	BF
Drilling Company	Pacific Drilling Co.	Drill Bit Size/Type	6"
Drill Rig Type	Yeti M10 Hollow Stem	Hammer Data	140 lbs @ 30 Inch Drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	Groundwater Stabilized at 32.2 Feet.		
Comments			

H-1

Total Depth Drilled (ft)	50.4
Approximate Ground Surface Elevation (ft)	33.0 msl

Elevation (ft)	Depth (ft)	Sample Number	Blows per foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0			SP-SM	Surface: Parking Lot, 3.5" Asphalt Concrete **Bay Point Formation (Qbp)**			B-1 @ 1-5', DS, GS, MD, CC
30		B-1 D-1	9		@ 2.5': Strong brown silty fine SAND, moist, loose, micaceous, trace rootlets, trace pinhole pores, FeO staining, friable.	5.1	103.8	
	5	D-2	28		@ 5': Upper: Strong brown silty fine SAND, moist, medium dense, micaceous, trace rootlets, few to little rounded gravel up to 2"-diameter, little to some shell fragments, FeO staining, friable.	9.4		
				SP	Lower: Yellowish brown fine SAND, damp to moist, medium dense, some to abundant shell fragments, some rounded gravel up to 2.5"-diameter, FeO staining, friable, trace silt.			
		D-3	37		@ 7.5': Strong brown to yellowish brown fine SAND, damp, medium dense, micaceous, FeO staining, trace shell fragments, some subrounded to rounded gravel up to 1"-diameter, friable, trace silt.	3.1	117.2	DS
	10	D-4	64		@ 10': No Recovery. Observed gravel/cobble in cuttings after sampling.			
20		D-5	13		@ 12.5': Yellowish brown fine SAND, damp, loose, micaceous, few mafic minerals, FeO staining, trace to few rounded gravel up to 1.5"-diameter, friable.	3.8	93.5	
	15	D-6	26		@ 15': Light gray to pale brown fine SAND, damp, medium dense, micaceous, trace to few shell fragments, trace FeO staining, trace rounded gravel up to 1/2"-diameter, friable to highly friable, abundant shell fragments in tip.	3.7	92.7	CN
	20	D-7	51		@ 20': Light gray to pale brown fine SAND, damp, dense, micaceous, trace to few shell fragments, trace FeO staining, trace rounded gravel up to 1/2"-diameter, friable to highly friable.	3.6	96.3	CN
10								
	25							

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25		D-8	75		SP	@ 25': Pale brown fine SAND, damp, very dense, micaceous, trace shell fragments, trace FeO staining, trace rounded gravel up to 1/4"-diameter, friable to highly friable, trace silt. @ 26': Rig chatter.	5.3	98.2	
	30		D-9	40			@ 30': Pale brown fine SAND, damp, medium dense, micaceous, trace shell fragments, trace FeO staining, trace rounded gravel up to 1/4"-diameter, friable to highly friable, trace silt, upper rings are more light brown in color, tip is light gray in color.	8.3	96.6	
0										
	35		D-10	74			@ 35': Pale brown to light gray fine to medium SAND, damp, dense, micaceous, laminations of mafic minerals, trace FeO staining, friable to highly friable.	3.5	100.3	
	40		D-11	86/9"			@ 40': Light brownish gray fine to medium SAND, saturated, very dense, micaceous, little to some mafic minerals, trace shell fragments, friable, trace silt, sample consolidated in tube.	22.3	95.8	
-10										
	45		D-12	75/11"			@ 45': Light brownish gray fine to medium SAND, saturated, very dense, micaceous, little to some mafic minerals, trace shell fragments, friable, trace silt, sample consolidated in tube.	20.5	105.5	
	50		D-13	50/5"			@ 50': Light brownish gray fine to medium SAND, saturated, very dense, micaceous, few to little mafic minerals, trace shell fragments, friable, trace silt, sample consolidated in tube.	20.6	101.1	
-20							Notes: Total Depth: 50.4 Feet. Groundwater Encountered at 31.2 Feet. Groundwater Stabilized at 32.2 Feet. Backfilled With Concrete Grout and Bentonite Chips. Patched With Cold Patch Asphalt Concrete.			
	55									

LOG OF BORING
Avalon Bay/ Pacific Beach
San Diego, CA

PROJECT NO. 21010-01

NMG

Report: HOLLOW STEM; Project: 21010-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 9/30/21

Date(s) Drilled	9/8/21	Logged By	BF	**H-2** **Sheet 1 of 2**	
Drilling Company	Pacific Drilling Co.	Drill Bit Size/Type	8"		
Drill Rig Type	Yeti M10 Hollow Stem	Hammer Data	140 lbs @ 30 Inch Drop		
Sampling Method(s)	Modified California, Bulk				
Approximate Groundwater Depth:	Groundwater Stabilized at 33 Feet.			Total Depth Drilled (ft)	51.4
Comments				Approximate Ground Surface Elevation (ft)	29.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0						Surface: parking Lot, 5" Asphalt Concrete			
						SP-SM	**Bay Point Formation (Qbp)** @ 0.5': Light yellowish brown to strong brown silty fine SAND, damp, highly friable.			B-1 @ 1-5', EI
			B-1 D-1	26			@ 2.5': Light brown to light reddish brown silty fine SAND, damp, medium dense, trace pinhole pores, friable.	3.8	110.3	
	5		D-2	9		SP	@ 5': Light yellowish brown fine SAND, damp, loose, micaceous, trace pinhole pores, friable to highly friable.	4.5	100.6	CN
							@ 7': Gravel layer.			
20			D-3	33			@ 8': Upper: Light yellowish brown fine to medium SAND, damp, medium dense, abundant shell fragments, subrounded gravel up to 1.5"-diameter, friable. Lower: Light yellowish brown fine SAND, damp, medium dense, trace pinhole pores, friable.	1.5	113.7	CN
	10		D-4	32			@ 10': Light yellowish brown fine SAND, damp, medium dense, micaceous, friable, lower rings contain rounded cobble ~3"-diameter.	2.9	101.5	
							@ 14': Gravel layer.			
	15		D-5	43			@ 15': No Recovery. Tip of Sample: Light yellowish brown fine SAND, damp, medium dense, some shell fragments, few rounded gravel up to 3"-diameter, highly friable.			
10										
	20		D-6	18			@ 20': Light yellowish gray fine SAND, damp, medium dense, abundant shell fragments, trace rounded to well rounded gravel up to 3"-diameter, friable to highly friable.	3.9	90.5	
	25									

LOG OF BORING
Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25		D-7	27		SP	@ 25': Light yellowish gray fine to medium SAND, damp, medium dense, micaceous, abundant shell fragments, trace rounded to well rounded gravel up to 2"-diameter, highly friable.	2.9	91.2	
0										
	30		D-8	54			@ 30': Light yellowish gray fine SAND, moist, dense micaceous, trace FeO staining, friable.	8.0	98.2	
							▼ ▽			
	35		D-9	79/11"			@ 35': Light grayish brown fine SAND, saturated, very dense, micaceous, abundant mafic minerals, trace FeO staining, friable, trace silt.	24.4	98.9	
-10										
	40		D-10	85/10"			@ 40': Light grayish brown fine SAND, saturated, very dense, micaceous, little to some mafic minerals, friable, sample consolidated in tube.	18.0	102.1	
	45		D-11	78/11"			@ 45': Light grayish brown fine SAND, saturated, very dense, micaceous, little to some mafic minerals, friable, sample consolidated in tube.	21.9	102.2	
-20										
	50		D-12	77/11"			@ 50': No Recovery.			
							Notes: Total Depth: 51.4 Feet. Groundwater Encountered at 34 Feet. Groundwater Stabilized at 33 Feet. Backfilled With Concrete Grout and Bentonite Chips. Patched With Cold Patch Asphalt Concrete.			
	55									

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA

PROJECT NO. 21010-01

NMG

Date(s) Drilled	**9/9/21**	Logged By	**BF**
Drilling Company	**Pacific Drilling Co.**	Drill Bit Size/Type	**6"**
Drill Rig Type	**Yeti M10 Hollow Stem**	Hammer Data	**140 lbs @ 30 Inch Drop**
Sampling Method(s)	**Modified California, Bulk**		
Approximate Groundwater Depth:	**No Groundwater Encountered.**		
Comments			

H-3

Total Depth Drilled (ft)	**31.5**
Approximate Ground Surface Elevation (ft)	**28.0 msl**

Elevation (ft)	Depth (ft)	Sample Type	Sample Number	Blows per foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0				SP-SM	Surface: Parking Lot, 4" Asphalt Concrete. **Bay Point Formation (Qbp)**			B-1 @ 1-5', DS, GS, MD, CC
		Bulk / Drive	B-1 D-1	49		@ 2.5': Upper: Strong brown fine SAND, damp, dense, micaceous, trace pinhole pores, friable, trace silt. Lower: Pale brown silty fine SAND, damp, dense, micaceous, trace pinhole pores, friable.	3.0	111.6	DS
	5	Drive	D-2	43	SP	@ 5': Light brown to strong brown fine SAND, damp, medium dense, trace pinhole pores, micaceous, trace subrounded gravel up to 1/2"-diameter, friable, trace silt.	2.7	110.3	
20		Drive	D-3	23		@ 7.5': Light brown to strong brown fine SAND, damp, medium dense, micaceous, trace pinhole pores, trace roots, trace subrounded gravel up to 1/2"-diameter, friable, trace silt.	2.0	103.0	
	10	Drive	D-4	33		@ 10': Light brown to pale brown fine SAND, damp, medium dense, micaceous, trace pinhole pores, abundant FeO staining, friable.	3.5	105.7	CN
	15	Drive	D-5	53		@ 15': Light brown to pale brown fine SAND, damp, dense, micaceous, trace pinhole pores, abundant FeO staining, friable.	5.3	110.0	
10									
	20	Drive	D-6	53		@ 20': Light gray to pale brown fine SAND, damp, dense, micaceous, trace shell fragments, few to little subrounded to rounded gravel up to 3"-diameter, friable to highly friable, trace silt.	1.2		
	25								

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA
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Elevation (ft)	Depth (ft)	SAMPLES Type	Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25		D-7	37		SP	@ 25': Pale brown to white fine to medium SAND, damp, medium dense, micaceous, abundant shell fragments, highly friable, trace silt.	1.9	94.5	
0										
	30		D-8	43			@ 30': Pale brown to white fine to medium SAND, damp, medium dense, micaceous, abundant shell fragments, highly friable, trace silt.	7.0	102.5	
							@ 31.5': Refusal.			
							Notes: Total Depth: 31.5 Feet. No Groundwater Encountered. Backfilled With Concrete Grout and Bentonite Chips. Patched With Cold Patch Asphalt Concrete.			
	35									
-10										
	40									
	45									
-20										
	50									
	55									

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA

PROJECT NO. 21010-01

Date(s) Drilled	9/8/21	Logged By	BF
Drilling Company	Pacific Drilling Co.	Drill Bit Size/Type	8"
Drill Rig Type	Yeti M10 Hollow Stem	Hammer Data	140 lbs @ 30 Inch Drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	No Groundwater Encountered.		
Comments			

P-1

Sheet 1 of 1

Total Depth Drilled (ft)	10.0
Approximate Ground Surface Elevation (ft)	32.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SP	Surface: Parking Lot, 4" Asphalt Concrete. **Bay Point Formation (Qbp)**			
30							@ 1.5': Gravel layer.			
			D-1	47			@ 2.5': Light yellowish brown fine SAND, damp, dense, micaceous, subrounded to rounded gravel up to 2"-diameter, highly friable, trace silt.	4.1	93.6	
							@ 4': Rig chatter.			
	5		D-2	45			@ 5': No Recovery. Rig metal cable jumped off pulley and dropped sampler on ground.			
			D-3	25			@ 8.5': Light yellowish brown to light yellowish gray fine SAND, damp, medium dense, micaceous, few rounded gravel up to 2"-diameter, highly friable.	1.5	92.0	
	10						Notes: Total Depth: 10 Feet. No Groundwater Encountered. Installed 2"-Diameter Slotted Pipe. Placed 3/4"-Gravel Under and Around Pipe. Pre-Soaked Boring On 9/8/2021. Percolation Test Performed On 9/9/2021. Backfilled With Cuttings and Tamped. Patched With Quickset Concrete and Black Dye.			
20										
	15									
	20									
10										
	25									

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

Date(s) Drilled	9/8/21	Logged By	BF
Drilling Company	Pacific Drilling Co.	Drill Bit Size/Type	8"
Drill Rig Type	Yeti M10 Hollow Stem	Hammer Data	140 lbs @ 30 Inch Drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	No Groundwater Encountered.		
Comments			

P-2

Total Depth Drilled (ft)	5.0
Approximate Ground Surface Elevation (ft)	28.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SP-SM	Surface: Parking Lot, 4" Asphalt Concrete. **Bay Point Formation (Qbp)**			
			D-1	9			@ 3.5': Light reddish brown silty fine SAND, damp, loose, micaceous, trace pinhole pores, FeO staining, highly friable.	5.1	100.9	
	5						Notes: Total Depth: 5 Feet. No Groundwater Encountered. Installed 2"-Diameter Slotted Pipe. Placed 3/4"-Gravel Under and Around Pipe. Pre-Soaked Boring On 9/8/2021. Percolation Test Performed On 9/9/2021. Backfilled With Cuttings and Tamped. Patched With Quickset Concrete and Black Dye.			
20										
	10									
	15									
10										
	20									
	25									

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG

Date(s) Drilled	9/8/21	Logged By	BF
Drilling Company	Pacific Drilling Co.	Drill Bit Size/Type	8"
Drill Rig Type	Yeti M10 Hollow Stem	Hammer Data	140 lbs @ 30 Inch Drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	No Groundwater Encountered.		
Comments			

P-3

Sheet 1 of 1

Total Depth Drilled (ft)	10.0
Approximate Ground Surface Elevation (ft)	28.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM	Surface: Parking Lot, 4" Asphalt Concrete. **Undocumented Artificial Fill (Afu)** @ 1': Rounded cobble up to 5.5"-diameter.			
			D-1	44			@ 2.5': Light brown silty SAND, damp to moist, medium dense, micaceous, some to abundant rounded gravel up to 2"-diameter, trace rounded cobble up to 3"-diameter, FeO staining, trace clay.	9.6		
						SP	**Bay Point Formation (Qbp)**			
	5		D-2	35			@ 5': Reddish brown fine SAND, damp, medium dense, micaceous, trace pinhole pores, trace roots, trace rounded gravel up to 2"-diameter, friable, trace silt.	2.2	94.4	
20										
			D-3	38			@ 8.5': Light reddish brown fine SAND, damp, medium dense, micaceous, trace pinhole pores, trace rounded gravel up to 1.5"-diameter, friable.	2.9	90.5	
	10						Notes: Total Depth: 10 Feet. No Groundwater Encountered. Installed 2"-Diameter Slotted Pipe. Place 3/4"-Gravel Under and Around Pipe. Pre-Soaked Boring On 9/8/2021. Percolation Test Performed On 9/9/2021. Backfilled With Cuttings and Tamped. Patched With Quickset Concrete and Black Dye.			
	15									
10										
	20									
	25									

LOG OF BORING

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG

APPENDIX C

Avalon Bay/ Pacific Beach
Project Number: 21010-01

APPENDIX
SUMMARY OF SOIL LABORATORY DATA

San Diego, CA

Boring/Sample Information: Boring No.	Sample No.	Depth (feet)	End Depth (feet)	Elevation (feet)	Blow Count (N)	Field Wet Density (pcf)	Field Dry Density (pcf)	Field Moisture Content (%)	Degree of Sat. (%)	Sieve/Hydrometer: Fines Content (% pass. #200)	Sieve/Hydrometer: Clay Content (% pass. 2µ)	Atterberg Limits: LL (%)	Atterberg Limits: PI (%)	USCS Group Symbol	Direct Shear Ultimate: Cohesion (psf)	Direct Shear Ultimate: Friction Angle (°)	Direct Shear Peak: Cohesion (psf)	Direct Shear Peak: Friction Angle (°)	Compaction: Maximum Dry Density (pcf)	Compaction: Optimum Moisture Content (%)	Expansion Index	R-Value	Soluble Sulfate Content (% by wt)	Remarks
H-1	B-1	1.0	5.0	32.0			112.6	18.8		22				SM	0	31	150	33.0	125.0	8.0				CC
H-1	D-1	2.5		30.5	9	109.0	103.8	5.1	22.0															
H-1	D-2	5.0		28.0	28			9.4																Disturbed
H-1	D-3	7.5		25.5	37	120.9	117.2	3.1	19.1					SP/SW	0	37	0	40.0						
H-1	D-4	10.0		23.0	64																			NR
H-1	D-5	12.5		20.5	13	97.1	93.5	3.8	12.8															
H-1	D-6	15.0		18.0	26	96.1	92.7	3.7	12.1					SP/SW										
H-1	D-7	20.0		13.0	51	99.8	96.3	3.6	12.9					SP/SW										
H-1	D-8	25.0		8.0	75	103.4	98.2	5.3	20.0															
H-1	D-9	30.0		3.0	40	104.7	96.6	8.3	30.2															
H-1	D-10	35.0		-2.0	74	103.8	100.3	3.5	13.8															
H-1	D-11	40.0		-7.0	86/9"	117.2	95.8	22.3	79.5															
H-1	D-12	45.0		-12.0	75/11"	127.1	105.5	20.5	92.8															
H-1	D-13	50.0		-17.0	50/5"	121.9	101.1	20.6	83.2															
H-2	B-1	1.0	5.0	28.0																	0			
H-2	D-1	2.5		26.5	26	114.4	110.3	3.8	19.4															
H-2	D-2	5.0		24.0	9	105.1	100.6	4.5	18.1					SM										
H-2	D-3	8.0		21.0	33	115.4	113.7	1.5	8.2					SM										
H-2	D-4	10.0		19.0	32	104.4	101.5	2.9	11.7															
H-2	D-5	15.0		14.0	43																			NR
H-2	D-6	20.0		9.0	18	94.0	90.5	3.9	12.3															
H-2	D-7	25.0		4.0	27	93.9	91.2	2.9	9.4															
H-2	D-8	30.0		-1.0	54	106.1	98.2	8.0	30.3															
H-2	D-9	35.0		-6.0	79/11"	123.1	98.9	24.4	93.6															
H-2	D-10	40.0		-11.0	85/10"	120.5	102.1	18.0	74.8															
H-2	D-11	45.0		-16.0	78/11"	124.5	102.2	21.9	91.0															
H-2	D-12	50.0		-21.0	77/11"																			NR
H-3	B-1	1.0	5.0	27.0			117.5	15.9		28				SM	0	30	250	31.0	130.5	7.5				CC
H-3	D-1	2.5		25.5	49	115.0	111.6	3.0	16.2					SM	0	30	0	32.0						
H-3	D-2	5.0		23.0	43	113.3	110.3	2.7	13.9															
H-3	D-3	7.5		20.5	23	105.1	103.0	2.0	8.6															
H-3	D-4	10.0		18.0	33	109.4	105.7	3.5	16.0					SM										
H-3	D-5	15.0		13.0	53	115.8	110.0	5.3	26.9															
H-3	D-6	20.0		8.0	53			1.2																Disturbed
H-3	D-7	25.0		3.0	37	96.3	94.5	1.9	6.7															

NMG Geotechnical, Inc.

Printed: 10/5/21; Template: SUM_SOIL_LAB_ALL; Proj ID: 21010-01.GPJ

Avalon Bay/ Pacific Beach
Project Number: 21010-01

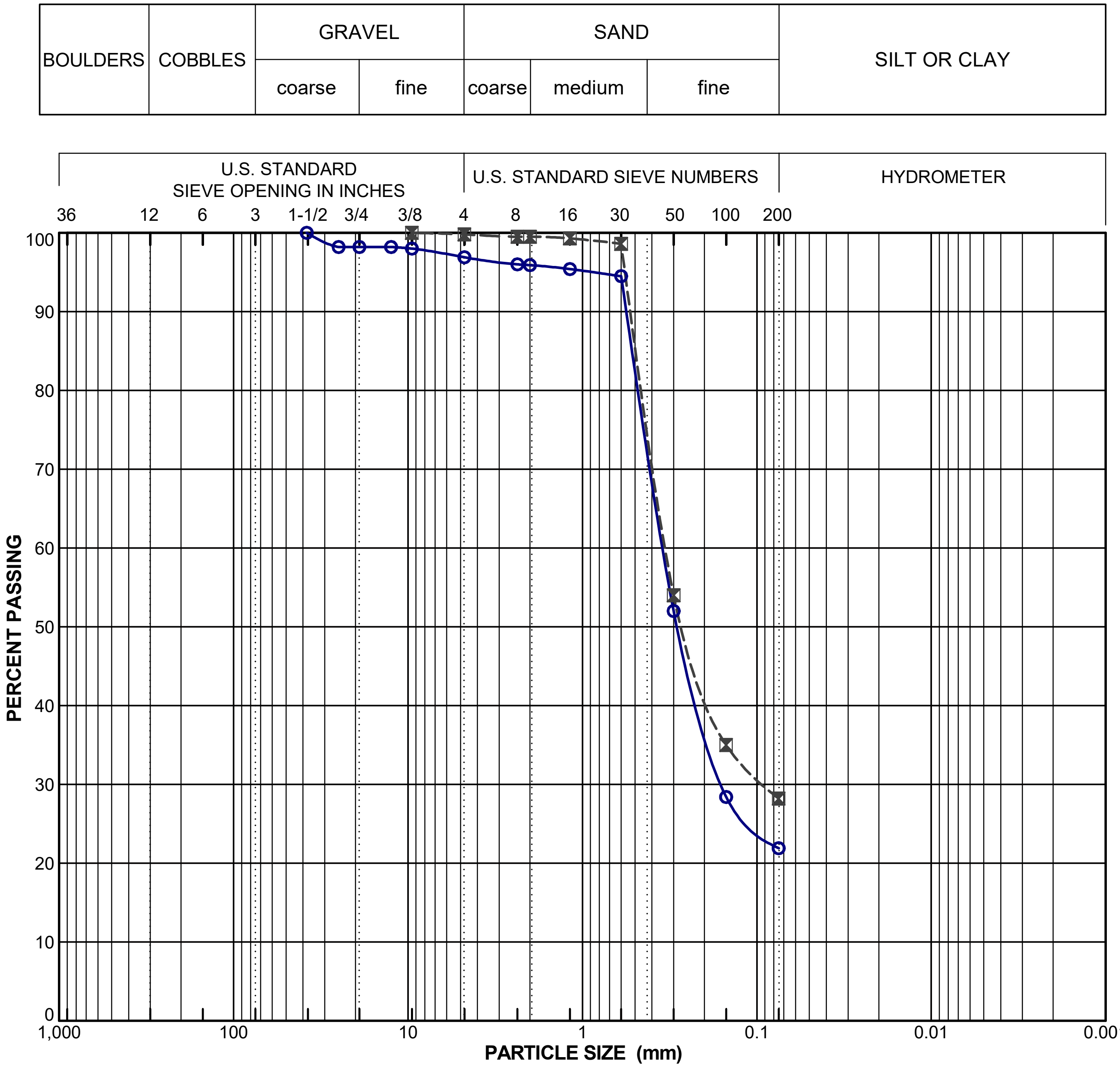
APPENDIX
SUMMARY OF SOIL LABORATORY DATA

San Diego, CA

Boring/Sample Information										Sieve/ Hydrometer		Atterberg Limits			Direct Shear				Compaction					
															Ultimate		Peak							
Boring No.	Sample No.	Depth (feet)	End Depth (feet)	Elevation (feet)	Blow Count (N)	Field Wet Density (pcf)	Field Dry Density (pcf)	Field Moisture Content (%)	Degree of Sat. (%)	Fines Content (% pass. #200)	Clay Content (% pass. 2µ)	LL (%)	PI (%)	USCS Group Symbol	Cohesion (psf)	Friction Angle (°)	Cohesion (psf)	Friction Angle (°)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Expansion Index	R-Value	Soluble Sulfate Content (% by wt)	Remarks
H-3	D-8	30.0		-2.0	43	109.7	102.5	7.0	29.4															
P-1	D-1	2.5		29.5	47	97.4	93.6	4.1	13.7															
P-1	D-2	5.0		27.0	45																			NR
P-1	D-3	8.5		23.5	25	93.4	92.0	1.5	5.0															
P-2	D-1	3.5		24.5	9	106.0	100.9	5.1	20.5															
P-3	D-1	2.5		25.5	44			9.6																Disturbed
P-3	D-2	5.0		23.0	35	96.4	94.4	2.2	7.5															
P-3	D-3	8.5		19.5	38	93.2	90.5	2.9	9.1															

NMG Geotechnical, Inc.

Printed: 10/5/21; Template: SUM_SOIL_LAB_ALL; Proj ID: 21010-01.GPJ

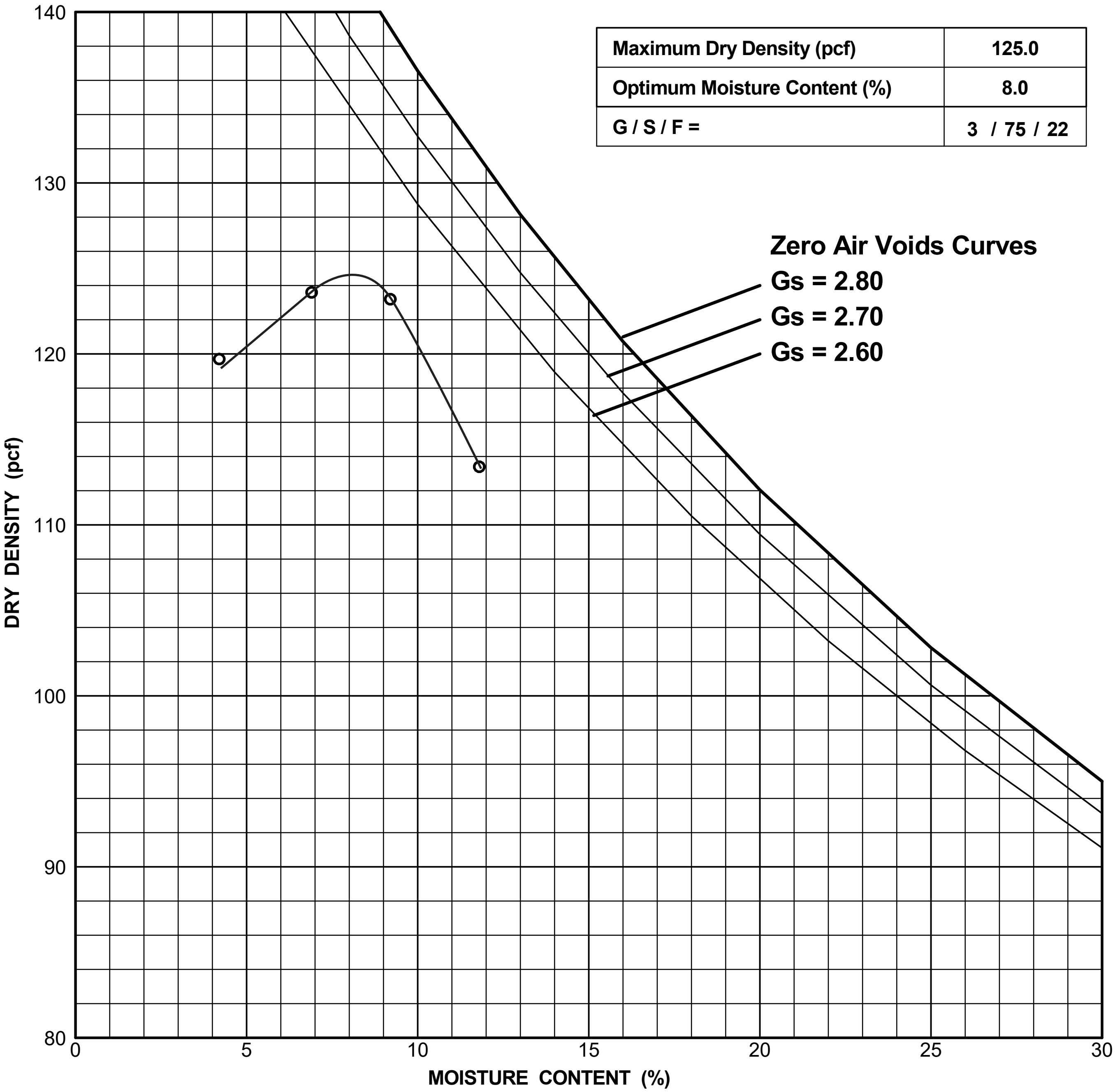


Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	H-1	B-1	1.0 - 5.0							22		SM
⊠	H-3	B-1	1.0 - 5.0							28		SM

PARTICLE SIZE DISTRIBUTION

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.



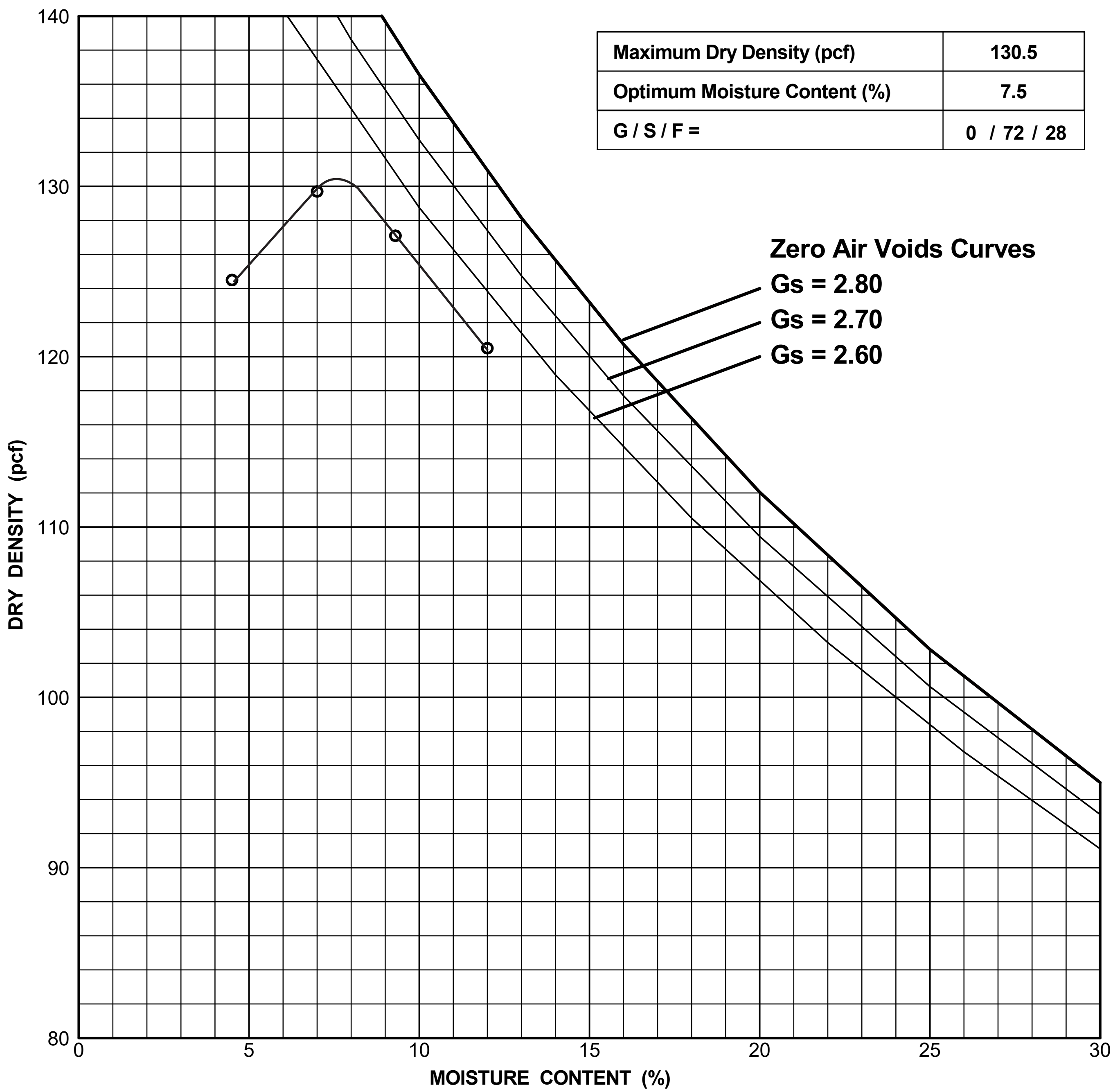
Maximum Dry Density (pcf)	125.0
Optimum Moisture Content (%)	8.0
G / S / F =	3 / 75 / 22

Boring No. H-1	**Sample No. B-1**	**Depth: 1.0 - 5.0 ft**
Sample Description: (Qop) Dark yellowish brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 22
Comments: 1557A		

COMPACTION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.



Maximum Dry Density (pcf)	130.5
Optimum Moisture Content (%)	7.5
G / S / F =	0 / 72 / 28

Boring No. H-3	**Sample No. B-1**	**Depth: 1.0 - 5.0 ft**
Sample Description: (Qop) Strong brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 28
Comments: 1557A		

COMPACTION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.

Template: NMCOMP_21; Prj ID: 21010-01.GPJ; Printed: 9/22/21

Sample	*Compacted Moisture (%)*	*Compacted Dry Density (pcf)*	*Final Moisture (%)*	*Volumetric Swell (%)*	*Expansion Index[1] Value/Method*		*Expansive Classification[2]*	*Soluble Sulfate (%)*	*Sulfate Exposure[3]*
H-2 B-1 1-5'	9.5	110.8	14.4	0.00	0	A	Very Low	--	--

Test Method:

ASTM D4829

HACH SF-1 (Turbidimetric)

Notes:

1. Expansion Index (EI) method of determination*:*
   - **[A]** E.I. determined by adjusting water content to achieve a 50 ±2% degree of saturation
   - **[B]** E.I. calculated based on measured saturation within the range of 40% and 60%
2. ASTM D4829 *(Classification of Expansive Soil)*
3. ACI-318-14 Table 19.3.1.1 *(Requirement for Concrete Exposed to Sulfate-Containing Solutions)*

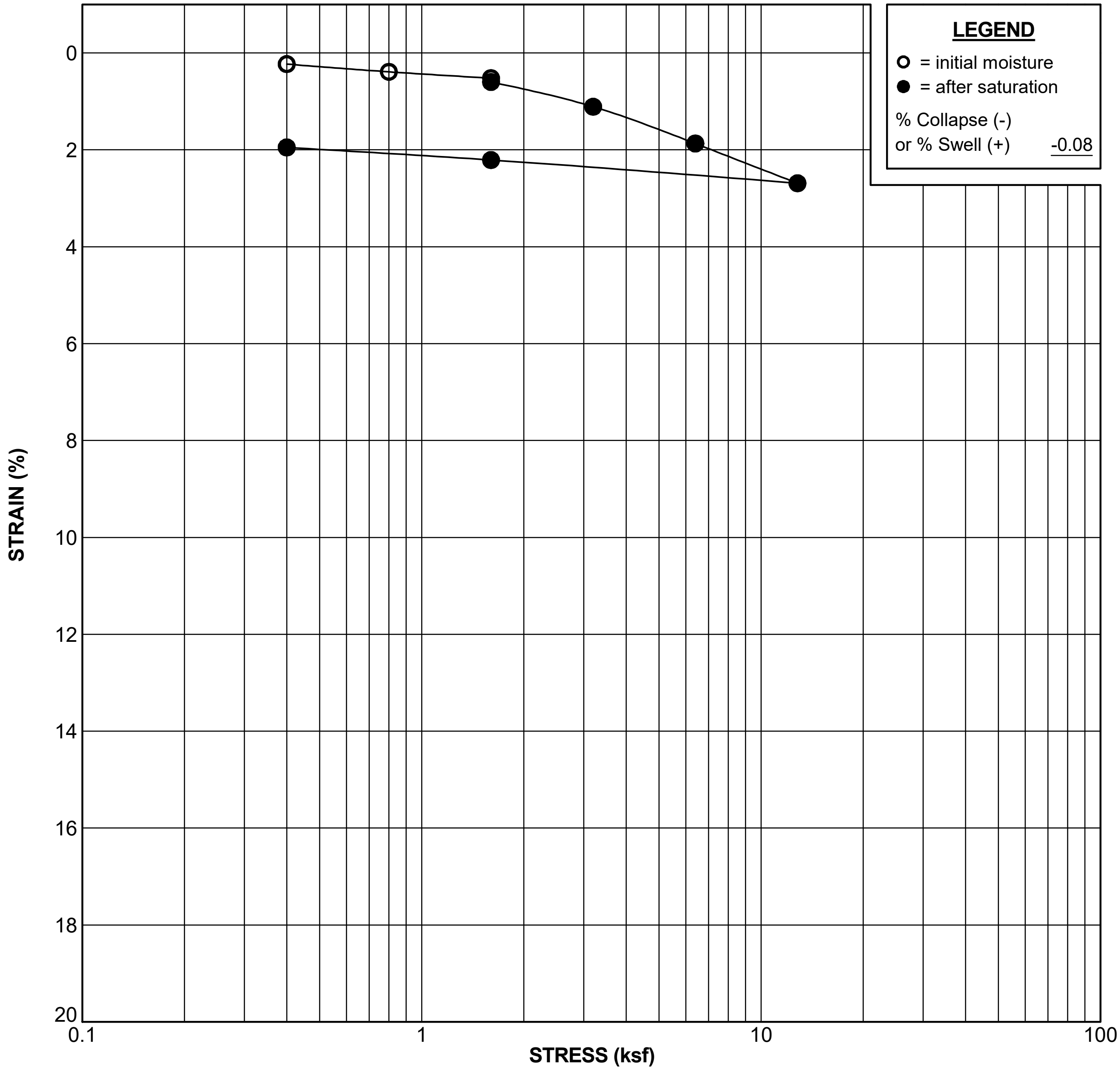
Expansion Index and Soluble Sulfate Test Results

(FRM001 Rev.5)

Project No. 21010-01

Project Name: Avalon Bay / Pacific Beach

NMG



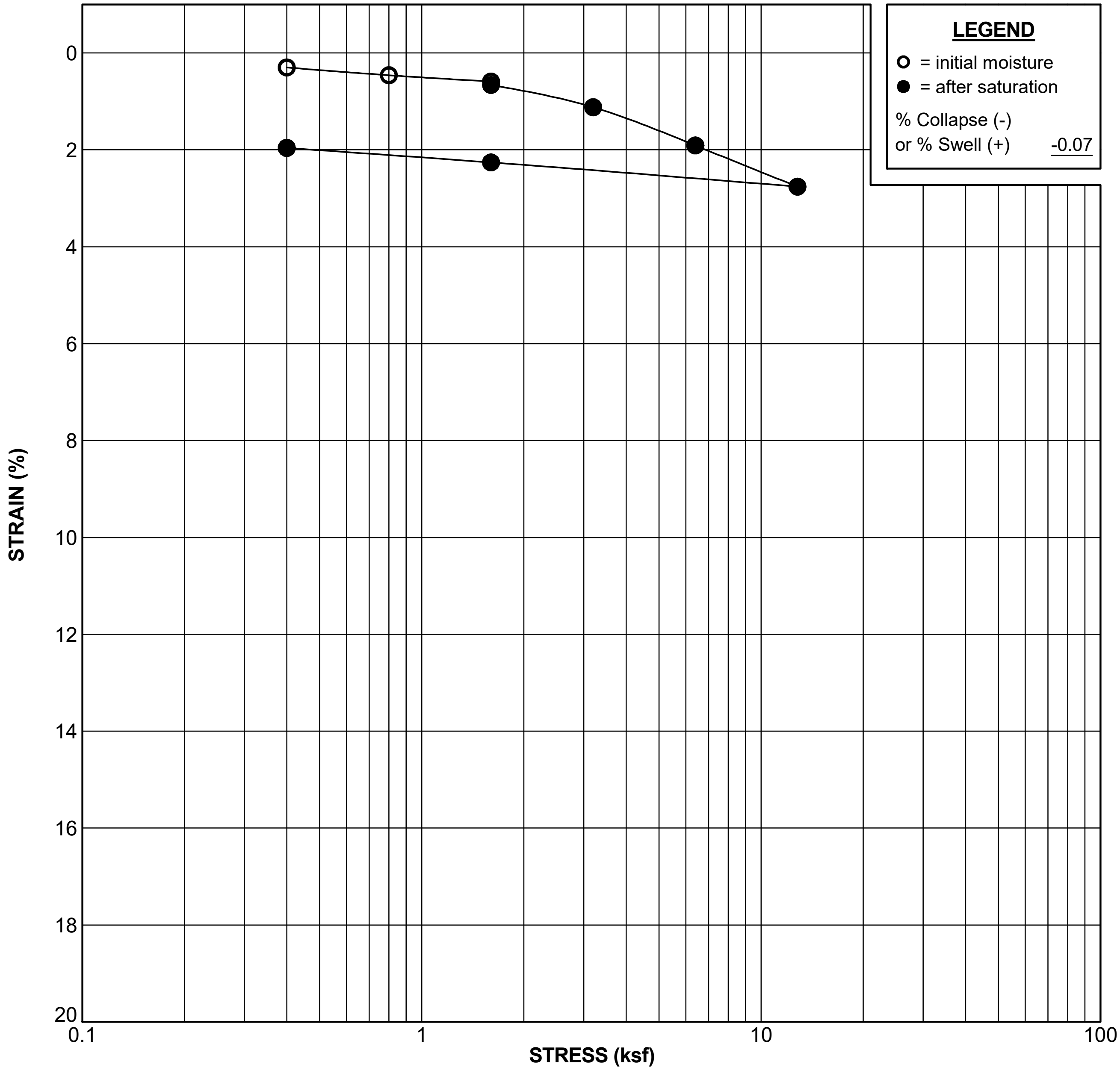
Boring No. H-1	Sample No. D-6	Depth: 15.0 ft
Sample Description: (Qbp) Light gray SAND		**USCS:** SP/SW
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	4.2	89.1	12.7	0.891
Final	28.5	90.8	89.9	0.856

CONSOLIDATION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.



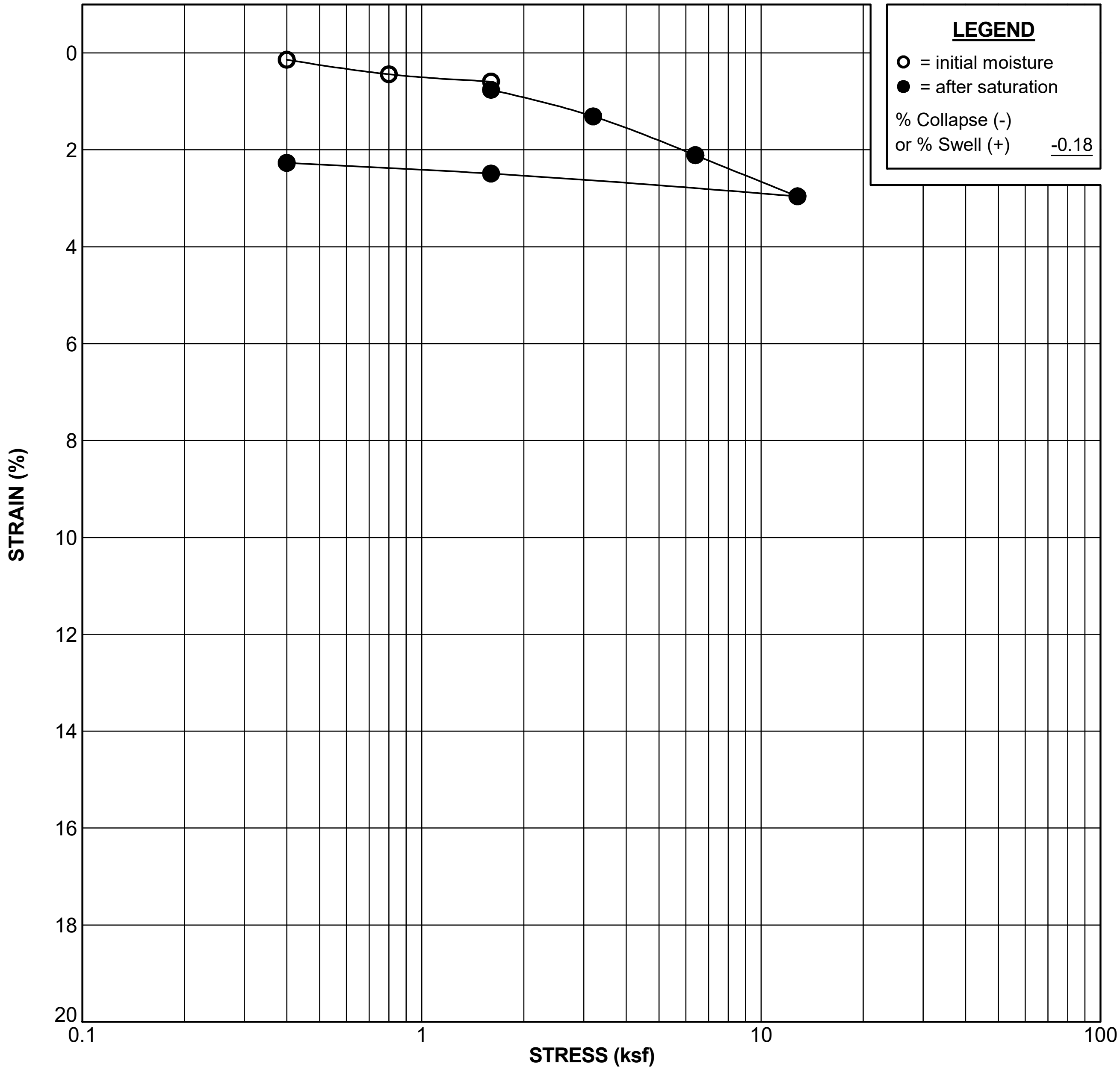
Boring No. H-1	Sample No. D-7	Depth: 20.0 ft
Sample Description: (Qbp) Pale yellow SAND		**USCS:** SP/SW
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	3.5	92.8	11.6	0.816
Final	26.6	94.6	92.0	0.781

CONSOLIDATION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.



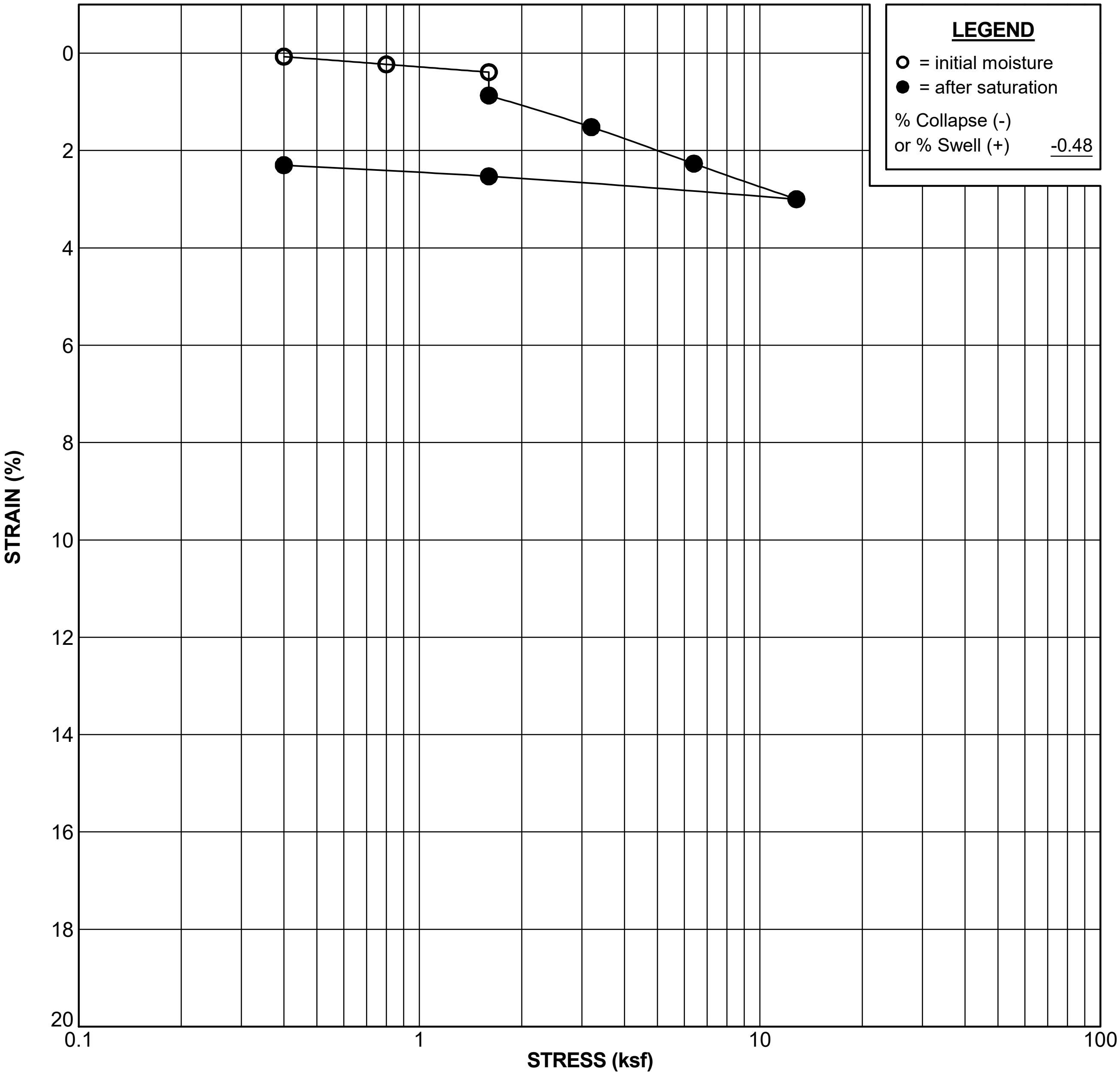
Boring No. H-2	**Sample No. D-2**	**Depth: 5.0 ft**
Sample Description: (Qbp) Yellowish red silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	5.1	94.7	17.7	0.779
Final	24.0	96.8	87.5	0.740

CONSOLIDATION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.



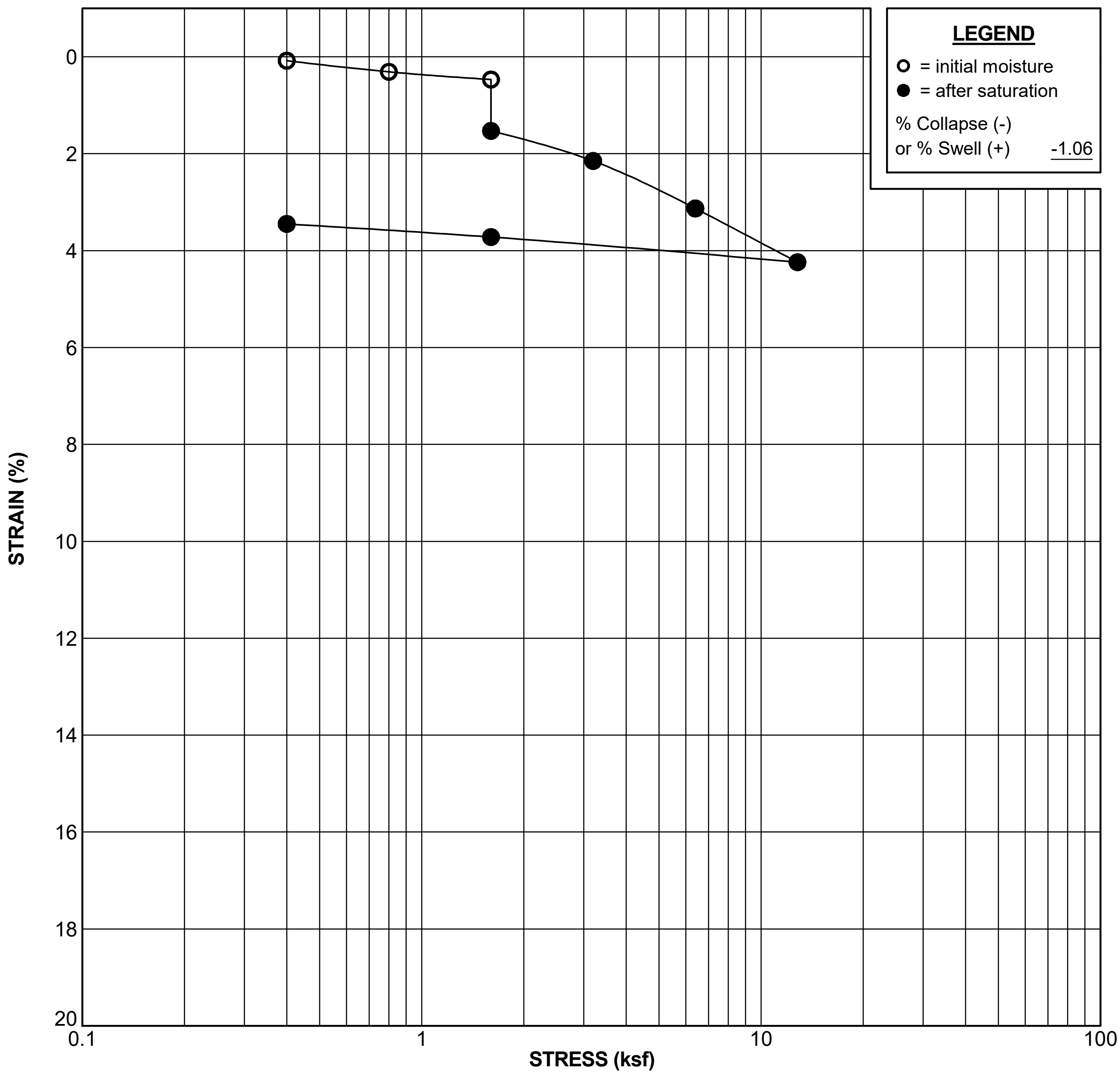
Boring No. H-2	Sample No. D-3	Depth: 8.0 ft
Sample Description: (Qbp) Yellowish red silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	3.4	97.6	12.6	0.726
Final	22.7	99.8	89.1	0.688

CONSOLIDATION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.



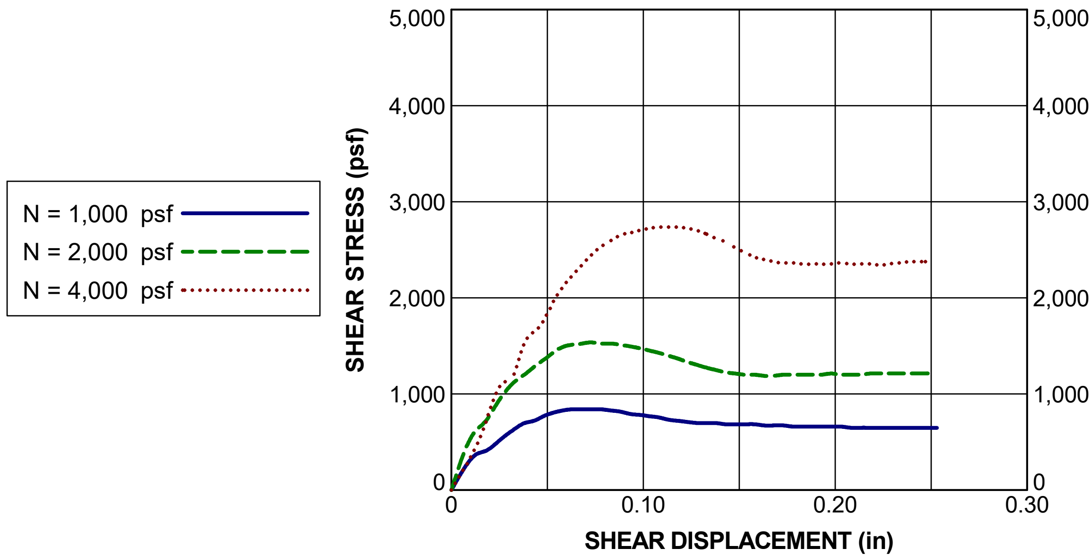
Boring No. H-3	**Sample No. D-4**	**Depth: 10.0 ft**
Sample Description: (Qbp) Yellowish brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**

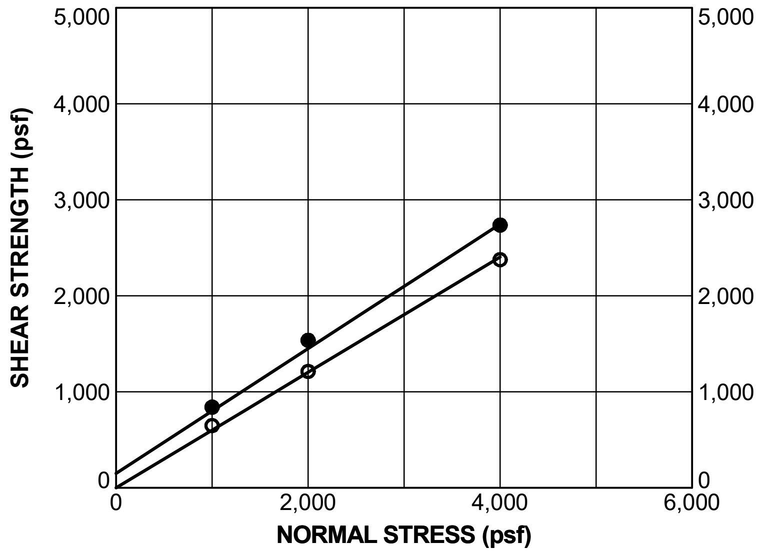
Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	5.0	105.4	22.6	0.598
Final	16.5	109.0	81.6	0.546

CONSOLIDATION TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.





Boring No. H-1	**Sample No. B-1**	**Depth: 1.0 - 5.0 ft**
Sample Description: (Qop) Dark yellowish brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 22
Final Moisture Content (%): 18.8	**Final Dry Density (pcf):** 112.6	**Degree of Saturation (%):** 100
Sample Type: Remolded to 90% RC	**Rate of Shear (in./min.):** 0.05	

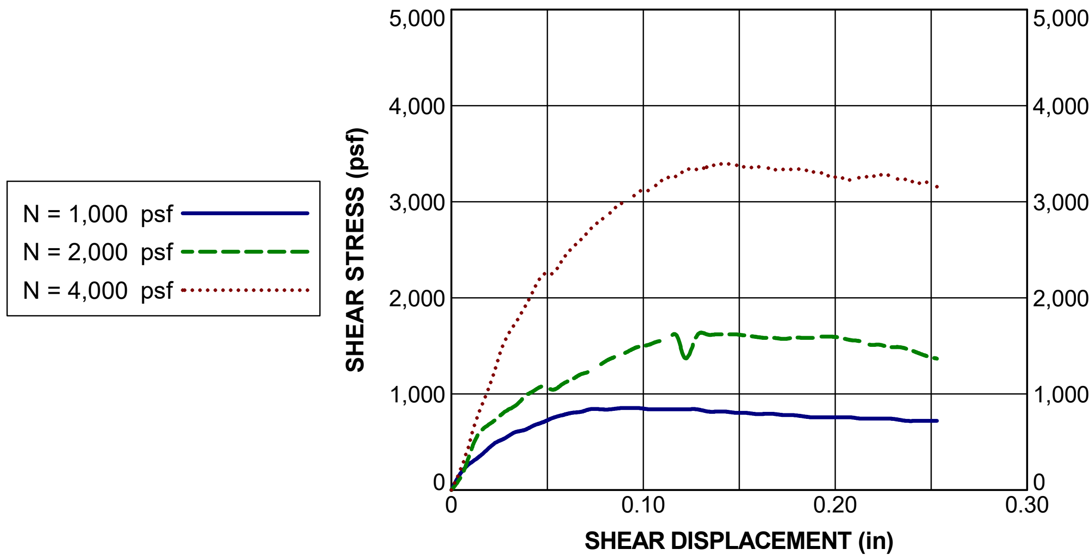
SHEAR STRENGTH PARAMETERS

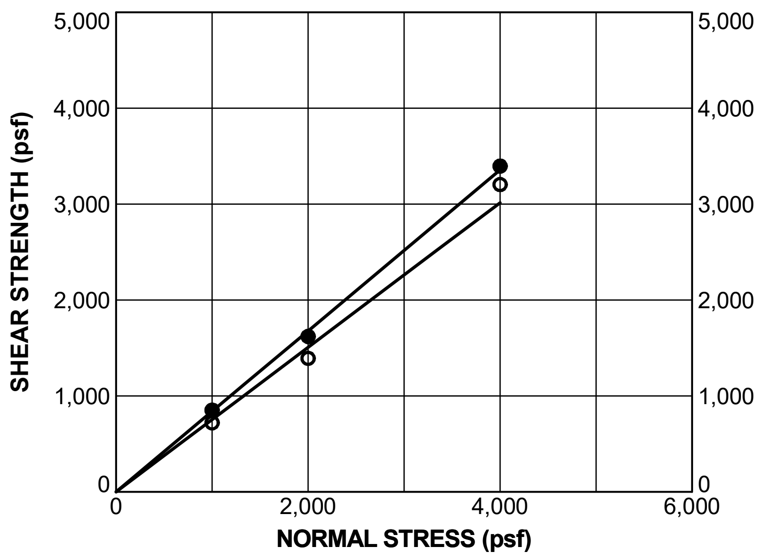
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	150	0
Friction Angle (degrees)	33.0	31.0

DIRECT SHEAR TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.





Boring No. H-1	Sample No. D-3	Depth: 7.5 ft
Sample Description: (Qop) Yellowish red SAND w/ gravel		**USCS:** SP/SW
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**
Final Moisture Content (%): 26.0	**Final Dry Density (pcf):** 100.7	**Degree of Saturation (%):** 100
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.05	

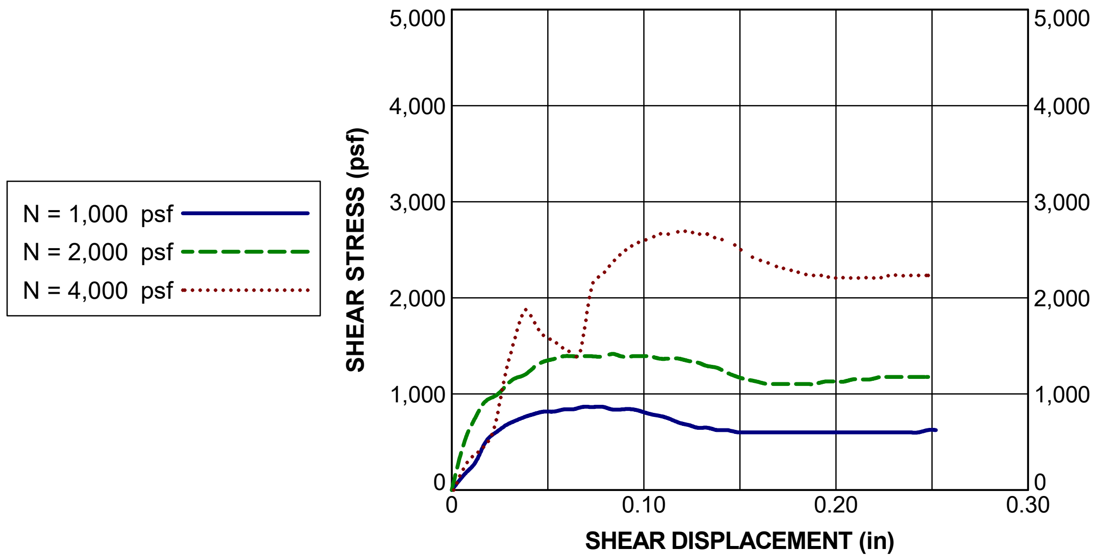
SHEAR STRENGTH PARAMETERS

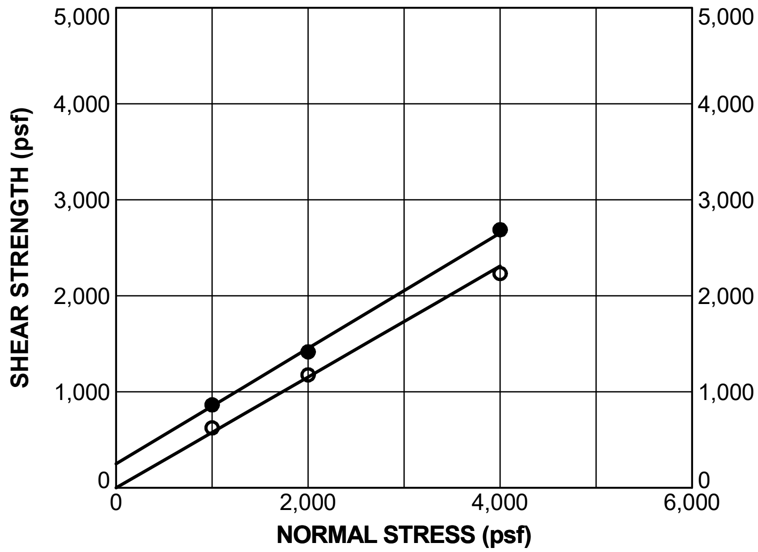
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	0	0
Friction Angle (degrees)	40.0	37.0

DIRECT SHEAR TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.





Boring No. H-3	**Sample No. B-1**	**Depth: 1.0 - 5.0 ft**
Sample Description: (Qop) Strong brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 28
Final Moisture Content (%): 15.9	**Final Dry Density (pcf):** 117.5	**Degree of Saturation (%):** 99
Sample Type: Remolded to 90% RC	**Rate of Shear (in./min.):** 0.05	

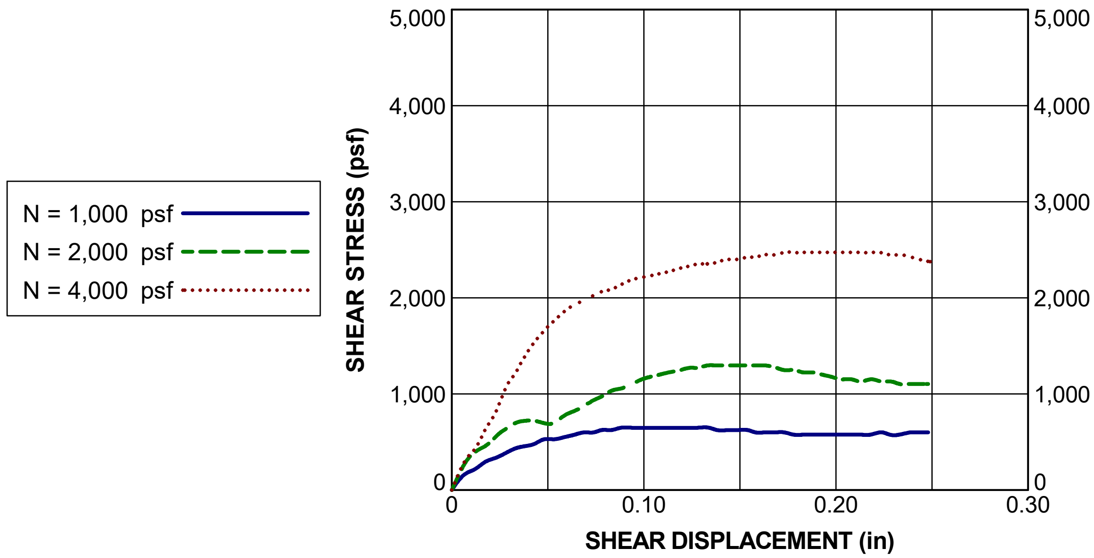
SHEAR STRENGTH PARAMETERS

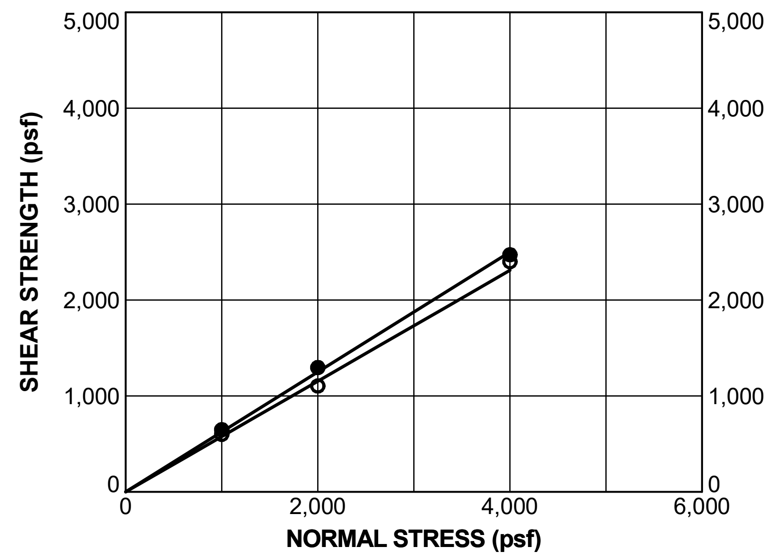
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	250	0
Friction Angle (degrees)	31.0	30.0

DIRECT SHEAR TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.





Boring No. H-3	**Sample No. D-1**	**Depth: 2.5 ft**	
Sample Description: (Qop) Yellowish red silty SAND		**USCS:**	SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Final Moisture Content (%): 20.6	**Final Dry Density (pcf):** 105.9	**Degree of Saturation (%):**	94
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.05		

SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	0	0
Friction Angle (degrees)	32.0	30.0

DIRECT SHEAR TEST RESULTS

Avalon Bay/ Pacific Beach
San Diego, CA
PROJECT NO. 21010-01

NMG Geotechnical, Inc.

October 1, 2021 via email: cthompson@nmggeotech.com

NMG Geotechnical, Inc.
17991 Fitch
Irvine, CA, 92614

Attention: Mr. Clint Thompson

Re: Soil Corrosivity Study
Avalon Bay / Pacific Beach
San Diego, CA
HDR #21-0858SCS, NMG #21010-01

Introduction

Laboratory tests have been completed on two soil samples provided to HDR for the Avalon Bay / Pacific Beach project. The purpose of these tests was to determine whether the soils are likely to have deleterious effects on underground utility piping, hydraulic elevator cylinders, and concrete structures. HDR assumes that the provided samples are representative of the most corrosive soils at the site.

The proposed parking structure and apartment building have four stories and two stories, respectively, and one subterranean level. The site is located at 3883 Ingraham Street in San Diego, California, and the water table is reportedly 30 feet deep.

The scope of this study is limited to a determination of soil corrosivity and general corrosion control recommendations for materials likely to be used for construction. HDR's recommendations do not constitute, and are not meant as a substitute for, design documents for the purpose of construction. If the architects and/or engineers desire more specific information, designs, specifications, or review of design, HDR will be happy to work with them as a separate phase of this project.

Soil Corrosivity Testing

Laboratory Testing

The electrical resistivity of each sample was measured in a soil box per *ASTM International (ASTM)* G187 in its as-received condition and again after saturation with distilled water. Resistivities are at about their lowest value when the soil is saturated. The pH of the saturated samples was measured per ASTM G51. A 5:1 water:soil extract from each sample was chemically analyzed for the major soluble salts commonly found in soil per ASTM D4327, ASTM D6919, and *American Water Works Association (AWWA*) Standard Method 2320-B.

The laboratory analyses were performed under HDR laboratory number 21-0858SCS. The full set of test results are shown in the attached Table 1.

Discussion

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity. Lower electrical resistivities result from higher moisture and soluble salt contents and indicate corrosive soil. A correlation between electrical resistivity and corrosivity toward ferrous metals is shown in Table 1.[1]

Table 1: Soil Corrosivity Categories.

Soil Resistivity (ohm-cm)	Corrosivity Category
Greater than 10,000	Mildly Corrosive
2,001 to 10,000	Moderately Corrosive
1,001 to 2,000	Corrosive
0 to 1,000	Severely Corrosive

Other soil characteristics that may influence corrosivity towards metals are pH, soluble salt content, soil types, aeration, anaerobic conditions, and site drainage.

Electrical resistivities was in the mildly corrosive category with as-received moisture. When saturated, the resistivities were in the moderately corrosive category. The resistivities dropped considerably with added moisture because the samples were dry as-received.

Soil pH values varied from 7.8 to 8.3. This range is mildly to moderately alkaline.[2] These values do not particularly increase soil corrosivity.

The soluble salt content of the samples were low.

Per ACI-318, the soil is classified as S0 with respect to sulfate concentration.[3]

Nitrate was detected in low concentrations. Ammonium was not detected.

Tests were not made for sulfide and oxidation-reduction (redox) potential because these samples did not exhibit characteristics typically associated with anaerobic conditions.

In conclusion, this soil is classified as moderately corrosive to ferrous metals and negligible (S0) for sulfate attack on concrete.

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[1] Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, pp. 166–167.
[2] Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, p. 8.
[3] American Concrete Institute (ACI) 318-19 Table 19.3.1.1.

Corrosion Control Recommendations

The life of buried materials depends on thickness, strength, loads, construction details, soil moisture, etc., in addition to soil corrosivity, and is, therefore, difficult to predict. Of more practical value are corrosion control methods that will increase the life of materials that would be subject to significant corrosion. The following recommendations are based on the evaluation of soil corrosivity described above. Unless otherwise indicated, these recommendations apply to the entire site or alignment.

All Pipe

1. On all pipes, appurtenances, and fittings not protected by cathodic protection, coat bare metal such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.
2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.
3. To prevent differential aeration corrosion cells, provide at least 2 inches of pipe bedding or backfill material all around metallic piping, including the bottom. Do not lay pipe directly on undisturbed soil.

Steel Pipe

1. Underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints should be bonded for electrical continuity. Electrical continuity is necessary for corrosion monitoring and the possible future application of cathodic protection.
2. Install corrosion monitoring test stations to facilitate corrosion monitoring and the possible future application of cathodic protection:
   a. At each end of the pipeline.
   b. At each end of all casings.
   c. Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
3. To prevent dissimilar metal corrosion cells and to facilitate the possible future application of cathodic protection, electrically isolate each buried steel pipeline per NACE SP0286 from:
   a. Dissimilar metals.
   b. Dissimilarly coated piping (cement-mortar vs. dielectric).
   c. Above ground steel pipe.
   d. All existing piping.

   Insulated joints should be placed above grade or in vaults where possible. Wrap all buried insulators with wax tape per AWWA C217.

4. Choose one of the following corrosion control options:

   OPTION 1

   a. Apply a suitable dielectric coating intended for underground use such as:

      i. Polyurethane per AWWA C222 *or*

      ii. Extruded polyethylene per AWWA C215 *or*

      iii. A tape coating system per AWWA C214 *or*

      iv. Hot applied coal tar enamel per AWWA C203 *or*

      v. Fusion bonded epoxy per AWWA C213.

   b. Although it is customary to cathodically protect bonded dielectrically coated structures, cathodic protection is not recommended at this time because the soil is considered only moderately corrosive to ferrous materials. Install joint bonds, test stations, and insulated joints to provide for corrosion monitoring and/or the future application of cathodic protection to control leaks if needed.

   OPTION 2

   As an alternative to the coating systems described in Option 1 and possible future cathodic protection, apply a ¾-inch cement mortar coating per AWWA C205 or encase all buried portions of metallic piping so that there is a minimum of 3 inches of concrete cover provided over and around surfaces of pipe, fittings, and valves using any type of ASTM C150 cement. Install joint bonds, test stations, and insulated joints to provide for corrosion monitoring and/or the future application of cathodic protection if needed.

NOTE: Some steel piping systems, such as for oil, gas, and high-pressure piping systems, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.

Ductile Iron Pipe

1. To prevent dissimilar metal corrosion cells and to facilitate the possible future application of cathodic protection, electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulating joints per NACE SP0286.

2. Bond all nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and possible future application of cathodic protection.

3. Install corrosion monitoring test stations to facilitate corrosion monitoring and the possible future application of cathodic protection:

   a. At each end of the pipeline.

   b. At each end of any casings.

   c. Other locations as necessary so the interval between test stations does not exceed 1,200 feet.

4. Choose one of the following corrosion control options:

   OPTION 1

   a. Apply a suitable coating intended for underground use such as:

      i. Polyethylene encasement per AWWA C105; *or*

      ii. Epoxy coating; *or*

      iii. Polyurethane; *or*

      iv. Wax tape.

      NOTE: The thin factory-applied asphaltic coating applied to ductile iron pipe for transportation and aesthetic purposes does not constitute a corrosion control coating.

   b. Although it is customary to cathodically protect coated structures, cathodic protection is not recommended at this time because the soil is considered only moderately corrosive to ferrous materials. Install joint bonds, test stations, and insulated joints to provide for corrosion monitoring and/or the future application of cathodic protection to control leaks if needed.

   OPTION 2

   As an alternative to the coating systems described in Option 1 and possible future cathodic protection, encase all buried portions of metallic piping so that there is a minimum of 3 inches of concrete cover provided over and around surfaces of pipe, fittings, and valves using any type of ASTM C150 cement. Install joint bonds, test stations, and insulated joints to provide for corrosion monitoring and/or the future application of cathodic protection if needed.

NOTE: Some iron piping systems, such as for fire water piping, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.

Cast Iron Soil Pipe

1. Protect cast iron soil pipe with either a double wrap 4-mil or single wrap 8-mil polyethylene encasement per AWWA C105.

2. It is not necessary to bond the pipe joints or apply cathodic protection.

3. Provide 6 inches of clean sand backfill all around the pipe. Use the following parameters for clean sand backfill:

   a. Minimum saturated resistivity of no less than 3,000 ohm-cm; *and*

   b. pH between 6.0 and 8.0.

   c. All backfill testing should be performed by a corrosion engineering laboratory.

Copper Tubing

1. Use Type K or Type L copper tubing as required by the applicable local plumbing code. Type M tubing should not be used for buried applications.[4]

2. Electrically insulate underground copper pipe from dissimilar metals and from above ground copper pipe with insulating devices per NACE SP0286. Sleeve copper pipe through footings and foundations to prevent pH concentration cells and prevent leaks caused by settlement.

3. Electrically insulate cold water piping from hot water piping systems.

4. Protect cold water pipe using all of the following measures:

    a. Place cold water copper tubing in an 8-mil polyethylene sleeve or encase in double 4-mil thick polyethylene sleeves. Ensure that sleeves are intact and free of cuts, tears, punctures, or other damage.

    b. Remove any construction debris, rocks, wood, or organic matter from the trench prior to backfill.

    c. Bed and backfill with at least 2 inches of clean sand all around the tubing, including the bedding. Use the following parameters for clean sand backfill:

        i. Minimum saturated resistivity of no less than 3,000 ohm-cm; and

        ii. pH between 6.0 and 8.0.

        iii. All backfill testing should be performed by a corrosion engineering laboratory.

    d. Copper tubing for cold water can also be treated the same as for hot water.

5. Hot water tubing may be subject to a higher corrosion rate. Protect hot copper tubing using one of the following measures:

    a. Prevent soil contact. Soil contact may be prevented by placing the tubing above ground or encasing the tubing with PVC pipe with solvent-welded joints. Either seal the PVC pipe at both ends using ammonia- and methanol-free caulk, or terminate both ends above-grade in a manner that doesn't allow water to infiltrate; *or*

    b. Applying cathodic protection per NACE SP0169. The amount of cathodic protection current needed can be minimized by coating the tubing with a suitable dielectric coating that is compatible with cathodic protection, such as Polyken 930.

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[4] 2016 California Plumbing Code (CPC), July 1, 2018 Supplement, Section 604.3.

Plastic and Vitrified Clay Pipe

1. No special corrosion control measures are required for plastic and vitrified clay piping placed underground.

2. Protect all metallic fittings and valves with wax tape per AWWA C217, or with epoxy and appropriately designed cathodic protection system per NACE SP0169.

Concrete Structures and Pipe

1. From a corrosion standpoint, any type of ASTM C150 cement may be used for concrete structures and pipe because the sulfate concentration is negligible (S0), from 0 to 0.10 percent. Use a minimum strength of 2,500 psi per applicable codes.[5,6,7]

2. Standard concrete cover over reinforcing steel may be used for concrete structures and pipe in contact with these soils due to the low chloride concentrations found on site.[8] Limit the water-soluble chloride ion content in the concrete mix design to less than 0.3 percent by weight of cement.

NOTE: This analysis is based strictly on the soil corrosivity characteristics. Designer must consider external sources of chloride from brackish water, seawater, or spray from these sources that would amend these recommendations.

Post-Tensioned Slabs: Unbonded Single-Stranded Tendons and Anchors

Although chloride levels were relatively low, soil is considered an aggressive environment for post-tensioning strands and anchors. Protect post-tensioning strands and anchors against corrosion by implementing all the following measures:[9,10,11]

1. Limit the water-soluble chloride ion content in the concrete mix design to less than 0.06 percent by weight of cement.
2. Design all tendons to prevent ingress of moisture. A corrosion-inhibiting coating should be incorporated into the tendon sheaths.
3. Use non-shrink grout mixes for all post-tensioning pockets.
4. Prior to grouting the pocket, apply a protective grease cap filled with corrosion protection material that provides a watertight seal for the strand end and wedge cavity. Ensure the cap fully seats against the face of the standard anchor at the live end.
5. Protect all components from moisture prior to installation and within one working day after installation.

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[5] *2018 International Building Code (IBC) which refers to American Concrete Institute (ACI) 318-19 Table 19.3.2.1*
[6] *2015 International Residential Code (IRC) which refers to American Concrete Institute (ACI) 318-19 Table 19.3.2.1*
[7] *2016 California Building Code (CBC) which refers to American Concrete Institute (ACI) 318-19 Table 19.3.2.1*
[8] *Design Manual 303: Concrete Cylinder Pipe. Ameron. p.65*
[9] *Post-Tensioning Manual, sixth edition. Post-Tensioning Institute (PTI), Phoenix, AZ, 2006.*
[10] *PTI M10.2-00: Specification for Unbonded Single Strand Tendons. Post-Tensioning Institute (PTI), Phoenix, AZ, 2000.*
[11] *ACI 423.6-01: Specification for Unbonded Single Strand Tendons. American Concrete Institute (ACI), 2001*

6. Ensure the minimum concrete cover over the tendon tail is 1 inch, or greater if required by the applicable building code.
7. Install caps within one working day after the cutting of the tendon tails and acceptance of the elongation records by the engineer.
8. Install pre-cast concrete plug over the grease cap to ensure the live end is sealed from further moisture intrusion.
9. Limit the access of direct runoff onto the anchorage area by designing proper drainage. Do not allow water to pond against anchors.
10. Provide at least 2 inches of space between finish grade and the anchorage area, or more if required by applicable building codes.

Hydraulic Elevators

1. Choose one of the following corrosion control options for the hydraulic steel cylinders.

   OPTION 1

   a. Coat hydraulic elevator cylinders with a suitable dielectric coating intended for underground use such as:
      i. Polyurethane per AWWA C222 or
      ii. Extruded polyethylene per AWWA C215 or
      iii. A tape coating system per AWWA C214 or
      iv. Hot applied coal tar enamel per AWWA C203 or
      v. Fusion bonded epoxy per AWWA C213.
   b. Electrically insulate each cylinder from building metals by installing dielectric material between the piston platen and car, insulating the bolts, and installing an insulated joint in the oil line; and
   c. Apply cathodic protection to hydraulic cylinders as per NACE SP0169.

   OPTION 2

   As an alternative to electrical insulation and cathodic protection, place each cylinder in a plastic casing with a plastic watertight seal at the bottom.

2. The elevator oil line should be placed above ground if possible but, if underground, should be protected by one of the following corrosion control options:

   OPTION 1

   a. Provide a bonded dielectric coating,
   b. Electrically isolate the pipeline, and
   c. Apply cathodic protection to steel piping as per NACE SP0169.

   OPTION 2

   Place the oil line in a PVC casing pipe with solvent-welded joints and sealed at both ends to prevent contact with soil and moisture.

Closure

The analysis and recommendations presented in this report are based upon data obtained from the laboratory samples. This report does not reflect variations that may occur across the site or due to the modifying effects of construction. If variations appear, HDR should be notified immediately so that further evaluation and supplemental recommendations can be provided.

HDR's services have been performed with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended.

Please call if you have any questions.

Respectfully Submitted,
HDR Engineering, Inc.

Bradley M. Stuart, PE
Corrosion Engineer

Marc E N Wegner, PE
Sr. Corrosion Project Manager

Enc: Table 1

21-0858SCS SCS-t

Table 1 - Laboratory Tests on Soil Samples

NMG Geotechnical, Inc.
Avalon Bay Pacific Beach
Your #21010-01, HDR Lab #21-0858SCS
22-Sep-21

Sample ID			H-1, B-1 @ 1-5'	H-3, B-1 @ 1-5'
Resistivity		**Units**		
as-received		ohm-cm	44,000	60,000
saturated		ohm-cm	8,000	2,360
pH			8.3	7.8
Electrical Conductivity		mS/cm	0.08	0.15
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	64	55
magnesium	Mg^{2+}	mg/kg	17	17
sodium	Na^{1+}	mg/kg	66	109
potassium	K^{1+}	mg/kg	8.6	22
ammonium	NH_4^{1+}	mg/kg	ND	ND
Anions				
carbonate	CO_3^{2-}	mg/kg	51	ND
bicarbonate	HCO_3^{1-}	mg/kg	79	153
fluoride	F^{1-}	mg/kg	6.1	4.6
chloride	Cl^{1-}	mg/kg	12	80
sulfate	SO_4^{2-}	mg/kg	26	107
nitrate	NO_3^{1-}	mg/kg	13	46
phosphate	PO_4^{3-}	mg/kg	ND	ND
Other Tests				
sulfide	S^{2-}	qual	na	na
Redox		mV	na	na

Resistivity per ASTM G187, pH per ASTM G51, Cations per ASTM D6919, Anions per ASTM D4327, and Alkalinity per APHA 2320-B.

Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

431 West Baseline Road · Claremont, CA 91711
Phone: 909.962.5485 · Fax: 909.626.3316

Enthalpy Analytical
931 West Barkley Ave
Orange, CA 92868
(714) 771-6900

enthalpy.com

Lab Job Number:	450692
Report Level:	II
Report Date:	09/22/2021

Analytical Report *prepared for:*

Cindy Johnson
Belshire Environmental Services
25971 Towne Centre Drive
Foothill Ranch, CA 92610

Location: Avalon Bay - Pacific Beach

Authorized for release by:

Ranjit K Clarke, Project Manager
(714) 771-9906
Ranjit.Clarke@enthalpy.com

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the above signature which applies to this PDF file as well as any associated electronic data deliverable files. The results contained in this report meet all requirements of NELAP and pertain only to those samples which were submitted for analysis. This report may be reproduced only in its entirety.

CA ELAP# 1338, NELAP# 4038, SCAQMD LAP# 18LA0518, LACSD ID# 10105, CDC ELITE Member

Sample Summary

Cindy Johnson		Lab Job #:	450692
Belshire Environmental Services		Location:	Avalon Bay - Pacific Beach
25971 Towne Centre Drive		Date Received:	09/17/21
Foothill Ranch, CA 92610			

Sample ID	Lab ID	Collected	Matrix
DRUM 1	450692-001	09/16/21 14:15	Soil
DRUM 2	450692-002	09/16/21 14:15	Soil
DRUM 3	450692-003	09/16/21 14:15	Soil
DRUM 1-3 COMP	450692-004	09/17/21 00:00	Soil

Case Narrative

Belshire Environmental Services		Lab Job Number:	450692
25971 Towne Centre Drive		Location:	Avalon Bay - Pacific Beach
Foothill Ranch, CA 92610		Date Received:	09/17/21
Cindy Johnson			

This data package contains sample and QC results for one soil composite, requested for the above referenced project on 09/17/21. The sample was received cold and intact.

TPH-Extractables by GC (EPA 8015B):
TPH (C13-C22), TPH (C23-C44), and TPH (C6-C12) were detected between the MDL and the RL in the method blank for batch 274223; these analytes were not detected in the sample at or above the RL. No other analytical problems were encountered.

Volatile Organics by GC/MS (EPA 8260B):
No analytical problems were encountered.

Metals (EPA 6010B and EPA 7471A):
High response was observed for antimony in the CCV analyzed 09/21/21 04:20; affected data was qualified with "b". High response was observed for antimony in the CCV analyzed 09/21/21 03:39; affected data was qualified with "b". Low recoveries were observed for antimony in the MS/MSD of DRUM 1-3 COMP (lab # 450692-004); the LCS was within limits, and the associated RPD was within limits. No other analytical problems were encountered.

ENTHALPY ANALYTICAL, INC.

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Billing: Enthalpy - SoCal

c/o Montrose Environmental Group

1 Park Plaza, Suite 1000, Irvine, CA 92614

ENTHALPY analytical, inc.

Chain of Custody Record

Lab No: 450692

Page: 1 of 1

Turn Around Time (Rush by advanced notice only)

Standard:		4 Day:		3 Day:	✓
2 Day:		1 Day:		Same Day:	

Matrix: A = Air DW = Drinking Water FL = Food Liquid FS = Food Solid L = Liquid PP = Pure Product S = Solid SeaW = Sea Water SW = Swab W = Water WP = Wipe O = Other

Preservatives: 1 = $Na_2S_2O_3$ 2 = HCl 3 = HNO_3 4 = H_2SO_4 5 = NaOH 6 = Other

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company:	Belshire Environmental Services	Name:	Avalon Bay - Pacific Beach
Report To:	Cindy Johnson	Number:	
Email:	cindy@belshire.com	P.O. #:	334132
Address:	25971 Towne Centre Dr.	Address:	3883 Ingraham St.
	Foothill Ranch, CA 92610		San Diego
Phone:	949-460-5200	Global ID:	
Fax:		Sampled By:	Jorge Villalpando

	Sample ID	Sampling Date	Sampling Time	Matrix	Container No. / Size	Pres.	Full VOCs by 8260	TPH Carbon Chain	Title 22 Metals	HOLD	Test Instructions / Comments
1	Drum 1	9-16-21	14:15	S	1 x 4 oz.	none				✓	
2	Drum 2	"	"	S	1 x 4 oz.	none				✓	
3	Drum 3	"	"	S	1 x 4 oz.	none				✓	
4	Composite (Drum 1, Drum 2, Drum 3)						✓	✓	✓		3:1 composite prior to analysis
5											
6											
7											
8											
9											
10											

	Signature	Print Name	Company / Title	Date / Time
1 Relinquished By:	Jorge V. [signature]	Jorge Villalpando	Belshire	9-16-21 14:15
1 Received By:	[signature]	Don Sampson	EA	9-17-21 1:05PM
2 Relinquished By:	[signature]	Don Sampson	EA	9-17-21 4:35PM
2 Received By:	[signature]	[illegible]	EA	9/17/21 4:35pm
3 Relinquished By:				
3 Received By:				

1.8/6.0

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SAMPLE ACCEPTANCE CHECKLIST

Section 1

Client: Belshire Environmental Services   Project: Avalon Bay - Pacific Beach

Date Received: 9/17/21   Sampler's Name Present: ☑ Yes ☐ No

Section 2

Sample(s) received in a cooler? ☑ Yes, How many? 1 ☐ No (skip section 2)   Sample Temp (°C) (No Cooler): ____

Sample Temp (°C), One from each cooler: #1: 6.0 #2: ____ #3: ____ #4: ____

(Acceptance range is < 6°C but not frozen (for Microbiology samples, acceptance range is < 10°C but not frozen). It is acceptable for samples collected the same day as sample receipt to have a higher temperature as long as there is evidence that cooling has begun.)

Shipping Information: ____

Section 3

Was the cooler packed with: ☑ Ice ☐ Ice Packs ☐ Bubble Wrap ☐ Styrofoam ☐ Paper ☐ None ☐ Other ____

Cooler Temp (°C): #1: 1.8 #2: ____ #3: ____ #4: ____

Section 4	YES	NO	N/A
Was a COC received?	✔		
Are sample IDs present?	✔		
Are sampling dates & times present?	✔		
Is a relinquished signature present?	✔		
Are the tests required clearly indicated on the COC?	✔		
Are custody seals present?		✔	
If custody seals are present, were they intact?			✔
Are all samples sealed in plastic bags? (Recommended for Microbiology samples)			✔
Did all samples arrive intact? If no, indicate in Section 4 below.	✔		
Did all bottle labels agree with COC? (ID, dates and times)	✔		
Were the samples collected in the correct containers for the required tests?	✔		
Are the containers labeled with the correct preservatives?			✔
Is there headspace in the VOA vials greater than 5-6 mm in diameter?			✔
Was a sufficient amount of sample submitted for the requested tests?	✔		

Section 5 Explanations/Comments

Section 6

For discrepancies, how was the Project Manager notified? ☐ Verbal PM Initials: ____ Date/Time ____
☐ Email (email sent to/on): ____ / ____

Project Manager's response:

Completed By: [signature] Date: 9/17/2021

Enthalpy Analytical, a subsidiary of Montrose Environmental Group, Inc.
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www.enthalpy.com/socal

Sample Acceptance Checklist – Rev 4, 8/8/2017

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Analysis Results for 450692

Cindy Johnson
Belshire Environmental Services
25971 Towne Centre Drive
Foothill Ranch, CA 92610

Lab Job #: 450692
Location: Avalon Bay - Pacific Beach
Date Received: 09/17/21

Sample ID: DRUM 1-3 COMP **Lab ID: 450692-004** **Collected: 09/17/21**
Matrix: Soil

450692-004 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA 6010B Prep Method: EPA 3050B										
Antimony	ND		mg/Kg	3.0	1.6	1	274225	09/20/21	09/21/21	KLN
Arsenic	**2.1**		mg/Kg	1.0	0.68	1	274225	09/20/21	09/21/21	KLN
Barium	**25**		mg/Kg	1.0	0.11	1	274225	09/20/21	09/21/21	KLN
Beryllium	**0.24**	J	mg/Kg	0.51	0.068	1	274225	09/20/21	09/21/21	KLN
Cadmium	ND		mg/Kg	0.51	0.095	1	274225	09/20/21	09/21/21	KLN
Chromium	**13**		mg/Kg	1.0	0.097	1	274225	09/20/21	09/21/21	KLN
Cobalt	**1.9**		mg/Kg	0.51	0.087	1	274225	09/20/21	09/21/21	KLN
Copper	**4.7**		mg/Kg	1.0	0.42	1	274225	09/20/21	09/21/21	KLN
Lead	**2.2**		mg/Kg	1.0	0.85	1	274225	09/20/21	09/21/21	KLN
Molybdenum	ND		mg/Kg	1.0	0.60	1	274225	09/20/21	09/21/21	KLN
Nickel	**3.0**		mg/Kg	1.0	0.26	1	274225	09/20/21	09/21/21	KLN
Selenium	ND		mg/Kg	3.0	1.8	1	274225	09/20/21	09/21/21	KLN
Silver	ND		mg/Kg	0.51	0.16	1	274225	09/20/21	09/21/21	KLN
Thallium	ND		mg/Kg	3.0	1.1	1	274225	09/20/21	09/21/21	KLN
Vanadium	**13**		mg/Kg	1.0	0.26	1	274225	09/20/21	09/21/21	KLN
Zinc	**14**		mg/Kg	5.1	0.76	1	274225	09/20/21	09/21/21	KLN
Method: EPA 7471A Prep Method: METHOD										
Mercury	ND		mg/Kg	0.16	0.046	1.2	274285	09/20/21	09/21/21	TNN
Method: EPA 8015B Prep Method: EPA 3580										
TPH (C6-C12)	**1.8**	B,J	mg/Kg	10	0.62	1	274223	09/20/21	09/21/21	MES
TPH (C13-C22)	**2.2**	B,J	mg/Kg	10	0.62	1	274223	09/20/21	09/21/21	MES
TPH (C23-C44)	**6.3**	B,J	mg/Kg	10	0.62	1	274223	09/20/21	09/21/21	MES
Surrogates				**Limits**						
n-Triacontane	80%		%REC	70-130		1	274223	09/20/21	09/21/21	MES
Method: EPA 8260B Prep Method: EPA 5030B										
3-Chloropropene	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
cis-1,4-Dichloro-2-butene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
trans-1,4-Dichloro-2-butene	ND		ug/Kg	5.0	0.9	1	274184	09/20/21	09/20/21	LXR
Isopropyl Ether (DIPE)	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
Ethyl tert-Butyl Ether (ETBE)	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Methyl tert-Amyl Ether (TAME)	ND		ug/Kg	5.0	0.7	1	274184	09/20/21	09/20/21	LXR
tert-Butyl Alcohol (TBA)	ND		ug/Kg	10	8.8	1	274184	09/20/21	09/20/21	LXR

Results for any subcontracted analyses are not included in this section.

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Analysis Results for 450692

450692-004 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Freon 12	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
Chloromethane	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
Vinyl Chloride	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
Bromomethane	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
Chloroethane	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
Trichlorofluoromethane	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
Acetone	ND		ug/Kg	100	25	1	274184	09/20/21	09/20/21	LXR
Freon 113	ND		ug/Kg	5.0	0.7	1	274184	09/20/21	09/20/21	LXR
1,1-Dichloroethene	ND		ug/Kg	5.0	0.2	1	274184	09/20/21	09/20/21	LXR
Methylene Chloride	ND		ug/Kg	5.0	0.7	1	274184	09/20/21	09/20/21	LXR
MTBE	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
trans-1,2-Dichloroethene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
1,1-Dichloroethane	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
2-Butanone	ND		ug/Kg	100	3.2	1	274184	09/20/21	09/20/21	LXR
cis-1,2-Dichloroethene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
2,2-Dichloropropane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Chloroform	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
Bromochloromethane	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
1,1,1-Trichloroethane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
1,1-Dichloropropene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
Carbon Tetrachloride	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
1,2-Dichloroethane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Benzene	ND		ug/Kg	5.0	0.2	1	274184	09/20/21	09/20/21	LXR
Trichloroethene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
1,2-Dichloropropane	ND		ug/Kg	5.0	0.6	1	274184	09/20/21	09/20/21	LXR
Bromodichloromethane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Dibromomethane	ND		ug/Kg	5.0	0.6	1	274184	09/20/21	09/20/21	LXR
4-Methyl-2-Pentanone	ND		ug/Kg	5.0	1.9	1	274184	09/20/21	09/20/21	LXR
cis-1,3-Dichloropropene	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
Toluene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
trans-1,3-Dichloropropene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
1,1,2-Trichloroethane	ND		ug/Kg	5.0	0.6	1	274184	09/20/21	09/20/21	LXR
1,3-Dichloropropane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Tetrachloroethene	ND		ug/Kg	5.0	0.6	1	274184	09/20/21	09/20/21	LXR
Dibromochloromethane	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
1,2-Dibromoethane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Chlorobenzene	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
1,1,1,2-Tetrachloroethane	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Ethylbenzene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
m,p-Xylenes	ND		ug/Kg	10	0.8	1	274184	09/20/21	09/20/21	LXR
o-Xylene	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
Styrene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Bromoform	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Isopropylbenzene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
1,1,2,2-Tetrachloroethane	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
1,2,3-Trichloropropane	ND		ug/Kg	5.0	0.7	1	274184	09/20/21	09/20/21	LXR

Results for any subcontracted analyses are not included in this section.

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Analysis Results for 450692

450692-004 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Propylbenzene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
Bromobenzene	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
1,3,5-Trimethylbenzene	ND		ug/Kg	5.0	0.4	1	274184	09/20/21	09/20/21	LXR
2-Chlorotoluene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
4-Chlorotoluene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
tert-Butylbenzene	ND		ug/Kg	5.0	0.3	1	274184	09/20/21	09/20/21	LXR
1,2,4-Trimethylbenzene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
sec-Butylbenzene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
para-Isopropyl Toluene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
1,3-Dichlorobenzene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
1,4-Dichlorobenzene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
n-Butylbenzene	ND		ug/Kg	5.0	0.7	1	274184	09/20/21	09/20/21	LXR
1,2-Dichlorobenzene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
1,2-Dibromo-3-Chloropropane	ND		ug/Kg	5.0	0.6	1	274184	09/20/21	09/20/21	LXR
1,2,4-Trichlorobenzene	ND		ug/Kg	5.0	0.9	1	274184	09/20/21	09/20/21	LXR
Hexachlorobutadiene	ND		ug/Kg	5.0	0.6	1	274184	09/20/21	09/20/21	LXR
Naphthalene	ND		ug/Kg	5.0	0.9	1	274184	09/20/21	09/20/21	LXR
1,2,3-Trichlorobenzene	ND		ug/Kg	5.0	0.5	1	274184	09/20/21	09/20/21	LXR
Xylene (total)	ND		ug/Kg	5.0		1	274184	09/20/21	09/20/21	LXR
Surrogates				**Limits**						
Dibromofluoromethane	105%		%REC	70-145	1.3	1	274184	09/20/21	09/20/21	LXR
1,2-Dichloroethane-d4	117%		%REC	70-145		1	274184	09/20/21	09/20/21	LXR
Toluene-d8	100%		%REC	70-145		1	274184	09/20/21	09/20/21	LXR
Bromofluorobenzene	99%		%REC	70-145	1.5	1	274184	09/20/21	09/20/21	LXR

B Contamination found in associated Method Blank
J Estimated value
ND Not Detected

Results for any subcontracted analyses are not included in this section.

Batch QC

Type:	Lab Control Sample	Lab ID:	QC944457	Batch:	274184
Matrix:	Soil	Method:	EPA 8260B	Prep Method:	EPA 5030B

QC944457 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
1,1-Dichloroethene	52.93	50.00	ug/Kg	106%		70-131
MTBE	56.40	50.00	ug/Kg	113%		69-130
Benzene	45.76	50.00	ug/Kg	92%		70-130
Trichloroethene	39.37	50.00	ug/Kg	79%		70-130
Toluene	42.93	50.00	ug/Kg	86%		70-130
Chlorobenzene	43.93	50.00	ug/Kg	88%		70-130
Surrogates						
Dibromofluoromethane	54.95	50.00	ug/Kg	110%		70-130
1,2-Dichloroethane-d4	58.51	50.00	ug/Kg	117%		70-145
Toluene-d8	45.23	50.00	ug/Kg	90%		70-145
Bromofluorobenzene	48.85	50.00	ug/Kg	98%		70-145

Type:	Lab Control Sample Duplicate	Lab ID:	QC944458	Batch:	274184
Matrix:	Soil	Method:	EPA 8260B	Prep Method:	EPA 5030B

QC944458 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
1,1-Dichloroethene	54.01	50.00	ug/Kg	108%		70-131	2	33
MTBE	56.11	50.00	ug/Kg	112%		69-130	1	30
Benzene	48.53	50.00	ug/Kg	97%		70-130	6	30
Trichloroethene	47.79	50.00	ug/Kg	96%		70-130	19	30
Toluene	50.37	50.00	ug/Kg	101%		70-130	16	30
Chlorobenzene	50.58	50.00	ug/Kg	101%		70-130	14	30
Surrogates								
Dibromofluoromethane	52.34	50.00	ug/Kg	105%		70-130		
1,2-Dichloroethane-d4	55.03	50.00	ug/Kg	110%		70-145		
Toluene-d8	50.16	50.00	ug/Kg	100%		70-145		
Bromofluorobenzene	51.58	50.00	ug/Kg	103%		70-145		

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Batch QC

Type:	Blank	Lab ID:	QC944461	Batch:	274184
Matrix:	Soil	Method:	EPA 8260B	Prep Method:	EPA 5030B

QC944461 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
3-Chloropropene	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
cis-1,4-Dichloro-2-butene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
trans-1,4-Dichloro-2-butene	ND		ug/Kg	5.0	0.9	09/20/21	09/20/21
Isopropyl Ether (DIPE)	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
Ethyl tert-Butyl Ether (ETBE)	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Methyl tert-Amyl Ether (TAME)	ND		ug/Kg	5.0	0.7	09/20/21	09/20/21
tert-Butyl Alcohol (TBA)	ND		ug/Kg	10	8.8	09/20/21	09/20/21
Freon 12	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
Chloromethane	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
Vinyl Chloride	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
Bromomethane	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
Chloroethane	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
Trichlorofluoromethane	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
Acetone	ND		ug/Kg	100	25	09/20/21	09/20/21
Freon 113	ND		ug/Kg	5.0	0.7	09/20/21	09/20/21
1,1-Dichloroethene	ND		ug/Kg	5.0	0.2	09/20/21	09/20/21
Methylene Chloride	ND		ug/Kg	5.0	0.7	09/20/21	09/20/21
MTBE	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
trans-1,2-Dichloroethene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
1,1-Dichloroethane	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
2-Butanone	ND		ug/Kg	100	3.2	09/20/21	09/20/21
cis-1,2-Dichloroethene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
2,2-Dichloropropane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Chloroform	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
Bromochloromethane	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
1,1,1-Trichloroethane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
1,1-Dichloropropene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
Carbon Tetrachloride	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
1,2-Dichloroethane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Benzene	ND		ug/Kg	5.0	0.2	09/20/21	09/20/21
Trichloroethene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
1,2-Dichloropropane	ND		ug/Kg	5.0	0.6	09/20/21	09/20/21
Bromodichloromethane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Dibromomethane	ND		ug/Kg	5.0	0.6	09/20/21	09/20/21
4-Methyl-2-Pentanone	ND		ug/Kg	5.0	1.9	09/20/21	09/20/21
cis-1,3-Dichloropropene	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
Toluene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
trans-1,3-Dichloropropene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
1,1,2-Trichloroethane	ND		ug/Kg	5.0	0.6	09/20/21	09/20/21
1,3-Dichloropropane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Tetrachloroethene	ND		ug/Kg	5.0	0.6	09/20/21	09/20/21
Dibromochloromethane	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21

Batch QC

QC944461 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
1,2-Dibromoethane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Chlorobenzene	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
1,1,1,2-Tetrachloroethane	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Ethylbenzene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
m,p-Xylenes	ND		ug/Kg	10	0.8	09/20/21	09/20/21
o-Xylene	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
Styrene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Bromoform	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Isopropylbenzene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
1,1,2,2-Tetrachloroethane	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
1,2,3-Trichloropropane	ND		ug/Kg	5.0	0.7	09/20/21	09/20/21
Propylbenzene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
Bromobenzene	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
1,3,5-Trimethylbenzene	ND		ug/Kg	5.0	0.4	09/20/21	09/20/21
2-Chlorotoluene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
4-Chlorotoluene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
tert-Butylbenzene	ND		ug/Kg	5.0	0.3	09/20/21	09/20/21
1,2,4-Trimethylbenzene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
sec-Butylbenzene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
para-Isopropyl Toluene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
1,3-Dichlorobenzene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
1,4-Dichlorobenzene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
n-Butylbenzene	ND		ug/Kg	5.0	0.7	09/20/21	09/20/21
1,2-Dichlorobenzene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
1,2-Dibromo-3-Chloropropane	ND		ug/Kg	5.0	0.6	09/20/21	09/20/21
1,2,4-Trichlorobenzene	ND		ug/Kg	5.0	0.9	09/20/21	09/20/21
Hexachlorobutadiene	ND		ug/Kg	5.0	0.6	09/20/21	09/20/21
Naphthalene	ND		ug/Kg	5.0	0.9	09/20/21	09/20/21
1,2,3-Trichlorobenzene	ND		ug/Kg	5.0	0.5	09/20/21	09/20/21
Xylene (total)	ND		ug/Kg	5.0		09/20/21	09/20/21
Surrogates				**Limits**			
Dibromofluoromethane	110%		%REC	70-130	1.3	09/20/21	09/20/21
1,2-Dichloroethane-d4	117%		%REC	70-145		09/20/21	09/20/21
Toluene-d8	95%		%REC	70-145		09/20/21	09/20/21
Bromofluorobenzene	99%		%REC	70-145	1.5	09/20/21	09/20/21

Type:	**Blank**	**Lab ID:**	**QC944576**
Matrix:	**Soil**	**Method:**	**EPA 8015B**

Batch: **274223** **Prep Method:** **EPA 3580**

QC944576 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
TPH (C6-C12)	1.9	J	mg/Kg	10	0.62	09/20/21	09/20/21
TPH (C13-C22)	3.6	J	mg/Kg	10	0.62	09/20/21	09/20/21
TPH (C23-C44)	5.2	J	mg/Kg	10	0.62	09/20/21	09/20/21
Surrogates				**Limits**			
n-Triacontane	82%		%REC	70-130		09/20/21	09/20/21

Batch QC

Type:	Lab Control Sample	Lab ID:	QC944577	Batch:	274223
Matrix:	Soil	Method:	EPA 8015B	Prep Method:	EPA 3580

QC944577 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Diesel C10-C28	224.9	250.0	mg/Kg	90%		76-122
Surrogates						
n-Triacontane	7.796	10.00	mg/Kg	78%		70-130

Type:	Matrix Spike	Lab ID:	QC944578	Batch:	274223
Matrix (Source ID):	Soil (450715-002)	Method:	EPA 8015B	Prep Method:	EPA 3580

QC944578 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Diesel C10-C28	221.7	2.145	250.0	mg/Kg	88%		62-126	1
Surrogates								
n-Triacontane	8.424		10.00	mg/Kg	84%		70-130	1

Type:	Matrix Spike Duplicate	Lab ID:	QC944579	Batch:	274223
Matrix (Source ID):	Soil (450715-002)	Method:	EPA 8015B	Prep Method:	EPA 3580

QC944579 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
Diesel C10-C28	222.5	2.145	250.0	mg/Kg	88%		62-126	0	35	1
Surrogates										
n-Triacontane	8.294		10.00	mg/Kg	83%		70-130			1

Batch QC

Type:	Blank	Lab ID:	QC944583	Batch:	274225
Matrix:	Soil	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC944583 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
Antimony	ND		mg/Kg	3.0	1.6	09/20/21	09/21/21
Arsenic	ND		mg/Kg	1.0	0.67	09/20/21	09/21/21
Barium	ND		mg/Kg	1.0	0.11	09/20/21	09/21/21
Beryllium	ND		mg/Kg	0.50	0.067	09/20/21	09/21/21
Cadmium	ND		mg/Kg	0.50	0.094	09/20/21	09/21/21
Chromium	ND		mg/Kg	1.0	0.096	09/20/21	09/21/21
Cobalt	ND		mg/Kg	0.50	0.086	09/20/21	09/21/21
Copper	ND		mg/Kg	1.0	0.42	09/20/21	09/21/21
Lead	ND		mg/Kg	1.0	0.84	09/20/21	09/21/21
Molybdenum	ND		mg/Kg	1.0	0.59	09/20/21	09/21/21
Nickel	ND		mg/Kg	1.0	0.26	09/20/21	09/21/21
Selenium	ND		mg/Kg	3.0	1.8	09/20/21	09/21/21
Silver	ND		mg/Kg	0.50	0.16	09/20/21	09/21/21
Thallium	ND		mg/Kg	3.0	1.1	09/20/21	09/21/21
Vanadium	ND		mg/Kg	1.0	0.26	09/20/21	09/21/21
Zinc	ND		mg/Kg	5.0	0.75	09/20/21	09/21/21

Type:	Lab Control Sample	Lab ID:	QC944584	Batch:	274225
Matrix:	Soil	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC944584 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Antimony	105.6	100.0	mg/Kg	106%	b	80-120
Arsenic	100.2	100.0	mg/Kg	100%		80-120
Barium	104.0	100.0	mg/Kg	104%		80-120
Beryllium	101.2	100.0	mg/Kg	101%		80-120
Cadmium	100.6	100.0	mg/Kg	101%		80-120
Chromium	97.99	100.0	mg/Kg	98%		80-120
Cobalt	103.4	100.0	mg/Kg	103%		80-120
Copper	98.13	100.0	mg/Kg	98%		80-120
Lead	99.03	100.0	mg/Kg	99%		80-120
Molybdenum	104.4	100.0	mg/Kg	104%		80-120
Nickel	103.5	100.0	mg/Kg	104%		80-120
Selenium	90.89	100.0	mg/Kg	91%		80-120
Silver	47.28	50.00	mg/Kg	95%		80-120
Thallium	108.2	100.0	mg/Kg	108%		80-120
Vanadium	100.6	100.0	mg/Kg	101%		80-120
Zinc	105.1	100.0	mg/Kg	105%		80-120

ENTHALPY ANALYTICAL

Batch QC

Type:	Matrix Spike	Lab ID:	QC944585	Batch:	274225
Matrix (Source ID):	Soil (450692-004)	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC944585 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Antimony	63.59	ND	100.0	mg/Kg	64%	b,*	75-125	1
Arsenic	108.3	2.078	100.0	mg/Kg	106%		75-125	1
Barium	128.1	25.22	100.0	mg/Kg	103%		75-125	1
Beryllium	105.2	0.2415	100.0	mg/Kg	105%		75-125	1
Cadmium	105.5	ND	100.0	mg/Kg	106%		75-125	1
Chromium	113.6	13.47	100.0	mg/Kg	100%		75-125	1
Cobalt	105.6	1.911	100.0	mg/Kg	104%		75-125	1
Copper	108.1	4.702	100.0	mg/Kg	103%		75-125	1
Lead	101.0	2.162	100.0	mg/Kg	99%		75-125	1
Molybdenum	105.8	ND	100.0	mg/Kg	106%		75-125	1
Nickel	105.9	2.993	100.0	mg/Kg	103%		75-125	1
Selenium	95.20	ND	100.0	mg/Kg	95%		75-125	1
Silver	48.31	ND	50.00	mg/Kg	97%		75-125	1
Thallium	107.2	ND	100.0	mg/Kg	107%		75-125	1
Vanadium	119.4	13.36	100.0	mg/Kg	106%		75-125	1
Zinc	118.7	14.02	100.0	mg/Kg	105%		75-125	1

Type:	Matrix Spike Duplicate	Lab ID:	QC944586	Batch:	274225
Matrix (Source ID):	Soil (450692-004)	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC944586 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
Antimony	67.45	ND	101.0	mg/Kg	67%	b,*	75-125	5	41	1
Arsenic	110.9	2.078	101.0	mg/Kg	108%		75-125	1	35	1
Barium	129.4	25.22	101.0	mg/Kg	103%		75-125	0	20	1
Beryllium	107.9	0.2415	101.0	mg/Kg	107%		75-125	2	20	1
Cadmium	107.8	ND	101.0	mg/Kg	107%		75-125	1	20	1
Chromium	115.1	13.47	101.0	mg/Kg	101%		75-125	0	20	1
Cobalt	107.1	1.911	101.0	mg/Kg	104%		75-125	0	20	1
Copper	109.6	4.702	101.0	mg/Kg	104%		75-125	0	20	1
Lead	102.5	2.162	101.0	mg/Kg	99%		75-125	0	20	1
Molybdenum	108.4	ND	101.0	mg/Kg	107%		75-125	1	20	1
Nickel	108.0	2.993	101.0	mg/Kg	104%		75-125	1	20	1
Selenium	97.61	ND	101.0	mg/Kg	97%		75-125	1	20	1
Silver	49.20	ND	50.51	mg/Kg	97%		75-125	1	20	1
Thallium	110.2	ND	101.0	mg/Kg	109%		75-125	2	20	1
Vanadium	119.9	13.36	101.0	mg/Kg	105%		75-125	1	20	1
Zinc	121.7	14.02	101.0	mg/Kg	107%		75-125	2	20	1

Batch QC

Type:	**Blank**	**Lab ID:**	**QC944741**	**Batch:**	**274285**
Matrix:	**Miscell.**	**Method:**	**EPA 7471A**	**Prep Method:**	**METHOD**

QC944741 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
Mercury	ND		mg/Kg	0.14	0.039	09/20/21	09/21/21

Type:	**Lab Control Sample**	**Lab ID:**	**QC944742**	**Batch:**	**274285**
Matrix:	**Miscell.**	**Method:**	**EPA 7471A**	**Prep Method:**	**METHOD**

QC944742 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Mercury	0.7861	0.8333	mg/Kg	94%		80-120

Type:	**Matrix Spike**	**Lab ID:**	**QC944743**	**Batch:**	**274285**
Matrix (Source ID):	**Soil (450633-006)**	**Method:**	**EPA 7471A**	**Prep Method:**	**METHOD**

QC944743 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Mercury	0.9578	0.08799	0.8929	mg/Kg	97%		75-125	1.1

Type:	**Matrix Spike Duplicate**	**Lab ID:**	**QC944744**	**Batch:**	**274285**
Matrix (Source ID):	**Soil (450633-006)**	**Method:**	**EPA 7471A**	**Prep Method:**	**METHOD**

QC944744 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
Mercury	0.9277	0.08799	0.8621	mg/Kg	97%		75-125	0	20	1

*	Value is outside QC limits
J	Estimated value
ND	Not Detected
b	See narrative

APPENDIX D

Latitude, Longitude: 32.790611, -117.237087

Date	9/14/2021, 3:51:56 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.351	MCE_R ground motion. (for 0.2 second period)
S_1	0.469	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.351	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.901	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.614	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.675	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.351	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.559	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.996	Factored deterministic acceleration value. (0.2 second)
S1RT	0.469	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.529	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.698	Factored deterministic acceleration value. (1.0 second)
PGAd	0.825	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.867	Mapped value of the risk coefficient at short periods
C_{R1}	0.886	Mapped value of the risk coefficient at a period of 1 s

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U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Latitude

Decimal degrees

32.790611

Longitude

Decimal degrees, negative values for western longitudes

-117.237087

Site Class

259 m/s (Site class D)

Spectral Period

Peak Ground Acceleration

Time Horizon

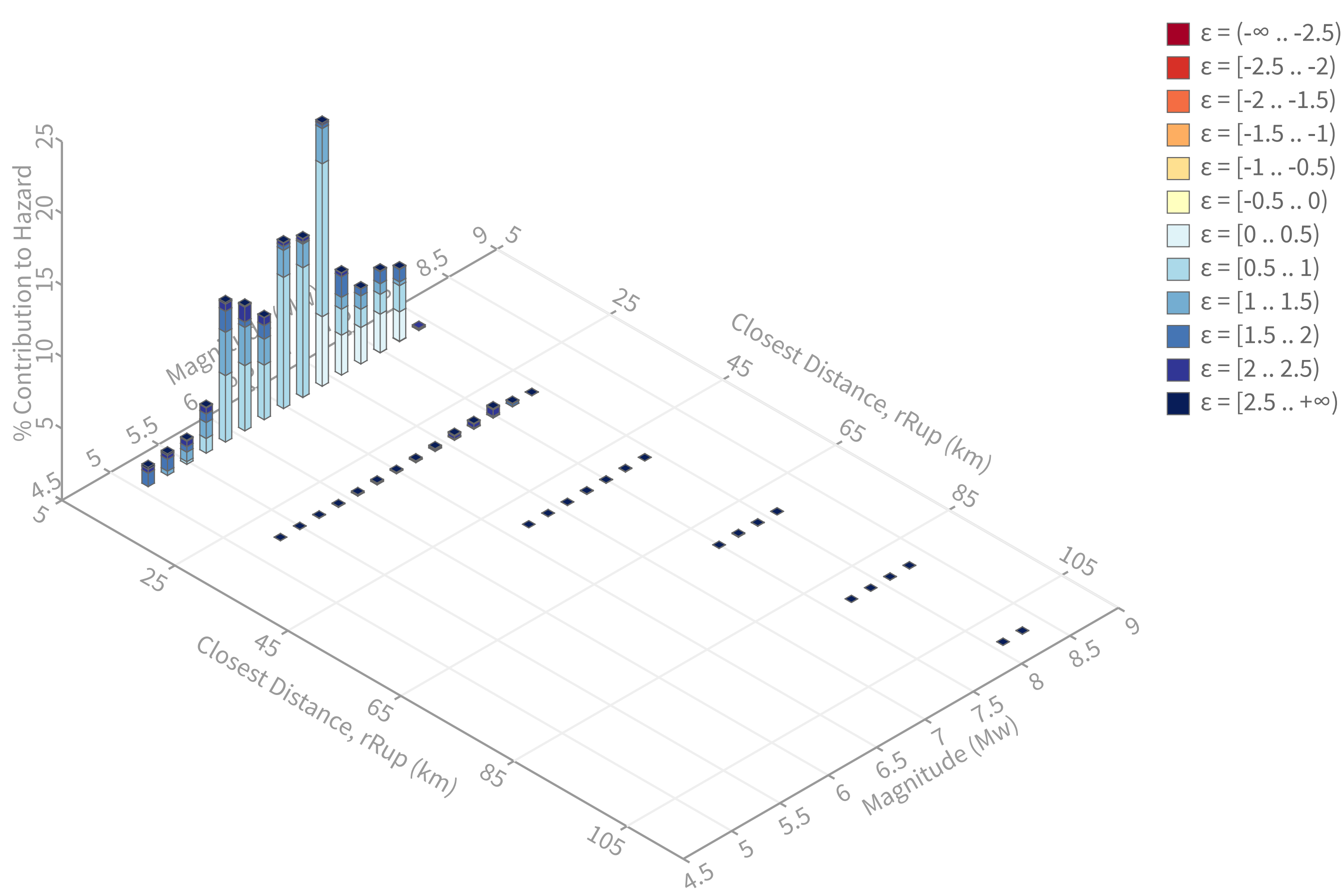
Return period in years

2475

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.65120586 g

Recovered targets

Return period: 2741.2979 yrs
Exceedance rate: 0.0003647907 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.1 %

Mean (over all sources)

m: 6.63
r: 5.65 km
ε_0: 0.96 σ

Mode (largest m-r bin)

m: 6.89
r: 3.25 km
ε_0: 0.67 σ
Contribution: 18.34 %

Mode (largest m-r-ε_0 bin)

m: 6.88
r: 2.89 km
ε_0: 0.61 σ
Contribution: 10.66 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							46.26
Rose Canyon [8]		2.84	6.77	0.68	117.216°W	32.807°N	46.72	31.56
Rose Canyon [7]		2.89	6.23	0.85	117.207°W	32.792°N	85.68	3.99
Rose Canyon [9]		3.56	6.44	0.87	117.228°W	32.821°N	14.15	1.89
Rose Canyon [6]		5.10	6.13	1.18	117.198°W	32.760°N	132.99	1.87
Coronado Bank alt1 [5]		19.82	7.04	2.00	117.431°W	32.720°N	246.66	1.78
UC33brAvg_FM32	System							45.97
Rose Canyon [8]		2.84	6.79	0.67	117.216°W	32.807°N	46.72	30.17
Rose Canyon [7]		2.89	6.27	0.84	117.207°W	32.792°N	85.68	3.79
Oceanside alt2 [2]		12.20	7.42	0.96	117.488°W	32.735°N	255.43	2.49
Coronado Bank alt2 [16]		19.82	7.47	1.74	117.433°W	32.724°N	247.99	2.04
Rose Canyon [9]		3.56	6.52	0.84	117.228°W	32.821°N	14.15	1.65
Rose Canyon [6]		5.10	6.19	1.16	117.198°W	32.760°N	132.99	1.38
UC33brAvg_FM32 (opt)	Grid							3.92
UC33brAvg_FM31 (opt)	Grid							3.84

APPENDIX E

Percolation Data Sheet

Project Name: Avalon Bay/ Pacific Beach	Project Number: 21010-01
Test Hole Number: P-1	Date Excavated: 9/8/2021
Depth (in): 118.8 Radius (in.): 4.0	Date Presoak: 9/8/2021
Tested By: ASC	Date Tested: 9/9/2021

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	9:38 9:43	5.0	36.0	109.2	73.2
2	9:49 9:54	5.0	36.0	106.8	70.8

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
10:41 10:46	5.0	5.0	36.0	102.6	66.6	799.2
10:47 10:52	5.0	10.0	36.0	104.4	68.4	820.8
10:55 11:00	5.0	15.0	36.0	103.2	67.2	806.4
11:02 11:07	5.0	20.0	36.0	102.6	66.6	799.2
11:09 11:14	5.0	25.0	36.0	101.4	65.4	784.8
11:16 11:21	5.0	30.0	36.0	100.8	64.8	777.6
11:24 11:29	5.0	35.0	36.0	99.6	63.6	763.2
11:31 11:36	5.0	40.0	36.0	99.0	63.0	756.0
11:44 11:49	5.0	45.0	36.0	100.8	64.8	777.6
11:51 11:56	5.0	50.0	36.0	99.6	63.6	763.2
11:58 12:03	5.0	55.0	36.0	99.6	63.6	763.2
12:05 12:10	5.0	60.0	36.0	99.6	63.6	763.2

Initial Height of Water (Ho) = 82.8

Final Height of Water (Hf) = 19.2

Change in Height Over Time (ΔH) = 63.6

Average Head Over Time (Havg) = 51.0

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

$I_t =$ 28.8 in./hr.

Percolation Data Sheet

Project Name: Avalon Bay/ Pacific Beach
Test Hole Number: P-2
Depth (in): 60.6 Radius (in.): 4.0
Tested By: ASC

Project Number: 21010-01
Date Excavated: 9/8/2021
Date Presoak: 9/8/2021
Date Tested: 9/9/2021

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	13:21 13:36	15.0	18.0	49.8	31.8
2	13:38 13:53	15.0	18.0	55.2	37.2

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
13:56 14:06	10.0	10.0	18.0	43.8	25.8	154.8
14:08 14:18	10.0	20.0	18.0	43.4	25.4	152.6
14:19 14:29	10.0	30.0	18.0	43.2	25.2	151.2
14:30 14:40	10.0	40.0	18.0	43.1	25.1	150.5
14:42 14:52	10.0	50.0	18.0	42.7	24.7	148.3
14:53 15:03	10.0	60.0	18.0	42.6	24.6	147.6

Initial Height of Water (Ho) = 42.6
Final Height of Water (Hf) = 18.0
Change in Height Over Time (ΔH) = 24.6
Average Head Over Time (Havg) = 30.3

I_t= ΔH(60r)/Δt(r+2Havg)
I_t= 9.1 in./hr.

Percolation Data Sheet

Project Name: Avalon Bay/ Pacific Beach
Test Hole Number: P-3
Depth (in): 115.2 Radius (in.): 4.0
Tested By: ASC

Project Number: 21010-01
Date Excavated: 9/8/2021
Date Presoak: 9/8/2021
Date Tested: 9/9/2021

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	16:00 16:15	15.0	48.0	114.5	66.5
2	16:18 16:33	15.0	60.0	109.2	49.2

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
16:35 16:45	10.0	10.0	48.0	90.0	42.0	252.0
16:47 16:57	10.0	20.0	48.0	87.7	39.7	238.3
17:00 17:10	10.0	30.0	48.0	88.1	40.1	240.5
17:12 17:22	10.0	40.0	48.0	87.5	39.5	236.9
17:24 17:34	10.0	50.0	48.0	87.1	39.1	234.7
17:37 17:47	10.0	60.0	48.0	87.0	39.0	234.0

Initial Height of Water (Ho) = 67.2
Final Height of Water (Hf) = 28.2
Change in Height Over Time (ΔH) = 39.0
Average Head Over Time (Havg) = 47.7

I_t= ΔH(60r)/Δt(r+2Havg)
I_t= 9.4 in./hr.

APPENDIX F

APPENDIX F

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 General

1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 Geotechnical Consultant: Prior to commencement of work, the owner shall employ a geotechnical consultant. The geotechnical consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General: Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

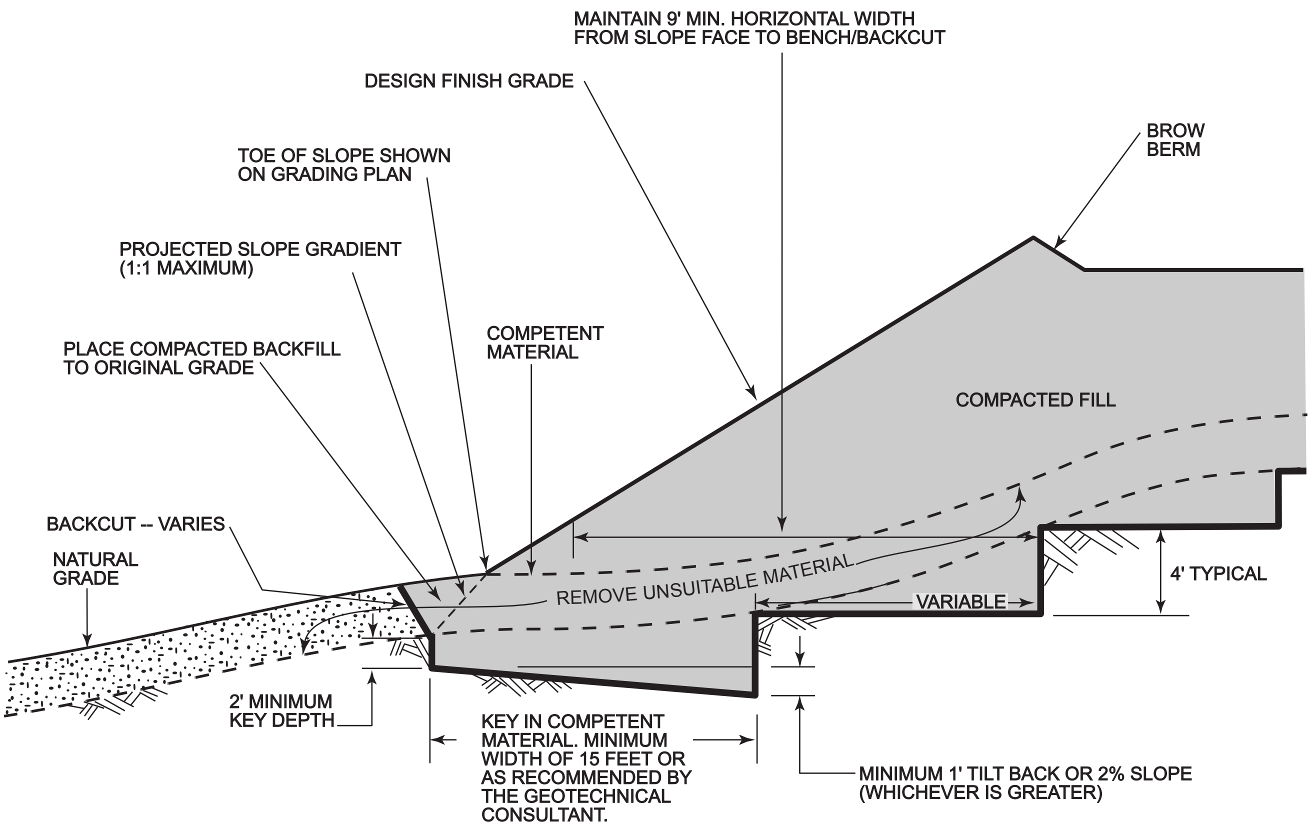
7.2 Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

7.3 Jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

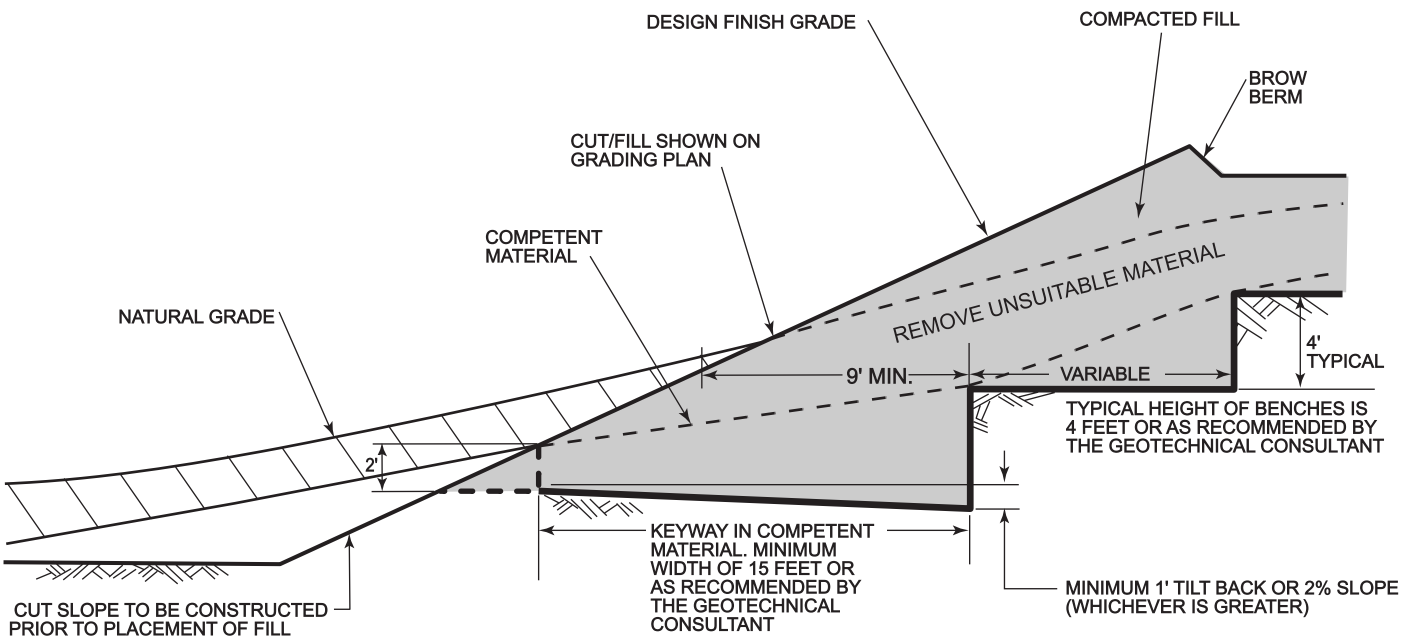
7.6 Trench backfill in the upper foot measured from finish grade/subgrade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction unless specified differently by the governing agency.



NOTE: BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE SOIL ENGINEER. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WILL BE PROVIDED BY THE GEOTECHNICAL ENGINEER.

FIGURE 1

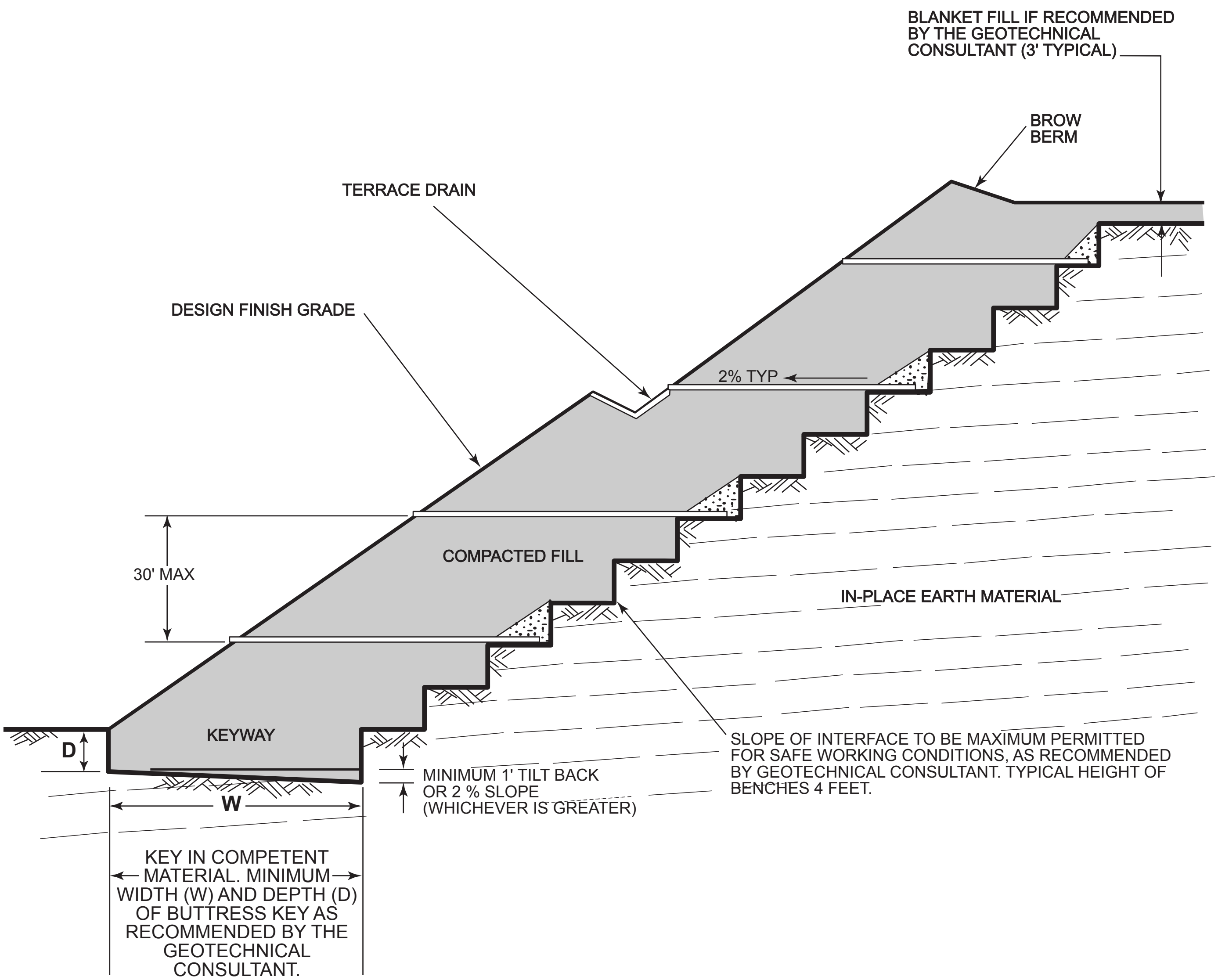
TYPICAL FILL KEY ABOVE NATURAL SLOPE
MINIMUM STANDARD GRADING DETAILS



NOTE: THE FILL PORTION OF THE SLOPE SHALL BE COMPACTED AS STATED IN THE PROJECT SPECIFICATIONS.

FIGURE 2

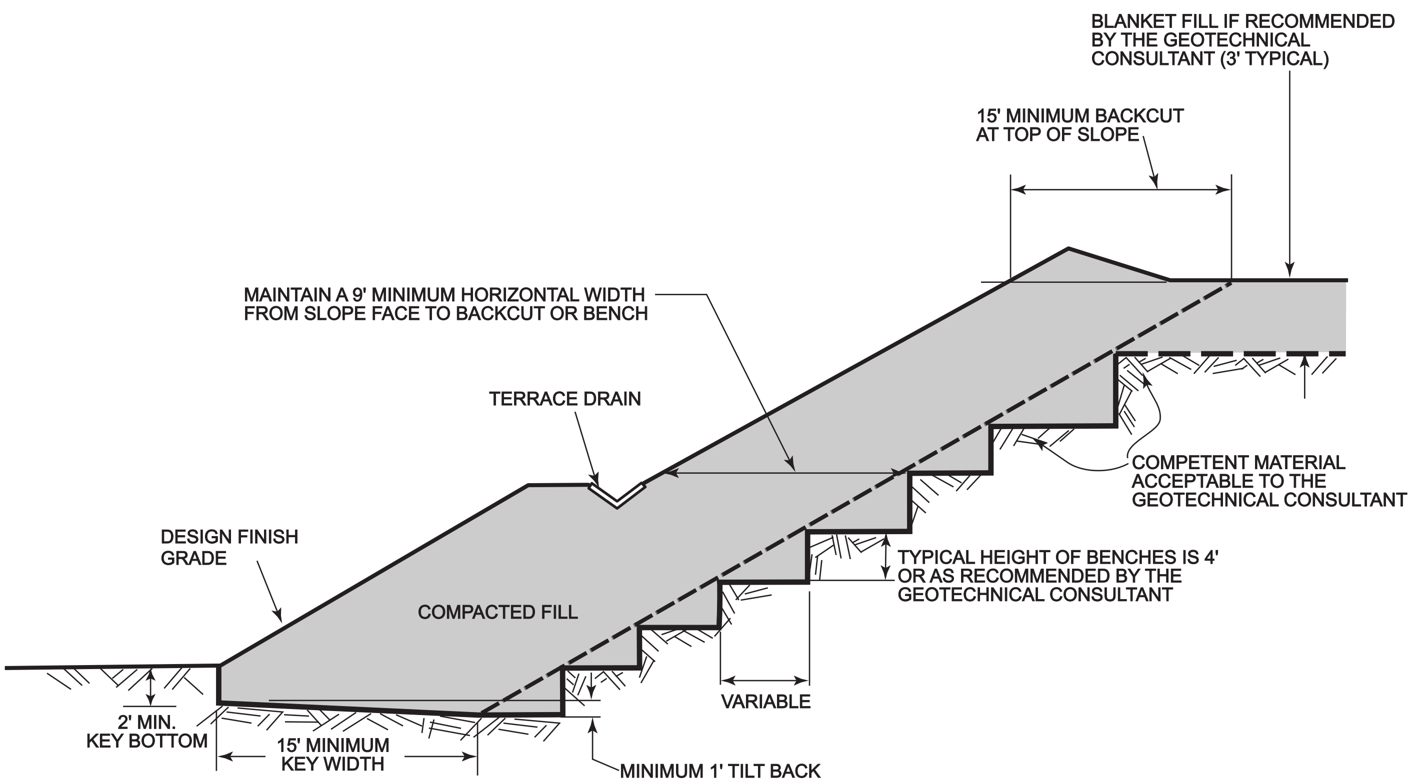
TYPICAL FILL ABOVE CUT SLOPE
MINIMUM STANDARD GRADING DETAILS



NOTE: SUBDRAIN DETAILS, SEE FIGURE 5.

FIGURE 3

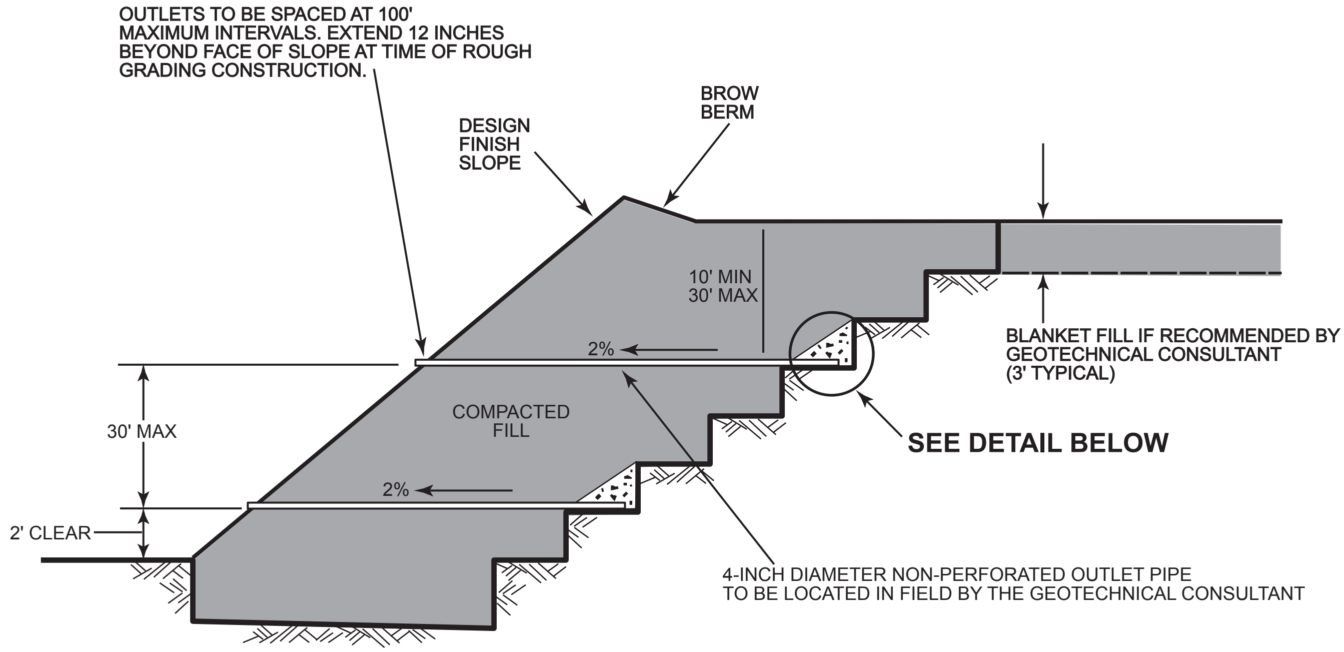
TYPICAL BUTTRESS FILL
MINIMUM STANDARD GRADING DETAILS



NOTE:
SEE FIGURE 5 FOR TYPICAL SUBDRAIN DETAILS FOR STABILIZATION FILLS

FIGURE 4

TYPICAL STABILIZATION FILL
MINIMUM STANDARD GRADING DETAILS



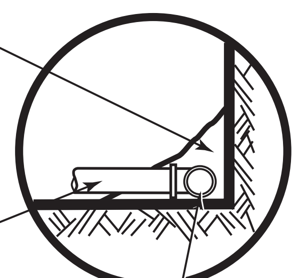
FILTER MATERIAL - MINIMUM OF THREE CUBIC FEET PER FOOT OF PIPE. SEE FILTER MATERIAL SPECIFICATION.

ALTERNATE: IN LIEU OF FILTER MATERIAL, THREE CUBIC FEET OF GRAVEL PER FOOT OF SUBDRAIN (WITHOUT PIPE) MAY BE ENCASED IN FILTER FABRIC. SEE GRAVEL SPECIFICATION, AND FIGURE 6 FOR FILTER FABRIC SPECIFICATION

"GRAVEL" TO CONSIST OF 1/2" TO 1" CRUSHED ROCK PER STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.

FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

DETAIL



OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW

MINIMUM 4-INCH DIAMETER SCHEDULE 40 ASTM D1527 OR D1785 OR SDR 35 ASTM D2751 OR D 3034. FOR FILL DEPTH OF 90 FEET OR GREATER, USE ONLY SCHEDULE 40 OR EQUIVALENT. THERE SHALL BE A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT.

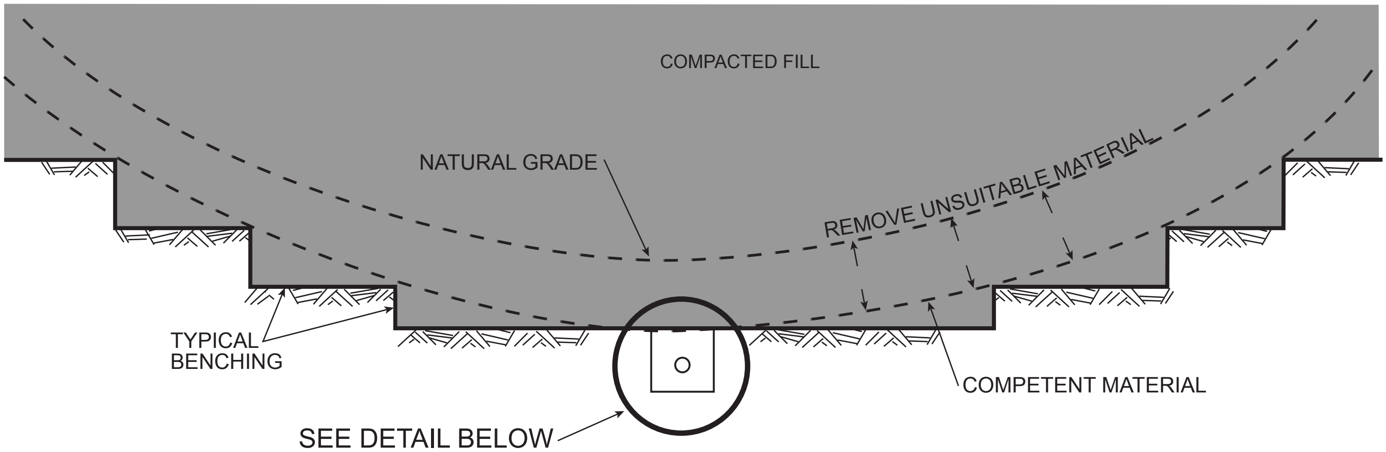
SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

NOTE:
TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

FIGURE 5

TYPICAL STABILIZATION AND BUTTRESS FILL SUBDRAINS MINIMUM STANDARD GRADING DETAILS

NMG Geotechnical, Inc.



FILTER FABRICS SHALL BE PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL CONFORMING TO THE FOLLOWING:

1) GRAB TENSILE STRENGTH. POUNDS, MIN. ASTM D 4632..90

2) ELONGATION, AT PEAK LOAD, PERCENT, MIN. ASTM D 4632...50

3) PUNCTURE STRENGTH, LBS., MIN. ASTM D 3787...45

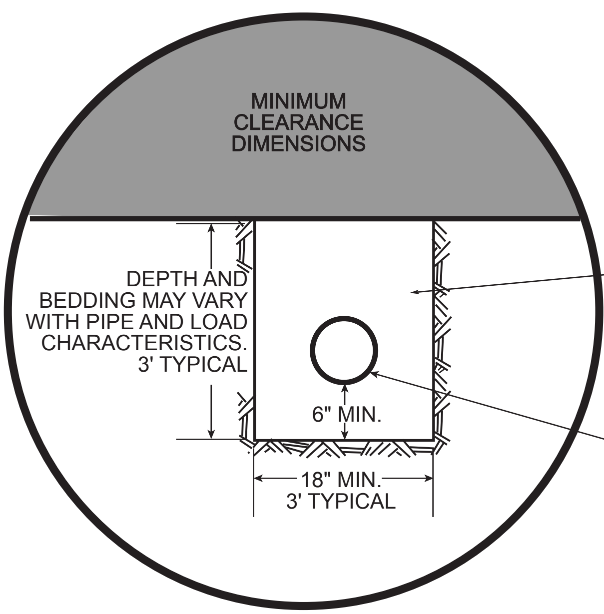
4) COEFFICIENT OF WATER PERMITTIVITY, 1/SEC. ASTM D 4491...>0.7

5) BURST STRENGTH, P.S.I., MIN. ASTM D 3786..180

NOTES: DOWNSTREAM 20' OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL

PIPE SHALL BE A MINIMUM OF 4-INCH DIAMETER. FOR RUNS OF 500 FEET OR MORE, USE 6-INCH DIAMETER PIPE, OR AS RECOMMENDED BY THE GEOTECHNICAL CONSULTANT

DETAIL



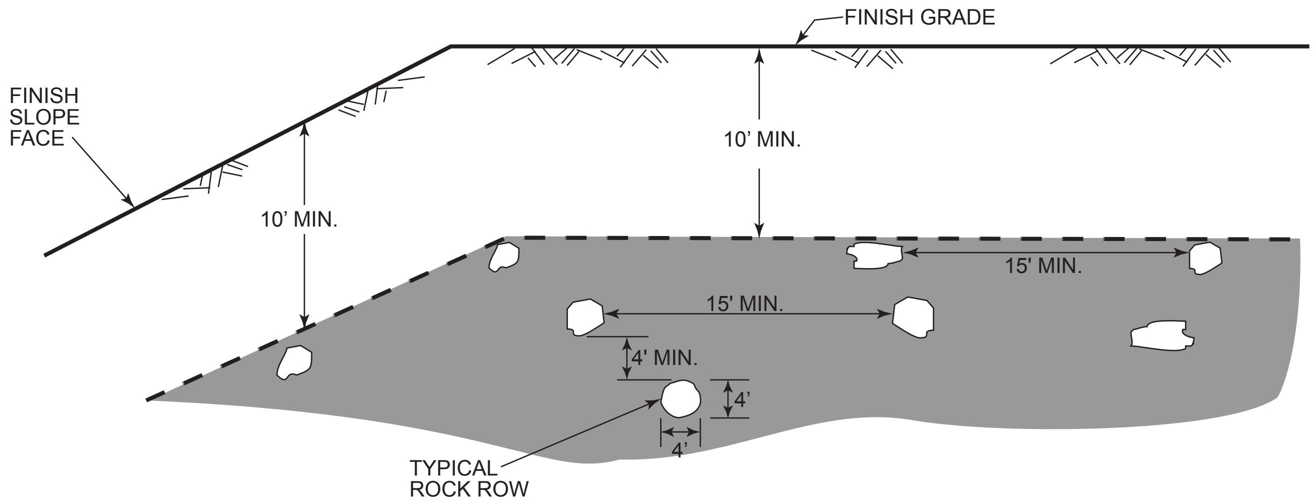
FILTER MATERIAL - MINIMUM OF NINE CUBIC FEET PER FOOT OF PIPE. SEE FIGURE 5 FOR FILTER MATERIAL SPECIFICATIONS.

ALTERNATE: IN LIEU OF FILTER MATERIAL, NINE CUBIC FEET OF GRAVEL PER FOOT OF SUBDRAIN (WITHOUT PIPE) MAY BE ENCASED IN FILTER FABRIC. SEE FIGURE 5 TO GRAVEL SPECIFICATION. SEE ABOVE FOR FILTER FABRIC SPECIFICATION. FILTER FABRIC SHALL BE LAPPED MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4 INCH DIAMETER SCHEDULE 40 ASTM D 1527, OR D 1785, OR SDR 35 ASTM 2751 OR D 3034. FOR FILL DEPTH OF 90 FEET OR GREATER, USE ONLY SCHEDULE 40 OR APPROVED EQUIVALENT. THERE SHALL BE A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE.

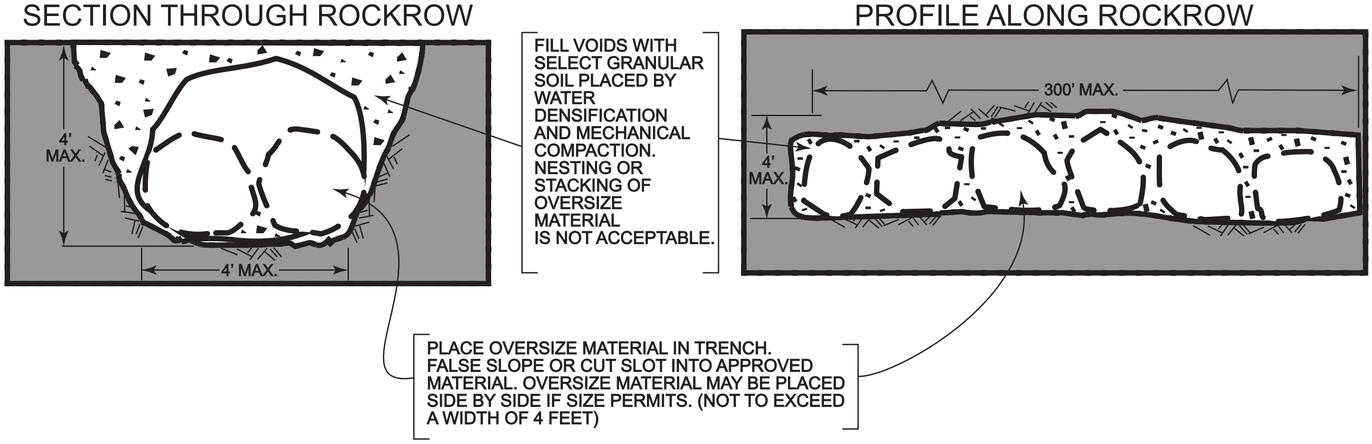
FIGURE 6

TYPICAL CANYON SUBDRAIN
MINIMUM STANDARD GRADING DETAILS



SECTION THROUGH ROCKROW

PROFILE ALONG ROCKROW



NOTES:

A) OVERSIZED ROCK IS DEFINED AS LARGER THAN 12" IN SIZE (IN GREATEST DIMENSION).

B) SPACE BETWEEN ROCKROWS SHOULD BE ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.

C) THE WIDTH AND HEIGHT OF THE ROCKROW SHALL BE LIMITED TO FOUR FEET AND THE LENGTH LIMITED TO 300 FEET UNLESS APPROVED OTHERWISE BY THE GEOTECHNICAL CONSULTANT. OVERSIZE SHOULD BE PLACED WITH FLATEST SIDE ON THE BOTTOM.

D) OVERSIZE MATERIAL EXCEEDING FOUR FEET MAY BE PLACED ON AN INDIVIDUAL BASIS IF APPROVED BY THE GEOTECHNICAL CONSULTANT.

E) FILLING OF VOIDS WILL REQUIRE SELECT GRANULAR SOIL (SE > 20, OR LESS THAN 20 PERCENT FINES) AS APPROVED BY THE GEOTECHNICAL CONSULTANT. VOIDS IN THE ROCKROW TO BE FILLED BY WATER DENSIFYING GRANULAR SOIL INTO PLACE ALONG WITH MECHANICAL COMPACTION EFFORT.

F) IF APPROVED BY THE GEOTECHNICAL CONSULTANT, ROCKROWS MAY BE PLACED DIRECTLY ON COMPETENT MATERIALS OR BEDROCK, PROVIDED ADEQUATE SPACE IS AVAILABLE FOR COMPACTION.

G) THE FIRST LIFT OF MATERIAL ABOVE THE ROCKROW SHALL CONSIST OF GRANULAR MATERIAL AND SHALL BE PROOF-ROLLED WITH A D-8 OR LARGER DOZER OR EQUIVALENT.

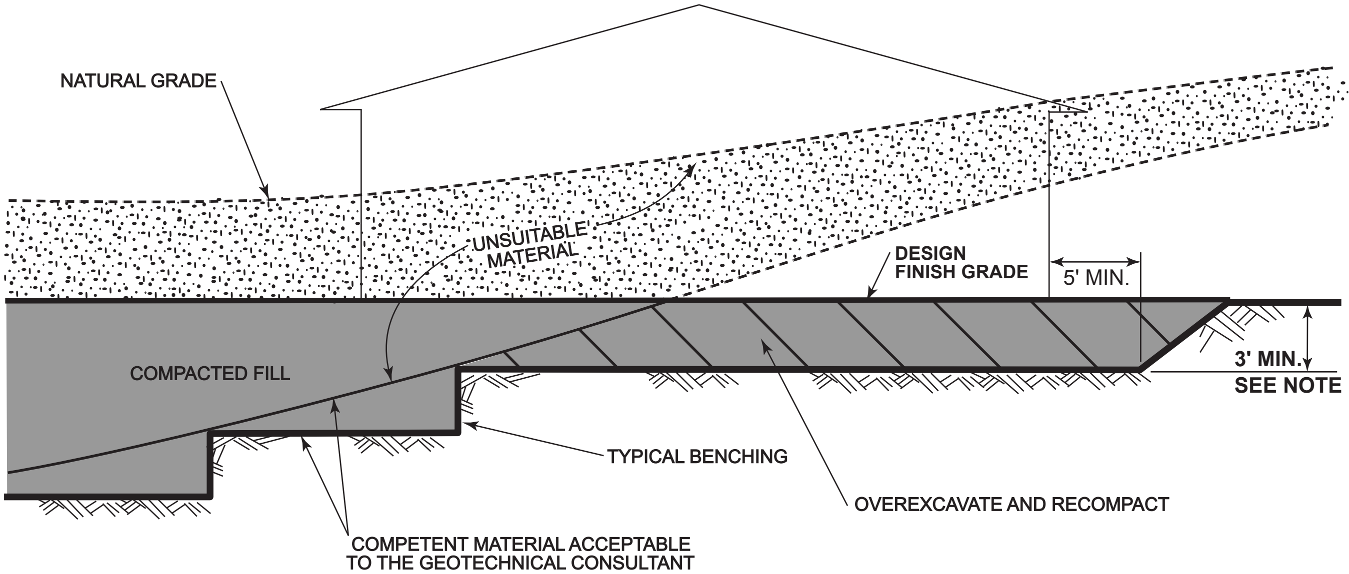
H) ROCKROWS NEAR SLOPES SHOULD BE ORIENTED PARALLEL TO SLOPE FACE.

I) NESTING OR STACKING OF ROCKS IS NOT ACCEPTABLE.

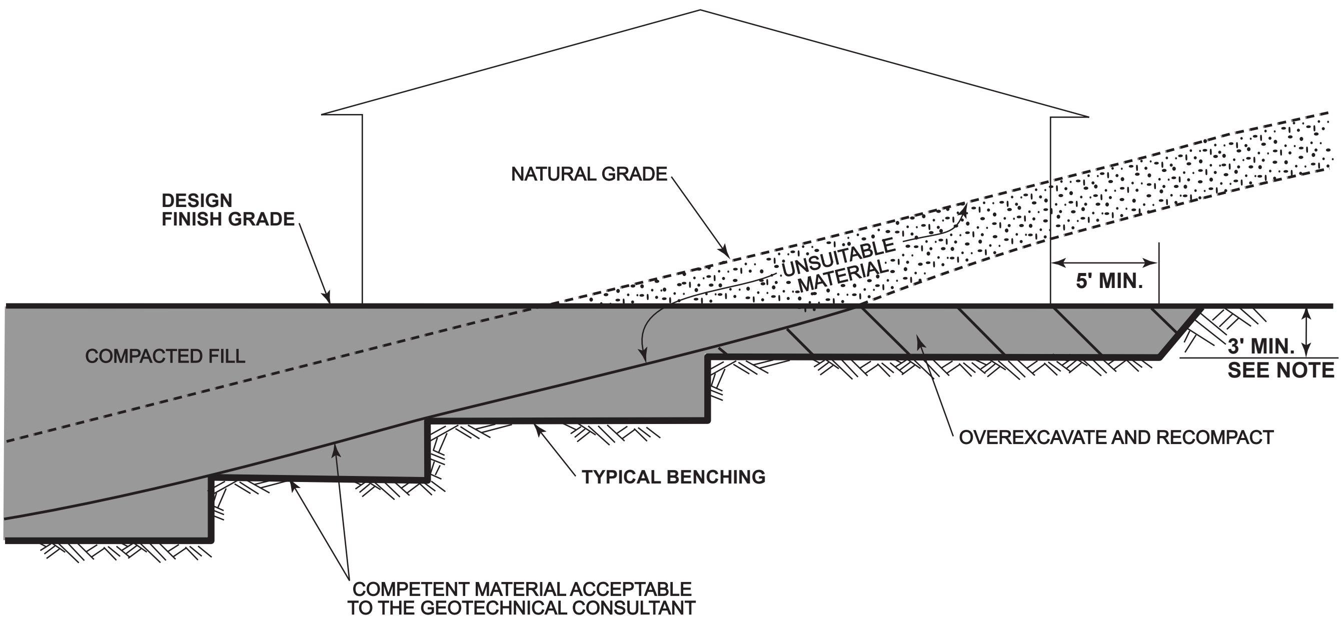
FIGURE 7

TYPICAL OVERSIZE ROCK PLACEMENT METHOD MINIMUM STANDARD GRADING DETAIL FOR STRUCTURAL FILL

CUT LOT



CUT FILL LOT (TRANSITION)



NOTE: DEEPER THAN THE 3-FOOT OVEREXCAVATION MAY BE RECOMMENDED BY THE GEOTECHNICAL CONSULTANT IN STEEP TRANSITIONS.

FIGURE 8

TYPICAL OVEREXCAVATION OF DAYLIGHT LINE
MINIMUM STANDARD GRADING DETAILS

APPENDIX C

FEMA MAPS

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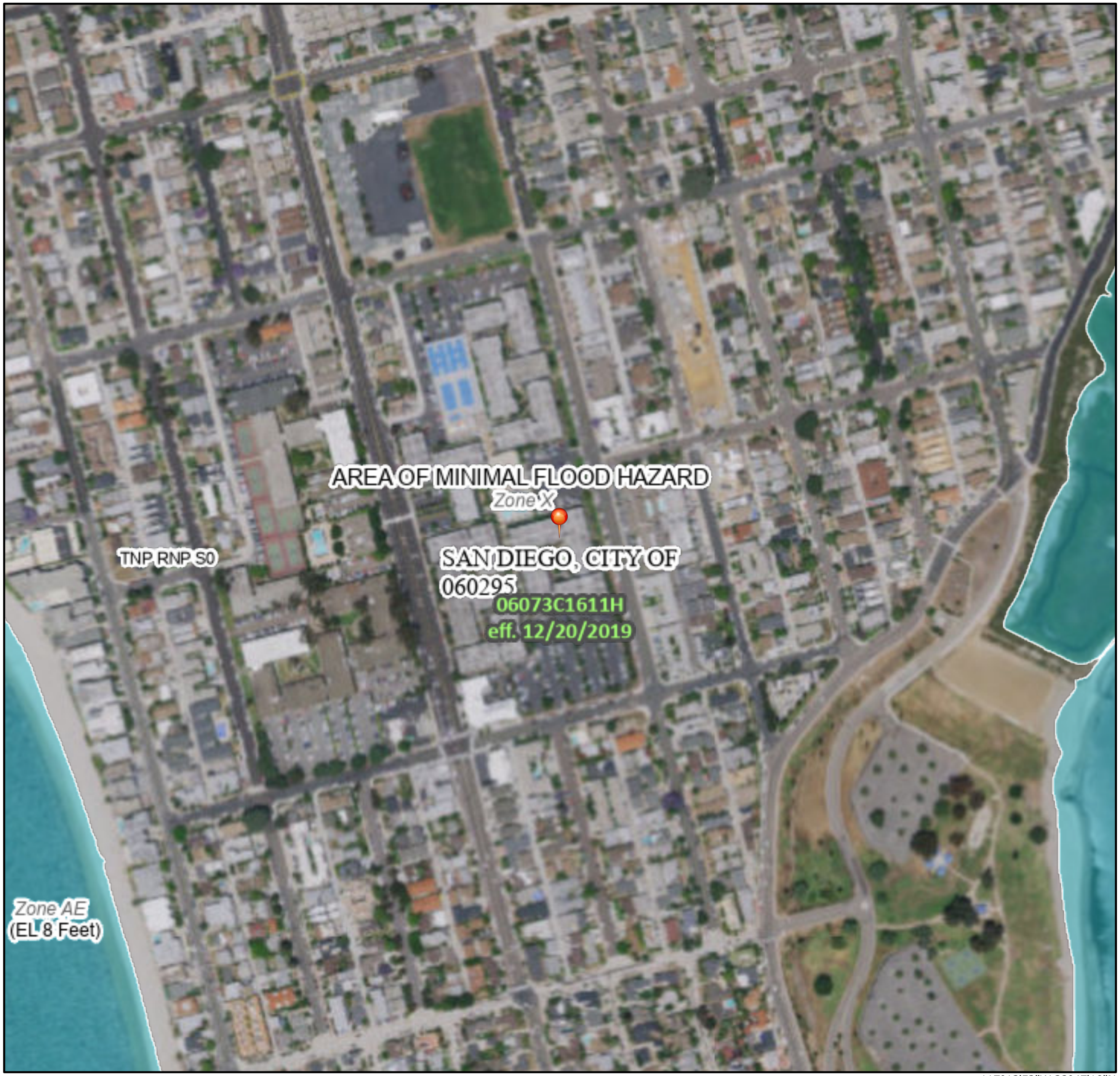
National Flood Hazard Layer FIRMette

FEMA

117°14'30"W 32°47'41"N



117°13'53"W 32°47'10"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/17/2022 at 4:10 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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