Appendix J

Priority Development Project –
Stormwater Quality Management Plan

City of Poway

Priority Development Project – Stormwater Quality Management Plan

Harmon Oaks

SP 22-0001, TTM 22-0001 & DR 22-0003

Oak Knoll Road, in between
Pomerado Road and Carriage Road
City of Poway, CA 92064
APN: 317-501-01-00, 317-500-02, 03,09,10,11,12,13,14

ENGINEER OF WORK:

____
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DATE OF SWQMP:
6/29/2022
REVISED:
09/05/2023

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Acronyms

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan
WMAA	Watershed Management Area Analysis
WQIP	Water Quality Improvement Plan

PDP SWQMP Preparer's Certification Page

Project Name: Harmon Oaks
Project/Permit Number: SP 22-0001, TTM 22-0001 & DR 22-0003

PREPARER'S CERTIFICATION

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Poway BMP Design Manual, which is a design manual for compliance with the City of Poway Municipal Code Sections 16.100 through 16.105 and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100) requirements for storm water management.

I have read and understand that the City of Poway has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by City staff is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

Alisa S. Vialpando, RCE #47945, 12/31/2023
Engineer of Work's Signature, PE Number & Expiration Date

Alisa S. Vialpando
Print Name

Hunsaker & Associates SD
Company

09/05/2023
Date

Engineer's Seal:

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
C 47945
CIVIL
STATE OF CALIFORNIA

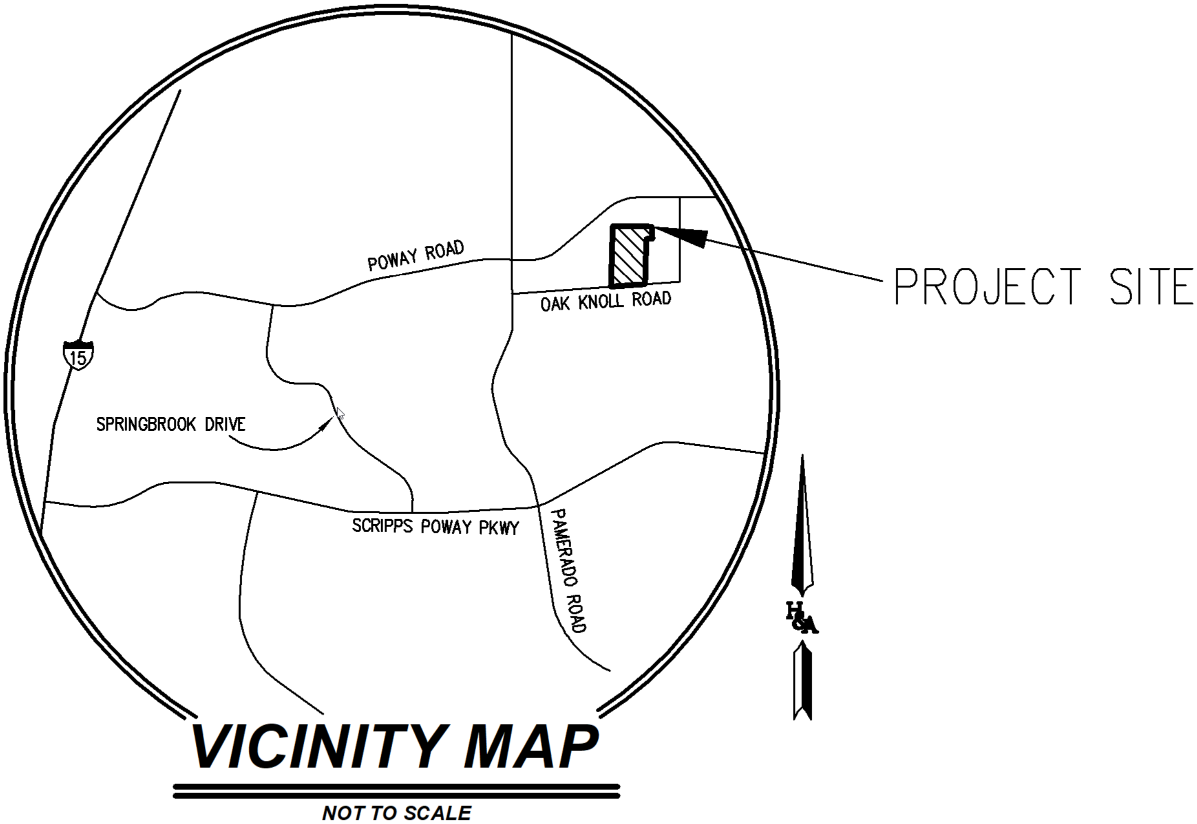
Submittal Record

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project.

Submittal Number	Date	Summary of Changes
1	6/29/2022	Initial Submittal
2	11/30/2022	City comments addressed
3	09/05/2023	Final Submittal
4		

Project Vicinity Map

Project Name: Harmon Oaks
Project ID: SP 22-0001, TTM 22-0001 & DR 22-0003



Step 1: Stormwater Intake Form

City of Poway
Storm Water Intake Form for All Permit Applications

Preparation Date:
09/05/2023

This form must be completed in its entirety and accompany applications for any of the discretionary or ministerial permits and approvals referenced in Sections 16.100 through 16.105 of the City of Poway Municipal Code (PMC). The purpose of this form is to establish the Stormwater Quality Management Plan (SWQMP) requirements applicable to the project.

Step 1: Project Identification

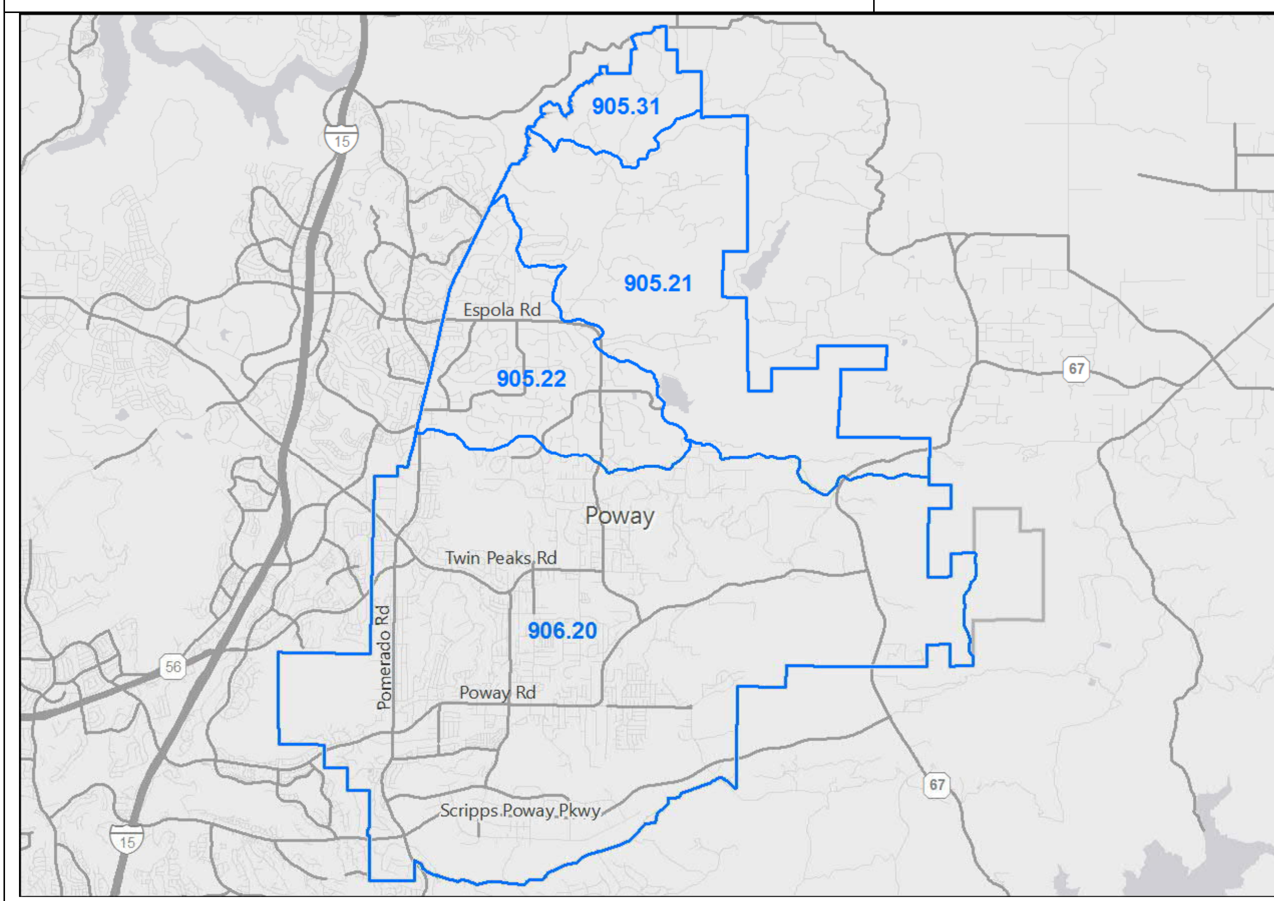
Applicant name:	APN(s):	Project/Permit Number:
Harmon Oaks	**317-501-01-00, 317-500-02, 03,09,10,11,12,13,14**	**SP 22-0001, TTM 22-0001 & DR 22-0003**

Project Address:

One portion North of Oak Knoll Road and one South, in between Pomerado Road and Carriage Road

Step 2: Geographic location

Step	Answer
What hydrologic unit is the project in? Use the map below to approximate the location.	☐905.31 ☐905.21 ☐905.22 ☑906.20



Show with an "X" the Approximate Project Location. A more detailed map is available online at http://poway.org/784/Online-Maps under the PowGIS link.

Step 3: Project type determination (Standard or Priority Development Project)

Is the project part of another Priority Development Project (PDP)? If so, a **PDP SWQMP** is required. Go to Step 4.	☐Yes ☑ No
The project is (select one):	☑ New Development ☐ Redevelopment[1]
The total proposed newly created or replaced impervious area is:	237,485 ft²
The total existing (pre-project) impervious area is:	11,488 ft²
The total area disturbed by the project is (including contractor lay-down areas, landscape areas, and septic fields):	370,076 ft²

If the total area disturbed by the project is 1 acre (43,560 sq. ft.) or more OR the project is part of a larger common plan of development (e.g., a building permit within a previously approved subdivision) disturbing 1 acre or more, a Waste Discharger Identification (WDID) number must be obtained from the State Water Resources Control Board.
WDID: ___________________________

Is the project in any of the following categories, (a) through (f)?[2]

Yes ☑	No ☐	(a)	New development projects that create 10,000 square feet or more of impervious surfaces[3] (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes	No ☑	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ☑	No ☐	(c)	New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

[1] Redevelopment is defined as: The creation, addition, and or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure. Replacement of impervious surfaces includes any activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include routine maintenance activities, such as trenching and resurfacing associated with utility work; pavement grinding; resurfacing existing roadways, sidewalks, pedestrian ramps, or bike lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair.
[2] Applicants should note that any development project that will create and/or replace 10,000 square feet or more of impervious surface (collectively over the entire project site) is considered a new development.
[3] For solar energy projects, the area of the solar panels does not count toward the total impervious area of the site.

Project Type Determination (continued)			
Yes ☑ ☑ ☐	No ☐ ☐ ☑	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and (i) Discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or (ii) Conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).
Yes ☐	No ☑	(e)	New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
Yes ☑	No ☐	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.

Does the project meet the definition of one or more of the Priority Development Project categories (a) through (f) listed above?

☐No – the project is not a Priority Development Project (Standard Project).

☑Yes – the project is a Priority Development Project (PDP).

Further guidance may be found in Chapter 1 and Table 1-2 of the BMP Design Manual.

The following is for **redevelopment PDPs only**:

The area of existing (pre-project) impervious area at the project site is: ______________ ft^2 (A)

The total proposed newly created or replaced impervious area is: ______________ ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: ______________ %

The percent impervious surface created or replaced is (select one based on the above calculation):

☐less than or equal to fifty percent (50%) – **only newly created or replaced impervious areas are considered a PDP and subject to stormwater requirements.**

OR

☒greater than fifty percent (50%) – **the entire project site is considered a PDP and subject stormwater requirements.**

Step 4: Storm Water Quality Management Plan requirements

Step	Answer	Progression
Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? To answer this item, complete the Project Type Determination Checklist on Pages 2 and 3 of this form, and see PDP exemption information below. For further guidance, see Section 1.4 of the BMP Design Manual *in its entirety*.	☐Standard Project	Standard Project requirements apply, including Standard Project SWQMP. **Complete Standard Project SWQMP.**
	☑PDP	Standard and PDP requirements apply, including PDP SWQMP. **Complete PDP SWQMP.**
	☐PDP Exemption	**Go to Step 5 below.**

Step 5: Exemption to PDP Definitions

Is the project exempt from PDP definitions based on either of the following: ☐ Projects that are only new or retrofit paved sidewalks, bicycle lanes, or trails that meet the following criteria: (i) Designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas; OR (ii) Designed and constructed to be hydraulically disconnected from paved streets or roads [i.e., runoff from the new improvement does not drain directly onto paved streets or roads]; OR (iii) Designed and constructed with permeable pavements or surfaces in accordance with County of San Diego Guidance on Green Infrastructure;	If so: Standard Project requirements apply, AND any additional requirements specific to the type of project. City concurrence with the exemption is required. *Provide discussion and list any additional requirements below in this form.* **Complete Standard Project SWQMP.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:	

Step 6: Certification

Applicant Certification: I have read and understand that the City of Poway has adopted minimum requirements for managing urban runoff, including storm water, from construction and land development activities, as described in the BMP Design Manual. I certify that this intake form has been completed to the best of my ability and accurately reflects the project being proposed. I also understand that non-compliance with the City's PMC may result in Code Enforcement action by the City.

Signature of Applicant:	*Date:*
	11/30/2022

For City Only:
☐ Standard SWQMP
☐ PDP SWQMP

Step 2: Site Information Checklist – Form I-3B

Site Information Checklist	Form I-3B (PDPs)
Project Summary Information	
Project Name	Harmon Oaks
Project Address	Oak Knoll Road, in between Pomerado Road and Carriage Road
Assessor's Parcel Number(s)	317-501-01-00, 317-500-02, 03,09,10,11,12,13,14
Project/Permit Number	SP 22-0001, TTM 22-0001 & DR 22-0003
Project Watershed (Hydrologic Unit)	Select One: ☐ San Dieguito 905 ☑ Penasquitos 906
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	__11.51__ Acres (__501,372__ Square Feet)
Area to be disturbed by the project (Project Area)	__8.50__ Acres (__370,076__ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	__5.45__ Acres (__237,485__ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	__3.04__ Acres (__132,591__ Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form I-3B Page 2 of 9
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☑Existing development ☐ Previously graded but not built out ☑Agricultural or other non-impervious use ☑Vacant, undeveloped/natural Description / Additional Information:
Existing Land Cover Includes (select all that apply): ☑ Vegetative Cover ☑ Non-Vegetated Pervious Areas ☑ Impervious Areas Description / Additional Information:
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☑ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☑ NRCS Type D
Approximate Depth to Groundwater: ☐ Groundwater Depth < 5 feet ☑ 5 feet < Groundwater Depth < 10 feet ☐ 10 feet < Groundwater Depth < 20 feet ☐ Groundwater Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☑Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information: The northern portion discharges indirectly into Poway Creek and the southern portion discharges directly

Form I-3B Page 3 of 9
Description of Existing Site Topography and Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? If so, describe]: The existing drainage conveyance is divided in two main areas, one north of Oak Knoll Road and the other one south. For the northern side, the conveyance is urban and for the southern side is natural. For the northern side, runoff sheet flows on a SW direction where a portion of it is caught by a catch basin and headwall on the property located immediately west of the project boundary and the other portion is caught by curb inlets on Oak Knoll Road. Both flows convey via storm drain and comingle downstream where it finally discharges into Poway Creek.

Form I-3B Page 4 of 9
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities: The project ultimately consist of a single family residential development of 64units (60 dwellings North of Oak Knoll Road and 4 more South), with associated sidewalks, parking areas and associated roads.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): Impervious features include 64 single family homes, sidewalks, parking areas and associated roads.
List/describe proposed pervious features of the project (e.g., landscape areas): Pervious features include landscape areas and slopes.
Does the project include grading and changes to site topography? ☑ Yes ☐ No Description / Additional Information:
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? ☑ Yes ☐ No Description / Additional Information: The project proposes a new storm drain system comingling with the existing storm drain located on Oak Knoll Road

Form I-3B Page 5 of 9
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply): ☑Onsite storm drain inlets ☐ Interior floor drains and elevator shaft sump pumps ☐ Interior parking garages ☑Need for future indoor & structural pest control ☑Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, and other water features ☐ Food service ☐ Refuse areas ☐ Industrial processes ☐ Outdoor storage of equipment or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☐ Loading docks ☑Fire sprinkler test water ☐ Miscellaneous drain or wash water ☑Plazas, sidewalks, and parking lots

Identification of Receiving Water Pollutants of Concern

Describe path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):

Runoff north of Oak Knoll Road will be captured onsite and pumped out to the existing storm drain system located on Oak Knoll Road where it will comingle with the flows from the south area, collected by an existing sump inlet on Oak Knoll Road, then discharging into Poway Creek. Poway Creek connects with Los Penasquitos Creek, then with Los Penasquitos Lagoon and finally discharges into the pacific ocean.

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs/WQIP Highest Priority Pollutant
Poway Creek	Selenium, Nitrogen, Toxicity	N/A
Los Penasquitos Creek	Total Dissolved Solids, Phosphate, Toxicity, Indicator Bacteria, Nitrogen, Benthic Community Effects, Chlorpyrifos, Bifenthrin	N/A
Los Penasquitos Lagoon	Sedimentation/Siltation, Toxicity	Sedimentation/Siltation
Pacific Ocean Shoreline, Miramar Reservoir HA, Los Penasquitos River mouth	Indicator Bacteria	Indicator Bacteria

Identification of Project Site Pollutants

Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see manual Appendix Table B.6-1):

Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Receiving Water Pollutant of Concern	Primary or Secondary Pollutant of Concern
Sediment		X	X	X
Nutrients		X	X	X
Heavy Metals	X		X	
Organic Compounds	X		X	
Trash & Debris		X		
Oxygen Demanding Substances		X		

Oil & Grease		X		
Bacteria & Viruses		X	X	X
Pesticides		X		
Identify whether each pollutant listed is Not Applicable to the Project Site, Anticipated from the Project Site, and/or a Receiving Water Pollutant of Concern with an X or ✓. Identify Primary or Secondary in the last column with a P or S unless Not Applicable to the Project Site has been selected.				

Form I-3B Page 7 of 9
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the manual)? ☑Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above):
Critical Coarse Sediment Yield Areas* *This Section only required if hydromodification management requirements apply
Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries? ☐ Yes ☑No, no critical coarse sediment yield areas to be protected based on WMAA maps If yes, have any of the optional analyses presented in Section 6.2 of the manual been performed? ☐ 6.2.1 Verification of GLUs Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite ☐ No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps If optional analyses were performed, what is the final result? ☐ No critical coarse sediment yield areas to be protected based on verification of GLUs onsite. ☐ Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 8 of the SWQMP. ☐ Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit. Discussion / Additional Information:

Form I-3B Page 8 of 9
Flow Control for Post-Project Runoff* *This Section only required if hydromodification management requirements apply
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit. One POC is proposed downstream on Poway Creek at the discharge of the existing storm drain system.
Has a geomorphic assessment been performed for the receiving channel(s)? ☑No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: Discussion / Additional Information: (optional)

Form I-3B Page 9 of 9
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

Step 3: Source Control BMP Checklist – Form I-4

Source Control BMP Checklist for All Development Projects			Form I-4
Project Identification			
Project Name: Harmon Oaks			
Project/Permit Number: SP 22-0001, TTM 22-0001 & DR 22-0003			
Source Control BMPs			
All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.			
Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☑Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☑Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑N/A
Discussion / justification if SC-3 not implemented:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑N/A
Discussion / justification if SC-4 not implemented:			

Form I-4 Page 2 of 2			
Source Control Requirement	Applied?		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☑ N/A
Discussion / justification if SC-5 not implemented:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
☐ Onsite storm drain inlets	☑ Yes	☐ No	☐ N/A
☐ Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☑ N/A
☐ Interior parking garages	☐ Yes	☐ No	☑ N/A
☐ Need for future indoor & structural pest control	☐ Yes	☐ No	☑ N/A
☐ Landscape/outdoor pesticide use	☑ Yes	☐ No	☐ N/A
☐ Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	☑ N/A
☐ Food service	☐ Yes	☐ No	☑ N/A
☐ Refuse areas	☐ Yes	☐ No	☑ N/A
☐ Industrial processes	☐ Yes	☐ No	☑ N/A
☐ Outdoor storage of equipment or materials	☐ Yes	☐ No	☑ N/A
☐ Vehicle and equipment cleaning	☐ Yes	☐ No	☑ N/A
☐ Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☑ N/A
☐ Fuel dispensing areas	☐ Yes	☐ No	☑ N/A
☐ Loading docks	☐ Yes	☐ No	☑ N/A
☐ Fire sprinkler test water	☑ Yes	☐ No	☐ N/A
☐ Miscellaneous drain or wash water	✓ Yes	☐ No	☐ N/A
☐ Plazas, sidewalks, and parking lots	☑ Yes	☐ No	☐ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for <u>all</u> "No" answers shown above.			

Step 4: Site Design BMP Checklist – Form I-5

Site Design BMP Checklist for All Development Projects				Form I-5
Project Identification				
Project Name: Harmon Oaks				
Project/Permit Number: SP 22-0001, TTM 22-0001 & DR 22-0003				
Site Design BMPs				
All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.				
Site Design Requirement	Applied?			
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☑Yes	☐ No	☐ N/A	
Discussion / justification if SD-1 not implemented:				
SD-2 Conserve Natural Areas, Soils, and Vegetation	☑Yes	☐ No	☐ N/A	
Discussion / justification if SD-2 not implemented:				
SD-3 Minimize Impervious Area	☑Yes	☐ No	☐ N/A	
Discussion / justification if SD-3 not implemented:				
SD-4 Minimize Soil Compaction	☑Yes	☐ No	☐ N/A	
Discussion / justification if SD-4 not implemented:				

Form I-5 Page 2 of 2			
Site Design Requirement	Applied?		
SD-5 Impervious Area Dispersion	☑Yes	☐ No	N/A
Discussion / justification if SD-5 not implemented:			
SD-6 Runoff Collection	☑Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented:			
SD-7 Landscaping with Native or Drought Tolerant Species	☑Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☑N/A
Discussion / justification if SD-8 not implemented:			

Step 5: Summary of PDP Structural BMPs – Form I-6

Summary of PDP Structural BMPs	Form I-6 (PDPs)
Project Identification	
Project Name: Harmon Oaks	
Project/Permit Number: SP 22-0001, TTM 22-0001 & DR 22-0003	
PDP Structural BMPs	
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the manual). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).	
Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate. The selection, sizing, and design of stormwater treatment and other source control and site design BMPS measures in this plan were done based on the City of Poway BMP Design Manual and the requirements of the MS4 permit (San Diego Regional Water Quality Control Board) Order No. R9-2013-0001. (Continue on page 2 as necessary.)	

Form I-6 Page 2 of 13
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)

(Continued from page 1)

Step 1. A- DMA 12, 13 and14 are identified as a self mitigating areas. These DMAs are natural, landscaped or turf area that does not generate significant pollutants and drains directly offsite or to the public storm drain system without being treated by a structural BMP and meet all requirements in section 5.2.1.

Step 1.B- Eleven DMAs have been delineated (DMA1-DMA11), and area break down for each DMA based on surface type was provide. Area weighted runoff factor for each DMA was calculated using Table 1.1 from Appendix B.1.1, and Appendix B.2.1. 85th percentile 24-hr storm depth from Figure B.1-1 has been determined to be 0.62 inch. DCV for each DMA was calculated using Worksheet B.2.1 and following Section 5.3.

Step 2. Harvest and use feasibility screening was provided using Havest and Use feasibility Checklist (Worksheet B.3.1 and following Section 5.4.1)

Harvest and Use deemed infeasible as the 36 hour demand is less than 0.25 of the total DCV (please refer to Worksheet B.3 in Attachment 1a).

Step 3. Infiltration feasibility analysis was prepared by a geotechnical Engineer (please refer to Form I-8 infiltration feasibility Screening prepared by Geocon), and full or partial infiltration deemed to be infeasible, because 1) per the Geotechnical Investigation, dated June 15, 2022 for storm water evaluation prepared by Geocon. Based on results of permeability testing, the unfactored infiltration rate was measured to be 0.07 inches/hour using a constant head borehole permeameter. If applying a feasibility factor of safety of 2.0, the infiltration rate would be 0.036 iph, which is less than the commonly used threshold value of 0.05 iph for partial infiltration. The USDA NRCS web soil survey website indicates the majority of the underlying soils belong to Placentia sandy loam (PfC) which is identified as Hydrologic Soil Group D, which is not conducive to infiltration BMP's. Information collected from the USDA website is attached. The downhole permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity is equal to the unfactored infiltration rate., 2)the potential for lateral water migration to adversely impact existing and proposed utilities, adversely impact proposed foundations and improvements is high. Compacted fill will be placed across the property and result in fills greater than 5 feet thick. Infiltration BMP's founded in compacted fill should be avoided to prevent adverse shrinking/swelling of the expansive soils, and adverse hydro-consolidation of the granular fill soils which causes differential settlement. The underlying Terrace Deposits and Friars Formation consists of stiff to very stiff clay that will also not percolate into the ground and water would migrate laterally, and 3) the Groundwater is located within 10 feet from the proposed BMP's. Therefore, the risk of groundwater contamination increases if infiltration BMP's are used.

As a result of Step 2 and Step3, harvest and use , and full or partial infiltration were deemed to be infeasible. Therefore, biofiltration BMP category was implemented (section 5.5.3), and Proprietary biofiltration BMPs were chosen (Filterra units or equivalent) from the biofiltration category.

-The proposed proprietary biofiltration BMP meets the minimum design criteria listed in Appendix F, including the pollutant treatment performance standard in Appendix F.1;

-The proprietary biofiltration BMP was designed and will be maintained in a manner consistent with its performance certifications. Refer to the T.A.P.E. Certification in Attachment 1.a, and the maintenance information in Attachment3

-The proprietary biofiltration BMPs were sized as a flow based Biofiltration BMP following appendix F.2.2.

Form I-6 Page 2 of 13
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1) The following steps were followed to demonstrate that the system is sized to treat 1.5 times the DCV: 1. The flow rate required to meet the pollutant treatment performance standard without scaling for the 1.5 factor was calculated from 0.2 inch per hour uniform intensity precipitation event. 2. The calculated water quality flow rate from Step 1 was multiplied by 1.5 to compute the design flow rate for the biofiltration system. 3. Based on the conditions of certification/verification (discussed above), the design capacity, as a flow rate, of a given sized unit was established. 4. An appropriate unit size and number of units is provided to provide a flow rate that meets the required flow rate from Step 2 for each DMA. 5. site design BMPs (Impervious area dispersion) was provided to meet minimum retention requirement in Appendix B. County of San Diego Automatic Worksheets (B.1, B.2, and B.3) were provided to verify that the provided dispersion areas meet minimum retention requirements. A total of 11 Filterra units (BF-3-1 to 11) were sized to address the water quality requirements for all of the Harmon Oaks development. Every Filterra unit was sized utilizing worksheet "B.6-1 for a flow based proprietary biofiltration BMP" to treat 1.5 times the calculated flow rate (0.2 in/hr rainfall intensity). The refer to Attachment 1a. For hydromodification flow control, an underground vault is proposed to mitigate the flow that is generated by the DMA-1 to DMA-10 (North of Oak Knoll Road Site). The flows generated by DMA-1 to DMA-10 (North of Oak Knoll Road Site) will be intercepted by Filterra units where the flows will be treated to address water quality requirements, then routed to the underground vault (HMP-1) to address hydromodification requirements and then conveyed via a storm drain to the existing 36" storm drain on Oak Knoll Road. The flows generated by DMA-11 will be intercepted by a Filterra unit located on Oak Knoll Road where the flows will be treated to address water quality requirements and then will commingle with the flows generated from DMA-1 to DMA-10 at the existing 36" storm drain on Oak Knoll Road. All flows will be conveyed via the existing storm drain network to POC-1, located at the downstream end of the existing 8'x5' box culvert discharging into Poway Creek. DMA 11 is routed directly to the poc, and the proposed vault will over-detain the flows from the other DMAs, so the project meets HMP requirement when measured at the POC. SWMM models for post and pre development were prepared and provided to verify that the proposed underground vault and outlet structure will meet HMP requirements. The existing soil on the site is classified as hydrologic soil group A and D. Harvest and use is considered infeasible for the entire project based on Form I-7.

management requirements apply.

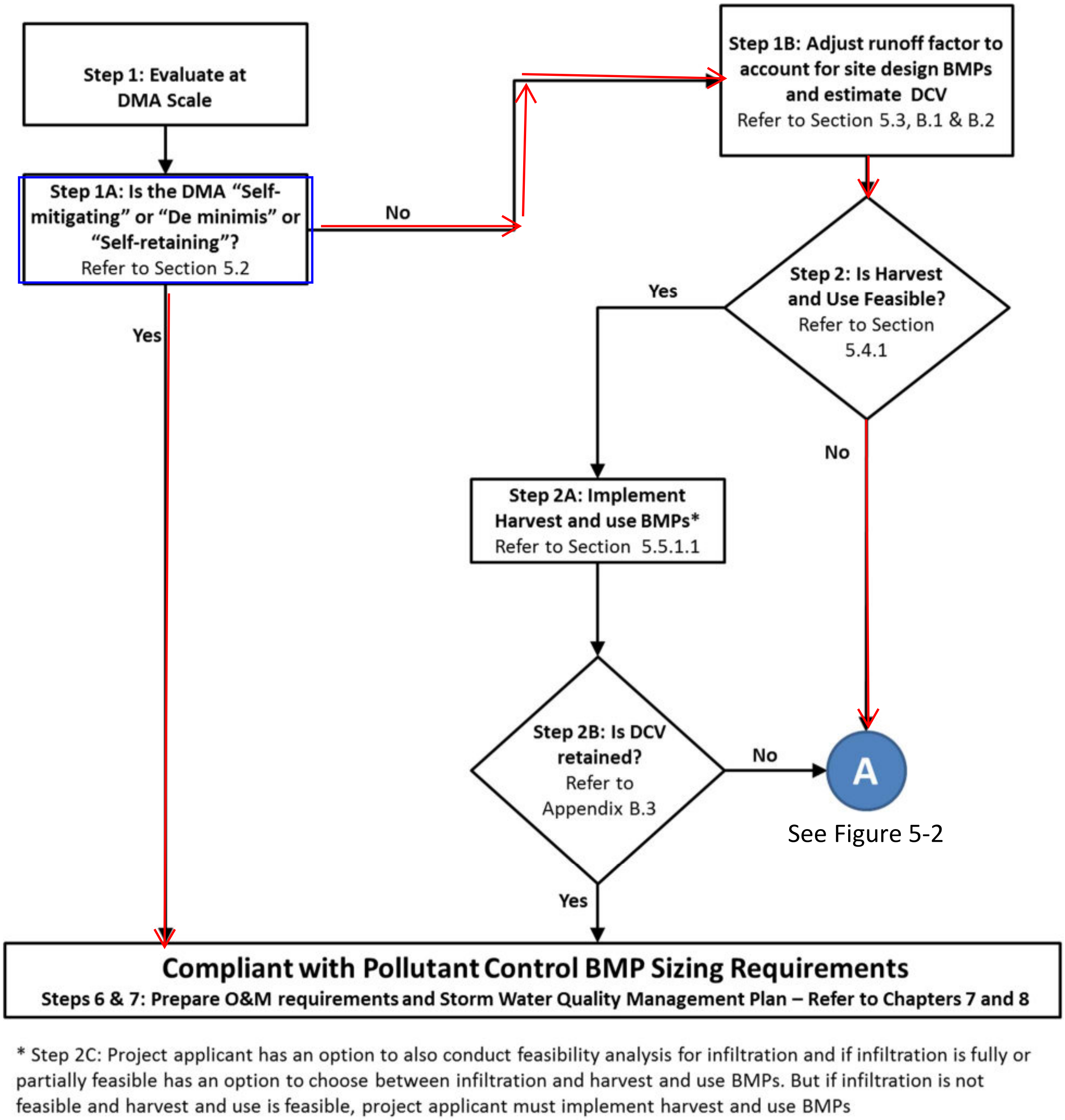


FIGURE 5-1. Storm Water Pollutant Control BMP Selection Flow Chart

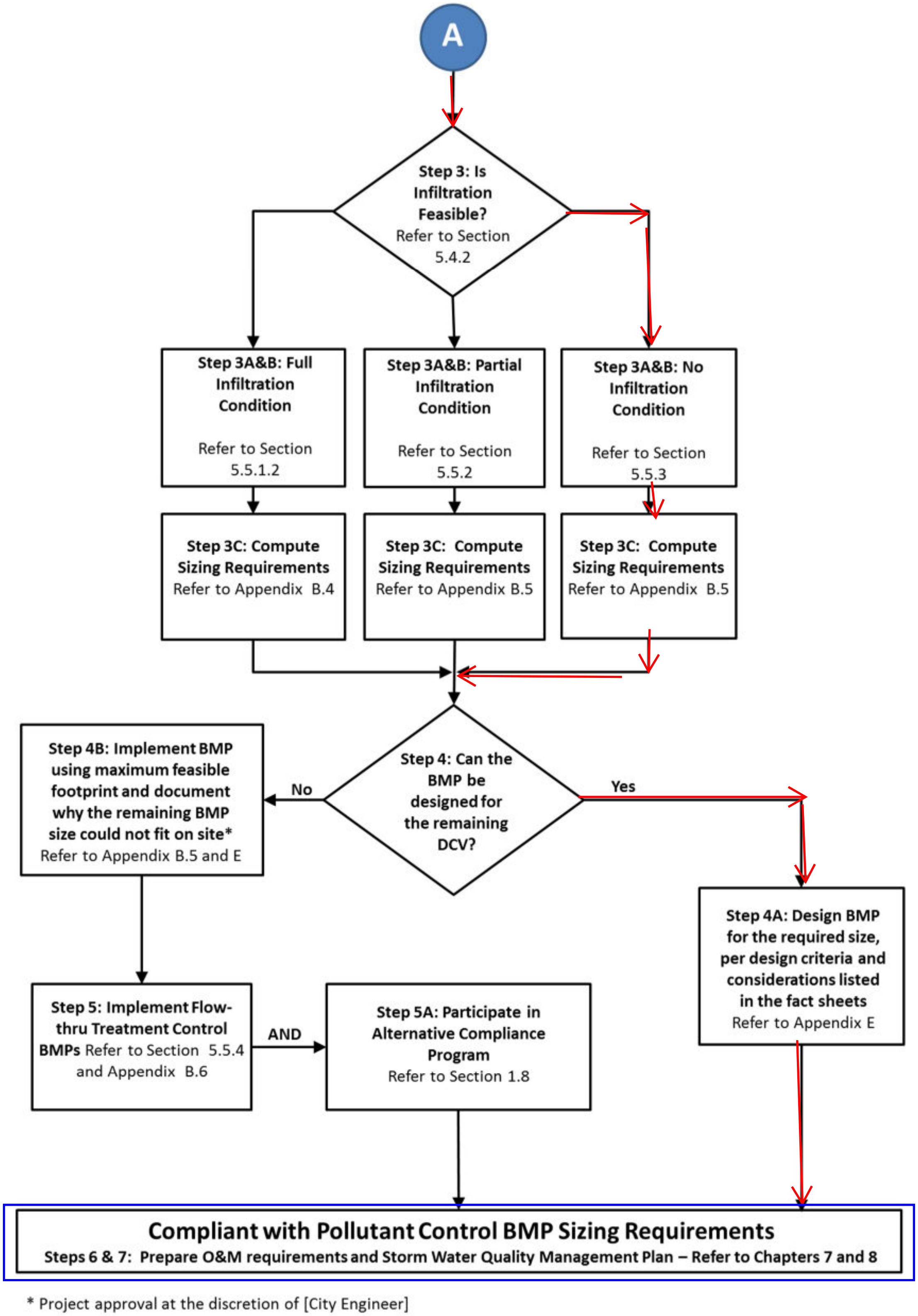


FIGURE 5-2. Storm Water Pollutant Control BMP Selection Flow Chart

Form I-6 Page 3 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-1	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration ~~(BF-1)~~ (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 4 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-2	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 5 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-3	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 6 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-4	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 7 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-5	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-6	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 9 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-7	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 10 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-8	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 11 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-9	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 12 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-10	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 12 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BF-3-11	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☑Biofiltration (BF-1) (BF-3) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☑Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

Form I-6 Page 13 of 13 (Copy as many as needed)	
Structural BMP Summary Information (Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. HMP-1	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☑ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☑ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the manual)	Lennar Homes of California, Inc. 16465 Via Esprillo, Ste. 150 San Diego, CA 92127 (858) 618-4942
Who will be the final owner of this BMP?	Lennar Homes of California, Inc.
Who will maintain this BMP into perpetuity?	Lennar Homes of California, Inc.
What is the funding mechanism for maintenance?	HOA
Discussion (as needed):	

ATTACHMENT 1 – BACKUP FOR PDP POLLUTANT CONTROL BMPs

This is the cover sheet for Attachment 1.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 1a	Storm Water Pollutant Control Worksheet Calculations Worksheet B.1-1 (Required) Worksheet B.3-1 (Required) Worksheet B.4-1 (if applicable) Worksheet B.4-2 (if applicable) Worksheet B.5-1 (if applicable) Worksheet B.5-2 (if applicable) Worksheet B.5-3 (if applicable) Worksheet B.6-1 (if applicable) Summary Worksheet (optional)	☒ B.1-1 Included ☒ B.3-1 Included ☐ B.4-1 Included ☐ B.4-2 Included ☐ B.5-1 Included ☐ B.5-2 Included ☐ B.5-3 Included ☒ B.6-1 Included ☒ Summary Worksheet Included
Attachment 1b	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	☒ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1c	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this Attachment cover sheet.	☒ Included

Attachment 1a

Harmon Oaks

DMA CALCULATIONS

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Tabular Summary of DMAs							Worksheet B-1		
DMA Unique Identifier	**Type of Surface**	**Area (square feet)**	**Impervious Area (square feet)**	**% Imp**	**Hydrologic** Soil Group	**Area Weighted Runoff Coefficient**	**Treated by (BMP ID)**	**Proposed Pollutant** Control Type	**Drains to (POC ID)**
DMA 1	ROOF	15490	15490	100%	D	0.90	BF-3-1	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	14661	14661	100%	D	0.90	BF-3-1	6x8 Filterra Unit	1
	SLOPE (D Soil)	10683	0	0%	D	0.30	BF-3-1	6x8 Filterra Unit	1
	LANDSCAPE	12260	0	0%	D	0.10	BF-3-1	6x8 Filterra Unit	1
DMA 2	ROOF	14837	14837	100%	D	0.90	BF-3-2	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	10802	10802	100%	D	0.90	BF-3-2	6x8 Filterra Unit	1
	LANDSCAPE	13136	0	0%	D	0.10	BF-3-2	6x8 Filterra Unit	1
DMA 3	ROOF	14209	14209	100%	D	0.90	BF-3-3	6x6 Filterra Unit	1
	CONCRETE/ASPHALT	10366	10366	100%	D	0.90	BF-3-3	6x6 Filterra Unit	1
	LANDSCAPE	9176	0	0%	D	0.10	BF-3-3	6x6 Filterra Unit	1
DMA 4	ROOF	8058	8058	100%	D	0.90	BF-3-4	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	8154	8154	100%	D	0.90	BF-3-4	6x8 Filterra Unit	1
	LANDSCAPE	6232	0	0%	D	0.10	BF-3-4	6x8 Filterra Unit	1
DMA 5	ROOF	13613	13613	100%	D	0.90	BF-3-5	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	9532	9532	100%	D	0.90	BF-3-5	6x8 Filterra Unit	1
	LANDSCAPE	11501	0	0%	D	0.10	BF-3-5	6x8 Filterra Unit	1
DMA 6	ROOF	1866	1866	100%	D	0.90	BF-3-6	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	7720	7720	100%	D	0.90	BF-3-6	6x8 Filterra Unit	1
	SLOPE (D Soil)	1797	0	0%	D	0.30	BF-3-6	6x8 Filterra Unit	1
	LANDSCAPE	5189	0	0%	D	0.10	BF-3-6	6x8 Filterra Unit	1
DMA 7	ROOF	14319	14319	100%	D	0.90	BF-3-7	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	7372	7372	100%	D	0.90	BF-3-7	6x8 Filterra Unit	1
	LANDSCAPE	10514	0	0%	D	0.10	BF-3-7	6x8 Filterra Unit	1
DMA 8	ROOF	7886	7886	100%	D	0.90	BF-3-8	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	15577	15577	100%	D	0.90	BF-3-8	6x8 Filterra Unit	1
	SLOPE (D Soil)	191	0	0%	D	0.30	BF-3-8	6x8 Filterra Unit	1
	LANDSCAPE	4799	0	0%	D	0.10	BF-3-8	6x8 Filterra Unit	1
DMA 9	ROOF	12477	12477	100%	D	0.90	BF-3-9	6x8 Filterra Unit	1
	CONCRETE/ASPHALT	11118	11118	100%	D	0.90	BF-3-9	6x8 Filterra Unit	1
	LANDSCAPE	18245	0	0%	D	0.10	BF-3-9	6x8 Filterra Unit	1
DMA 10	ROOF	13892	13892	100%	D	0.90	BF-3-10	4x8 Filterra Unit	1
	CONCRETE/ASPHALT	14127	14127	100%	D	0.90	BF-3-10	4x8 Filterra Unit	1
	LANDSCAPE	10794	0	0%	D	0.10	BF-3-10	4x8 Filterra Unit	1
DMA 11	ROOF	7946	7946	100%	D	0.90	BF-3-10	4x8 Filterra Unit	1
	CONCRETE/ASPHALT	3464	3464	100%	D	0.90	BF-3-10	4x8 Filterra Unit	1
	LANDSCAPE	9302	0	0%	D	0.10	BF-3-10	4x8 Filterra Unit	1
DMA 12	Natural (D Soil)	6953	0	0%	D	0.30	N/A	Self Mitigating Area	1
DMA 13	Natural (D Soil)	929	0	0%	D	0.30	N/A	Self Mitigating Area	1
DMA 14	Natural (D Soil)	891	0	0%	A	0.10	N/A	Self Mitigating Area	1
Total Disturbed Area =		370076	237485						

Summary of DMA Information (Must match Project description and SWQMP narrative)									
No. of DMAs	**Total DMA Area (acres)**	**Total Impervious Area (acres)**	**%** Impervious	**Area Weighted Runoff Coefficient**	**Design Intensity (in/hr)**	**Adjustment Factor**	**Safe Factor**	**Design Flow Rate (cfs)**	**Proposed Pollutant Control Type**
DMA 1	1.22	0.69	56.79%	0.59	0.20	0.983	1.5	0.216	6x10 Filterra Unit
DMA 2	0.89	0.59	66.12%	0.63	0.20	0.984	1.5	0.167	6x8 Filterra Unit
DMA 3	0.77	0.56	72.81%	0.68	0.20	0.984	1.5	0.157	6x8 Filterra Unit
DMA 4	0.52	0.37	72.23%	0.68	0.20	0.985	1.5	0.104	4x8 Filterra Unit
DMA 5	0.80	0.53	66.80%	0.63	0.20	0.984	1.5	0.150	6x8 Filterra Unit
DMA 6	0.38	0.22	57.85%	0.55	0.20	0.981	1.5	0.062	4x4 Filterra Unit
DMA 7	0.74	0.50	67.35%	0.64	0.20	0.984	1.5	0.141	6x6 Filterra Unit
DMA 8	0.65	0.54	82.46%	0.76	0.20	0.987	1.5	0.148	6x8 Filterra Unit
DMA 9	0.96	0.54	56.39%	0.55	0.20	0.988	1.5	0.158	6x8 Filterra Unit
DMA 10	0.89	0.64	72.19%	0.68	0.20	0.985	1.5	0.180	6x8 Filterra Unit
DMA 11	0.48	0.26	55.09%	0.54	0.20	0.981	1.5	0.076	4x6 Filterra Unit
DMA 12	0.16	0.00	0.00%	0.30	N/A	N/A	N/A	N/A	Self Mitigating Area
DMA 13	0.02	0.00	0.00%	0.30	N/A	N/A	N/A	N/A	Self Mitigating Area
DMA 14	0.02	0.00	0.00%	0.10	N/A	N/A	N/A	N/A	Self Mitigating Area
Σ =	8.50	5.45	64.17%	0.61					

Harmon Oaks
Worksheet B-2.1

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

	DMA 1: Design Capture Volume	Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	1.22	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.59	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,631	cubic-feet

	DMA2: Design Capture Volume	Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.89	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.63	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,260	cubic-feet

	DMA 3: Design Capture Volume	Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.77	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.63	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,097	cubic-feet

	DMA 4: Design Capture Volume	Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.52	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.68	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	786	cubic-feet

	DMA 5: Design Capture Volume	Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.80	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.63	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,136	cubic-feet

	DMA6: Design Capture Volume	Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.38	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.55	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	473	cubic-feet

Harmon Oaks
Worksheet B-2.1

DMA 7: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.74	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.64	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,063	cubic-feet

DMA 8: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.65	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.76	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,119	cubic-feet

DMA 9: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.96	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.55	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,191	cubic-feet

DMA 10: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.89	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.68	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	1,359	cubic-feet

DMA 11: Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.62	inches
2	Area tributary to BMP (s)	A=	0.48	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.54	unitless
4	Street trees volume reduction	TCV=	0.00	cubic-feet
5	Rain barrels volume reduction	RCV=	0.00	cubic-feet
6	Calculate DCV= (3630 x C x d x A) - TCV - RCV	DCV=	579	cubic-feet

<table>
<tr><th>Harvest and Use Feasibility Checklist</th><th>Worksheet B.3-1</th></tr>
<tr><td colspan="2">1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?
☒ Toilet and urinal flushing
☒ Landscape irrigation
☐ Other</td></tr>
<tr><td colspan="2">2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

36 hr toilet use per resident= 9.3 gal x 2.5 residents per unit x 63units x 1.5 days = 2197.1gallons = 293.7 cf
36 hour landscape use/acre = 390 gls/ac x 2.81 ac = 1,096 gals = 146.5 cf
Total anticipated 36 hr use = 444.9 cf

9.3 gal per resident from TABLE B.3.1 SECTION 3.2 BMP Manual</td></tr>
<tr><td colspan="2">3. Calculate the DCV using worksheet B-2.1.
DCV = <u>11,531</u> Cubic Feet 0.25 (11,531) = <u>2,883</u> Cubic Feet</td></tr>
</table>

<table>
<tr><td>3a. Is the 36 hour demand greater than or equal to the DCV?
☐ Yes / ☒ No ⇨
⇩</td><td>3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV?
☐ Yes / ☒ No ⇨
⇩</td><td>3c. Is the 36 hour demand less than 0.25DCV?
☒ Yes
⇩</td></tr>
<tr><td>Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.</td><td>Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.</td><td>Harvest and use is considered to be infeasible.</td></tr>
<tr><td colspan="3">The Harvest and Use calculations were performed for the residential DMA’s only.</td></tr>
</table>

Harmon Oaks
Worksheet B-6.1

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Flow-thru Design Flows (BF-3-1)		Worksheet B.6-1		
1	DCV	DCV	1631	cubic-feet
2	DCV retained	$DCV_{retained}$	27	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1604	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.983	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	1.22	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.59	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.144	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.216	cfs

Flow-thru Design Flows (BF-3-2)		Worksheet B.6-1		
1	DCV	DCV	1260	cubic-feet
2	DCV retained	$DCV_{retained}$	20	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1240	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.984	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.89	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.63	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.111	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.167	cfs

Flow-thru Design Flows (BF-3-3)		Worksheet B.6-1		
1	DCV	DCV	1097	cubic-feet
2	DCV retained	$DCV_{retained}$	18	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1079	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.984	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.77	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.68	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.105	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.157	cfs

Harmon Oaks
Worksheet B-6.1

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Flow-thru Design Flows (BF-3-4)			Worksheet B.6-1	
1	DCV	DCV	786	cubic-feet
2	DCV retained	$DCV_{retained}$	12	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	774	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.985	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.52	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.68	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.069	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.104	cfs

Flow-thru Design Flows (BF-3-5)			Worksheet B.6-1	
1	DCV	DCV	1136	cubic-feet
2	DCV retained	$DCV_{retained}$	18	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1118	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.984	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.80	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.63	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.100	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.150	cfs

Flow-thru Design Flows (BF-3-6)			Worksheet B.6-1	
1	DCV	DCV	473	cubic-feet
2	DCV retained	$DCV_{retained}$	9	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	463.6	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.981	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.38	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.55	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.042	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.062	cfs

Harmon Oaks
Worksheet B-6.1

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

	Flow-thru Design Flows (BF-3-7)	Worksheet B.6-1		
1	DCV	DCV	1063	cubic-feet
2	DCV retained	$DCV_{retained}$	17	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1046	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.984	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.74	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.64	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.094	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.141	cfs

	Flow-thru Design Flows (BF-3-8)	Worksheet B.6-1		
1	DCV	DCV	1119	cubic-feet
2	DCV retained	$DCV_{retained}$	14	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1105	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.987	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.65	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.76	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.099	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.148	cfs

	Flow-thru Design Flows (BF-3-9)	Worksheet B.6-1		
1	DCV	DCV	1191	cubic-feet
2	DCV retained	$DCV_{retained}$	14	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-thru}$	1177	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.988	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.96	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.55	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.105	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.158	cfs

Harmon Oaks
Worksheet B-6.1

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Flow-thru Design Flows (BF-3-10)		Worksheet B.6-1		
1	DCV	DCV	1359	cubic-feet
2	DCV retained	$DCV_{retained}$	20	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV^{flow-thru}$	1339	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.985	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.89	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.68	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.119	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.178	cfs

Flow-thru Design Flows (BF-3-11)		Worksheet B.6-1		
1	DCV	DCV	579	cubic-feet
2	DCV retained	$DCV_{retained}$	11	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV^{flow-thru}$	567.6	cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=	0.981	unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=	0.48	acres
8	Area-weighted runoff factor (estimate using Appx B.2)	C=	0.54	unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=	0.050	cfs
10	Design Flow Rate (Appx F.2.2, BMP Manual) = 1.5Q	Q=	0.076	cfs

Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA 1	DMA 2	DMA 3	DMA 4	DMA 5	DMA 6	DMA 7	DMA 8	DMA 9	DMA 10	unitless
	2	85th Percentile 24-hr Storm Depth	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	29,831	25,418	24,355	16,102	22,925	9,486	21,471	23,313	23,335	27,819	sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)	12,100	13,026	9,066	6,177	11,391	5,139	10,404	4,724	18,115	10,694	sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	10,683					1,797		191			sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	11	Impervious Surfaces Directed to Dispersion Area per SD-B (Ci=0.90)	320	220	220	110	220	100	220	150	260	200	sq-ft
	12	Semi-Pervious Surfaces Serving as Dispersion Area per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces Serving as Dispersion Area per SD-B (Ci=0.10)	160	110	110	55	110	50	110	75	130	100	sq-ft
	14	Natural Type A Soil Serving as Dispersion Area per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil Serving as Dispersion Area per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil Serving as Dispersion Area per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil Serving as Dispersion Area per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	53,094	38,775	33,751	22,444	34,646	16,572	32,205	28,453	41,839	38,813	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.59	0.63	0.68	0.68	0.63	0.58	0.64	0.76	0.55	0.68	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	unitless
	25	Initial Weighted Runoff Factor	0.59	0.63	0.68	0.68	0.63	0.58	0.64	0.76	0.55	0.68	unitless
	26	Initial Design Capture Volume	1,618	1,262	1,186	789	1,128	497	1,065	1,117	1,189	1,364	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	320	220	220	110	220	100	220	150	260	200	sq-ft
	28	Total Pervious Dispersion Area	160	110	110	55	110	50	110	75	130	100	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.58	0.62	0.67	0.67	0.62	0.57	0.63	0.75	0.54	0.67	unitless
	32	Design Capture Volume After Dispersion Techniques	1,591	1,242	1,168	777	1,110	488	1,048	1,103	1,167	1,344	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.58	0.62	0.67	0.67	0.62	0.57	0.63	0.75	0.54	0.67	unitless
	36	Final Effective Tributary Area	30,795	24,041	22,613	15,037	21,481	9,446	20,289	21,340	22,593	26,005	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	27	20	18	12	18	9	17	14	22	20	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	1,591	1,242	1,168	777	1,110	488	1,048	1,103	1,167	1,344	cubic-feet

No Warning Messages

Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA 11										unitless
	2	85th Percentile 24-hr Storm Depth	0.62										inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	11,260										sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)	9,227										sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	Yes										yes/no
	11	Impervious Surfaces Directed to Dispersion Area per SD-B (Ci=0.90)	150										sq-ft
	12	Semi-Pervious Surfaces Serving as Dispersion Area per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces Serving as Dispersion Area per SD-B (Ci=0.10)	75										sq-ft
	14	Natural Type A Soil Serving as Dispersion Area per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil Serving as Dispersion Area per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil Serving as Dispersion Area per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil Serving as Dispersion Area per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	20,712	0	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	578	0	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	150	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	75	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	2.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.53	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	567	0	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	10,977	0	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	11	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	567	0	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

Automated Worksheet B.2: Retention Requirements (V2.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Basic Analysis	1	Drainage Basin ID or Name	DMA 1	DMA 2	DMA 3	DMA 4	DMA 5	DMA 6	DMA 7	DMA 8	DMA 9	DMA 10	unitless
	2	85th Percentile Rainfall Depth	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	inches
	3	Predominant NRCS Soil Type Within BMP Location	D	D	D	D	D	D	D	D	D	D	unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted	Restricted	Restricted	Restricted	Restricted	Restricted	Restricted	Restricted	Restricted	Restricted	unitless
	5	Nature of Restriction	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No	No	No	No	No	No	No	No	No	No	yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	No	No	No	No	No	No	No	No	No	No	yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer											in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	percentage
	12	Fraction of DCV Requiring Retention	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	ratio
	13	Required Retention Volume	16	12	12	8	11	5	10	11	12	13	cubic-feet

No Warning Messages

Automated Worksheet B.2: Retention Requirements (V2.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Basic Analysis	1	Drainage Basin ID or Name	DMA 11	-	-	-	-	-	-	-	-	-	unitless
	2	85th Percentile Rainfall Depth	0.62	-	-	-	-	-	-	-	-	-	inches
	3	Predominant NRCS Soil Type Within BMP Location	D										unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted										unitless
	5	Nature of Restriction	n/a										unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes										yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No										yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	No										yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer											in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	-	-	-	-	-	-	-	-	-	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	1.5%	-	-	-	-	-	-	-	-	-	percentage
	12	Fraction of DCV Requiring Retention	0.01	-	-	-	-	-	-	-	-	-	ratio
	13	Required Retention Volume	6	-	-	-	-	-	-	-	-	-	cubic-feet

No Warning Messages

Automated Worksheet B.3: BMP Performance (V2.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
BMP Inputs	1	Drainage Basin ID or Name	DMA 1	DMA 2	DMA 3	DMA 4	DMA 5	DMA 6	DMA 7	DMA 8	DMA 9	DMA 10	sq-ft
	2	Design Infiltration Rate Recommended	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	in/hr
	3	Design Capture Volume Tributary to BMP	1,591	1,242	1,168	777	1,110	488	1,048	1,103	1,167	1,344	cubic-feet
	4	Is BMP Vegetated or Unvegetated?											unitless
	5	Is BMP Impermeably Lined or Unlined?											unitless
	6	Does BMP Have an Underdrain?											unitless
	7	Does BMP Utilize Standard or Specialized Media?											unitless
	8	Provided Surface Area											sq-ft
	9	Provided Surface Ponding Depth											inches
	10	Provided Soil Media Thickness											inches
	11	Provided Gravel Thickness (Total Thickness)											inches
	12	Underdrain Offset											inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)											inches
	14	Specialized Soil Media Filtration Rate											in/hr
	15	Specialized Soil Media Pore Space for Retention											unitless
	16	Specialized Soil Media Pore Space for Biofiltration											unitless
	17	Specialized Gravel Media Pore Space											unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	19	Ponding Pore Space Available for Retention	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	23	Effective Retention Depth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	0	0	0	0	0	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	0	0	0	0	0	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	1,591	1,242	1,168	777	1,110	488	1,048	1,103	1,167	1,344	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	37	Effective Depth of Biofiltration Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	0	0	0	0	0	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	0	0	0	0	0	0	0	0	0	0	hours
	40	Total Depth Biofiltered	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	2,387	1,863	1,752	1,166	1,665	732	1,572	1,655	1,751	2,016	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	1,193	932	876	583	833	366	786	827	875	1,008	cubic-feet
	44	Option 2 - Provided Storage Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	Deficit of Effectively Treated Stormwater	-1,591	-1,242	-1,168	-777	-1,110	-488	-1,048	-1,103	-1,167	-1,344	cubic-feet

Attention!

Minimum retention is met with Site Design BMPs, Stormwater treatment is addressed with Flow Based proprietary biofiltration BMPs

-This BMP does not fully satisfy the performance standards for pollutant control for the drainage area.

Automated Worksheet B.3: BMP Performance (V2.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
BMP Inputs	1	Drainage Basin ID or Name	DMA 11	-	-	-	-	-	-	-	-	-	sq-ft
	2	Design Infiltration Rate Recommended	0.000	-	-	-	-	-	-	-	-	-	in/hr
	3	Design Capture Volume Tributary to BMP	567	-	-	-	-	-	-	-	-	-	cubic-feet
	4	Is BMP Vegetated or Unvegetated?											unitless
	5	Is BMP Impermeably Lined or Unlined?											unitless
	6	Does BMP Have an Underdrain?											unitless
	7	Does BMP Utilize Standard or Specialized Media?											unitless
	8	Provided Surface Area											sq-ft
	9	Provided Surface Ponding Depth											inches
	10	Provided Soil Media Thickness											inches
	11	Provided Gravel Thickness (Total Thickness)											inches
	12	Underdrain Offset											inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)											inches
	14	Specialized Soil Media Filtration Rate											in/hr
	15	Specialized Soil Media Pore Space for Retention											unitless
	16	Specialized Soil Media Pore Space for Biofiltration											unitless
	17	Specialized Gravel Media Pore Space											unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	19	Ponding Pore Space Available for Retention	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	23	Effective Retention Depth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	0	0	0	0	0	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	0	0	0	0	0	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	567	0	0	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	37	Effective Depth of Biofiltration Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	0	0	0	0	0	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	0	0	0	0	0	0	0	0	0	0	hours
	40	Total Depth Biofiltered	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	851	0	0	0	0	0	0	0	0	0	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	425	0	0	0	0	0	0	0	0	0	cubic-feet
	44	Option 2 - Provided Storage Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	-	-	-	-	-	-	-	-	-	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	Deficit of Effectively Treated Stormwater	-567	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	cubic-feet

Attention!

Minimum retention is met with Site Design BMPs, Stormwater treatment is addressed with Flow Based proprietary biofiltration BMPs

-This BMP does not fully satisfy the performance standards for pollutant control for the drainage area.

T.A.P.E. CERTIFICATE

September 2019

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), ENHANCED, PHOSPHORUS & OIL TREATMENT

For

CONTECH Engineered Solutions Filterra®

<u>Ecology's Decision:</u>

Based on Contech's submissions, including the Final Technical Evaluation Reports, dated August 2019, March 2014, December 2009, and additional information provided to Ecology dated October 9, 2009, Ecology hereby issues the following use level designations:

1. A General Use Level Designation for Basic, Enhanced, Phosphorus, and Oil Treatment for the Filterra® system constructed with a minimum media thickness of 21 inches (1.75 feet), at the following water quality design hydraulic loading rates:

Treatment	Infiltration Rate (in/hr) for use in Sizing
Basic	175
Phosphorus	100
Oil	50
Enhanced	175

2. The Filterra is not appropriate for oil spill-control purposes.
3. Ecology approves Filterra systems for treatment at the hydraulic loading rates listed above, to achieve the maximum water quality design flow rate. Calculate the water quality design flow rates using the following procedures:

- Western Washington: for treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three flow rate based methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

4. This General Use Level Designation has no expiration date, but Ecology may revoke or amend the designation, and is subject to the conditions specified below.

Ecology's Conditions of Use:

Filterra systems shall comply with these conditions shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the Filterra systems in accordance with applicable Contech Filterra manuals and this Ecology Decision.
2. The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in this Ecology Decision, Item 3, above) and the Infiltration Rate from the table above (use the lowest applicable Infiltration Rate depending on the level of treatment required). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the Infiltration Rate (converted to ft/sec) to obtain required surface area (sq-ft) of the Filterra unit.
3. Each site plan must undergo Contech Filterra review before Ecology can approve the unit for site installation. This will ensure that design parameters including site grading and slope are appropriate for use of a Filterra unit.
4. Filterra media shall conform to the specifications submitted to and approved by Ecology and shall be sourced from Contech Engineered Solutions, LLC with no substitutions.
5. Maintenance includes removing trash, degraded mulch, and accumulated debris from the filter surface and replacing the mulch layer. Use inspections to determine the site-specific maintenance schedules and requirements. Follow maintenance procedures given in the most recent version of the Filterra Operation and Maintenance Manual.
6. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured treatment device.
   - Contech designs Filterra systems for a target maintenance interval of 6 months in the Pacific Northwest. Maintenance includes removing and replacing the mulch layer above the media along with accumulated sediment, trash, and captured organic materials therein, evaluating plant health, and pruning the plant if deemed necessary.
   - Conduct maintenance following manufacturer's guidelines.
7. Filterra systems come in standard sizes.
8. Install the Filterra in such a manner that flows exceeding the maximum Filterra operating rate are conveyed around the Filterra mulch and media and will not resuspend captured sediment.
9. Discharges from the Filterra units shall not cause or contribute to water quality standards violations in receiving waters.

Approved Alternate Configurations

Filterra Internal Bypass - Pipe (FTIB-P)

1. The Filterra® Internal Bypass – Pipe allows for piped-in flow from area drains, grated inlets, trench drains, and/or roof drains. Design capture flows and peak flows enter the structure through an internal slotted pipe. Filterra® inverted the slotted pipe to allow design flows to drop through to a series of splash plates that then disperse the design flows over the top surface of the Filterra® planter area. Higher flows continue to bypass the slotted pipe and convey out the structure.
2. To select a FTIB-P unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filterra Internal Bypass – Curb (FTIB-C)

1. The Filterra® Internal Bypass –Curb model (FTIB-C) incorporates a curb inlet, biofiltration treatment chamber, and internal high flow bypass in one single structure. Filterra® designed the FTIB-C model for use in a "Sag" or "Sump" condition and will accept flows from both directions along a gutter line. An internal flume tray weir component directs treatment flows entering the unit through the curb inlet to the biofiltration treatment chamber. Flows in excess of the water quality treatment flow rise above the flume tray weir and discharge through a standpipe orifice; providing bypass of untreated peak flows. Americast manufactures the FTIB-C model in a variety of sizes and configurations and you may use the unit on a continuous grade when a single structure providing both treatment and high flow bypass is preferred. The FTIB-C model can also incorporate a separate junction box chamber to allow larger diameter discharge pipe connections to the structure.
2. To select a FTIB-C unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filterra® Shallow

1. The Filterra Shallow provides additional flexibility for design engineers and designers in situations where various elevation constraints prevent application of a standard Filterra configuration. Engineers can design this system up to six inches shallower than any of the previous Filterra unit configurations noted above.
2. Ecology requires that the Filterra Shallow provide a media contact time equivalent to that of the standard unit. This means that with a smaller depth of media, the surface area must increase.
3. To select a Filterra Shallow System unit, the designer must first identify the size of the standard unit using the modeling guidance described above.
4. Once the size of the standard Filterra unit is established using the sizing technique described above, use information from the following table to select the appropriate size Filterra Shallow System unit.

Shallow Unit Basic, Enhanced, and Oil Treatment Sizing

Standard Depth	Equivalent Shallow Depth
4x4	4x6 or 6x4
4x6 or 6x4	6x6
4x8 or 8x4	6x8 or 8x6
6x6	6x10 or 10x6
6x8 or 8x6	6x12 or 12x6
6x10 or 10x6	13x7

Notes:
1. Shallow Depth Boxes are less than the standard depth of 3.5 feet but no less than 3.0 feet deep (TC to INV).

Applicant: Contech Engineered Solutions, LLC.

Applicant's Address: 11815 NE Glenn Widing Drive
Portland, OR 97220

Application Documents:

- State of Washington Department of Ecology Application for Conditional Use Designation, Americast (September 2006)
- Quality Assurance Project Plan Filterra® Bioretention Filtration System Performance Monitoring, Americast (April 2008)
- Quality Assurance Project Plan Addendum Filterra® Bioretention Filtration System Performance Monitoring, Americast (June 2008)
- Draft Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (August 2009)
- Final Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (December 2009)
- Technical Evaluation Report Appendices Filterra® Bioretention Filtration System Performance Monitoring, Americast, (August 2009)
- Memorandum to Department of Ecology Dated October 9, 2009 from Americast, Inc. and Herrera Environmental Consultants
- Quality Assurance Project Plan Filterra® Bioretention System Phosphorus treatment and Supplemental Basic and Enhanced Treatment Performance Monitoring, Americast (November 2011)
- Filterra® letter August 24, 2012 regarding sizing for the Filterra® Shallow System.
- University of Virginia Engineering Department Memo by Joanna Crowe Curran, Ph. D dated March 16, 2013 concerning capacity analysis of Filterra® internal weir inlet tray.
- Terraphase Engineering letter to Jodi Mills, P.E. dated April 2, 2013 regarding Terraflume Hydraulic Test, Filterra® Bioretention System and attachments.
- Technical Evaluation Report, Filterra® System Phosphorus Treatment and Supplemental Basic Treatment Performance Monitoring. March 27th, 2014.
- State of Washington Department of Ecology Application for Conditional Use Level Designation, Contech Engineered Solutions (May 2015)

- Quality Assurance Project Plan Filterra® Bioretention System, Contech Engineered Solutions (May 2015)
- Filterra Bioretention System Armco Avenue General Use Level Designation Technical Evaluation Report, Contech Engineered Solutions (August 2019)

Applicant's Use Level Request:

General Level Use Designation for Basic (175 in/hr), Enhanced (175 in/hr), Phosphorus (100 in/hr), and Oil Treatment (50 in/hr).

Applicant's Performance Claims:

Field-testing and laboratory testing show that the Filterra® unit is promising as a stormwater treatment best management practice and can meet Ecology's performance goals for basic, enhanced, phosphorus, and oil treatment.

Findings of Fact:

Field Testing 2015-2019

1. Contech completed field testing of a 4 ft. x 4 ft. Filterra® unit at one site in Hillsboro, Oregon from September 2015 to July 2019. Throughout the monitoring period a total of 24 individual storm events were sampled, of which 23 qualified for TAPE sampling criteria.
2. Contech encountered several unanticipated events and challenges that prevented them from collecting continuous flow and rainfall data. An analysis of the flow data from the sampled events, including both the qualifying and non-qualifying events, demonstrated the system treated over 99 % of the influent flows. Peak flows during these events ranged from 25 % to 250 % of the design flow rate of 29 gallons per minute.
3. Of the 23 TAPE qualified sample events, 13 met requirements for TSS analysis. Influent concentrations ranged from 20.8 mg/L to 83 mg/L, with a mean concentration of 46.3 mg/L. The UCL95 mean effluent concentration was 15.9 mg/L, meeting the 20 mg/L performance goal for Basic Treatment.
4. All 23 TAPE qualified sample events met requirements for dissolved zinc analysis. Influent concentrations range from 0.0384 mg/L to 0.2680 mg/L, with a mean concentration of 0.0807 mg/L. The LCL 95 mean percent removal was 62.9 %, meeting the 60 % performance goal for Enhanced Treatment.
5. Thirteen of the 23 TAPE qualified sample events met requirements for dissolved copper analysis. Influent concentrations ranged from 0.00543 mg/L to 0.01660 mg/L, with a mean concentration of 0.0103 mg/L. The LCL 95 mean percent removal was 41.2 %, meeting the 30 % performance goal for Enhanced Treatment.
6. Total zinc concentrations were analyzed for all 24 sample events. Influent EMCs for total zinc ranged from 0.048 mg/L to 5.290 mg/L with a median of 0.162 mg/L. Corresponding effluent EMCs for total zinc ranged from 0.015 mg/L to 0.067 mg/L with a median of

0.029 mg/L. Total event loadings for the study for total zinc were 316.85 g at the influent and 12.92 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 95.9 %.

7. Total copper concentrations were analyzed for all 24 sample events. Influent EMCs for total copper ranged from 0.003 mg/L to 35.600 mg/L with a median value of 0.043 mg/L. Corresponding effluent EMCs for total copper ranged from 0.002 mg/L to 0.015 mg/L with a median of 0.004 mg/L. Total event loadings for total copper for the study were 1,810.06 g at the influent and 1.90 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 99.9 %.

<u>Field Testing 2013</u>

1. Filterra completed field-testing of a 6.5 ft x 4 ft. unit at one site in Bellingham, Washington. Continuous flow and rainfall data collected from January 1, 2013 through July 23, 2013 indicated that 59 storm events occurred. Water quality data was obtained from 22 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. The system treated 98.9 % of the total 8-month runoff volume during the testing period. Consequently, the system achieved the goal of treating 91 % of the volume from the site. Stormwater runoff bypassed Filterra treatment during four of the 59 storm events.
3. Of the 22 sampled events, 18 qualified for TSS analysis (influent TSS concentrations ranged from 25 to 138 mg/L). The data were segregated into sample pairs with influent concentration greater than and less than 100 mg/L. The UCL95 mean effluent concentration for the data with influent less than 100 mg/L was 5.2 mg/L, below the 20-mg/L threshold. Although the TAPE guidelines do not require an evaluation of TSS removal efficiency for influent concentrations below 100 mg/L, the mean TSS removal for these samples was 90.1 %. Average removal of influent TSS concentrations greater than 100 mg/L (three events) was 85 %. In addition, the system consistently exhibited TSS removal greater than 80 % at flow rates equivalent to a 100 in/hr infiltration rate and was observed at 150 in/hr.
4. Ten of the 22 sampled events qualified for TP analysis. Americast augmented the dataset using two sample pairs from previous monitoring at the site. Influent TP concentrations ranged from 0.11 to 0.52 mg/L. The mean TP removal for these twelve events was 72.6 %. The LCL95 mean percent removal was 66.0, well above the TAPE requirement of 50 %. Treatment above 50 % was evident at 100 in/hr infiltration rate and as high as 150 in/hr. Consequently, the Filterra test system met the TAPE Phosphorus Treatment goal at 100 in/hr. Influent ortho-P concentrations ranged from 0.005 to 0.012 mg/L; effluent ortho-P concentrations ranged from 0.005 to 0.013 mg/L. The reporting limit/resolution for the ortho-P test method is 0.01 mg/L, therefore the influent and effluent ortho-P concentrations were both at and near non-detect concentrations.

Field Testing 2008-2009

1. Filterra completed field-testing at two sites at the Port of Tacoma. Continuous flow and rainfall data collected during the 2008-2009 monitoring period indicated that 89 storm events occurred. The monitoring obtained water quality data from 27 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. During the testing at the Port of Tacoma, 98.96 to 99.89 % of the annual influent runoff volume passed through the POT1 and POT2 test systems respectively. Stormwater runoff bypassed the POT1 test system during nine storm events and bypassed the POT2 test system during one storm event. Bypass volumes ranged from 0.13 % to 15.3% of the influent storm volume. Both test systems achieved the 91 % water quality treatment-goal over the 1-year monitoring period.
3. Consultants observed infiltration rates as high as 133 in/hr during the various storms. Filterra did not provide any paired data that identified percent removal of TSS, metals, oil, or phosphorus at an instantaneous observed flow rate.
4. The maximum storm average hydraulic loading rate associated with water quality data is <40 in/hr, with the majority of flow rates < 25 in/hr. The average instantaneous hydraulic loading rate ranged from 8.6 to 53 in/hr.
5. The field data showed a removal rate greater than 80 % for TSS with an influent concentration greater than 20 mg/L at an average instantaneous hydraulic loading rate up to 53 in/hr (average influent concentration of 28.8 mg/L, average effluent concentration of 4.3 mg/L).
6. The field data showed a removal rate generally greater than 54 % for dissolved zinc at an average instantaneous hydraulic loading rate up to 60 in/hr and an average influent concentration of 0.266 mg/L (average effluent concentration of 0.115 mg/L).
7. The field data showed a removal rate generally greater than 40 % for dissolved copper at an average instantaneous hydraulic loading rate up to 35 in/hr and an average influent concentration of 0.0070 mg/L (average effluent concentration of 0.0036 mg/L).
8. The field data showed an average removal rate of 93 % for total petroleum hydrocarbon (TPH) at an average instantaneous hydraulic loading rate up to 53 in/hr and an average influent concentration of 52 mg/L (average effluent concentration of 2.3 mg/L). The data also shows achievement of less than 15 mg/L TPH for grab samples. Filterra provided limited visible sheen data due to access limitations at the outlet monitoring location.
9. The field data showed low percentage removals of total phosphorus at all storm flows at an average influent concentration of 0.189 mg/L (average effluent concentration of 0.171 mg/L). We may relate the relatively poor treatment performance of the Filterra system at this location to influent characteristics for total phosphorus that are unique to the Port of Tacoma site. It appears that the Filterra system will not meet the 50 % removal performance goal when the majority of phosphorus in the runoff is expected to be in the dissolved form.

Laboratory Testing

1. Filterra performed laboratory testing on a scaled down version of the Filterra unit. The lab data showed an average removal from 83-91 % for TSS with influents ranging from 21 to 320 mg/L, 82-84 % for total copper with influents ranging from 0.94 to 2.3 mg/L, and 50-61 % for orthophosphate with influents ranging from 2.46 to 14.37 mg/L.
2. Filterra conducted permeability tests on the soil media.
3. Lab scale testing using Sil-Co-Sil 106 showed removals ranging from 70.1 % to 95.5 % with a median removal of 90.7 %, for influent concentrations ranging from 8.3 to 260 mg/L. Filterra ran these laboratory tests at an infiltration rate of 50 in/hr.
4. Supplemental lab testing conducted in September 2009 using Sil-Co-Sil 106 showed an average removal of 90.6 %. These laboratory tests were run at infiltration rates ranging from 25 to 150 in/hr for influent concentrations ranging from 41.6 to 252.5 mg/L. Regression analysis results indicate that the Filterra system's TSS removal performance is independent of influent concentration in the concentration rage evaluated at hydraulic loading rates of up to 150 in/hr.

Contact Information:

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Ecology web link: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
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douglas.howie@ecy.wa.gov

Date	**Revision**
December 2009	GULD for Basic, Enhanced, and Oil granted, CULD for Phosphorus
September 2011	Extended CULD for Phosphorus Treatment
September 2012	Revised design storm discussion, added Shallow System.
January 2013	Revised format to match Ecology standards, changed Filterra contact information
February 2013	Added FTIB-P system
March 2013	Added FTIB-C system
April 2013	Modified requirements for identifying appropriate size of unit

June 2013	Modified description of FTIB-C alternate configuration
March 2014	GULD awarded for Phosphorus Treatment. GULD updated for a higher flow-rate for Basic Treatment.
June 2014	Revised sizing calculation methods
March 2015	Revised Contact Information
June 2015	CULD for Basic and Enhanced at 100 in/hr infiltration rate
September 2019	GULD for Basic and Enhanced at 175 in/hr infiltration rate

Attachment 1b

Categorization of Infiltration Feasibility Condition — Form I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

Provide basis: Please refer to the Geotechnical Investigation, dated June 15, 2022 for our storm water evaluation. Based on results of permeability testing, the unfactored infiltration rate was measured to be 0.07 inches/hour using a constant head borehole permeameter. If applying a feasibility factor of safety of 2.0, the infiltration rate would be 0.036 iph, which is less than the required threshold value of 0.5 iph. The USDA NRCS web soil survey website indicates the majority of the underlying soils belong to Placentia sandy loam (PfC) which is identified as Hydrologic Soil Group D, which is not conducive to infiltration BMP's. Information collected from the USDA website is attached. The downhole permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity is equal to the unfactored infiltration rate.

2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

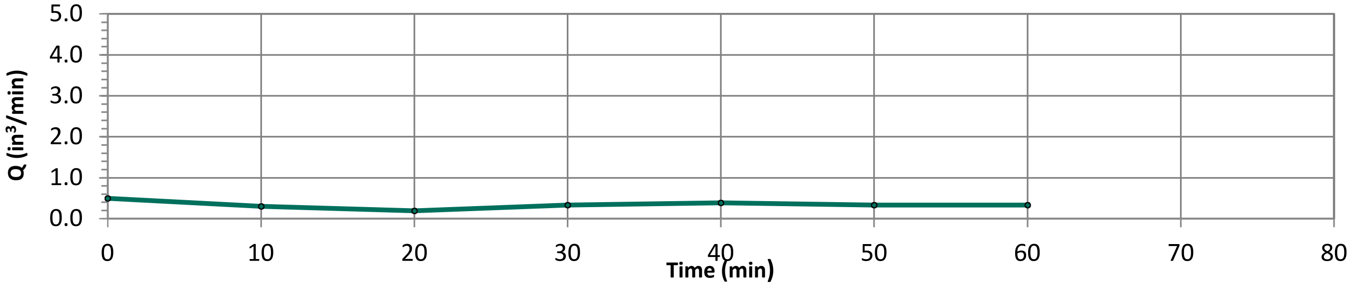
No slopes greater than 25% are proposed in the vicinity of the proposed basins, a liquefaction potential is very low to negligible, and the landslide potential is very low to negligible. However, the potential for lateral water migration to adversely impact existing and proposed utilities, adversely impact proposed foundations and improvements is high. Compacted fill will be placed across the property and result in fills greater than 5 feet thick. Infiltration BMP's founded in compacted fill should be avoided to prevent adverse shrinking/swelling of the expansive soils, and adverse hydro-consolidation of the granular fill soils which causes differential settlement. The underlying Terrace Deposits and Friars Formation consists of stiff to very stiff clay that will also not percolate into the ground and water would migrate laterally.

REGISTERED PROFESSIONAL ENGINEER
TREVOR E. MYERS
No. RCE63773
CIVIL
STATE OF CALIFORNIA

TEST NO.: **I-1** GEOLOGIC UNIT: **Qt**
EXCAVATION ELEVATION (MSL, FT): **449**

TEST INFORMATION	
BOREHOLE DIAMETER (IN):	4
BOREHOLE DEPTH (FT):	2.7
TEST/BOTTOM ELEVATION (MSL, FT):	446
MEASURED HEAD HEIGHT (IN):	5.5
CALCULATED HEAD HEIGHT (IN):	5.9
FACTOR OF SAFETY:	2.0

TEST RESULTS	
STEADY FLOW RATE (IN^3/MIN):	**0.332**
FIELD-SATURATED INFILTRATION RATE (IN/HR):	**0.071**
FACTORED INFILTRATION RATE (IN/HR):	**0.036**



TEST DATA

Reading	Time Elapsed (min)	Water Weight Consumed (lbs)	Water Volume Consumed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	10.00	0.180	4.98	0.498
3	10.00	0.110	3.05	0.305
4	10.00	0.070	1.94	0.194
5	10.00	0.120	3.32	0.332
6	10.00	0.140	3.88	0.388
7	10.00	0.120	3.32	0.332
8	10.00	0.120	3.32	0.332

GEOCON INCORPORATED
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DOWNHOLE PERMEAMETER TEST RESULTS

OAK KNOLL, POWAY, CA

PROJECT NO.: G2746-32-02

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
San Diego County Area, California

Oak Knoll North, Poway

June 8, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,590 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 22, 2018—Aug 31, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded	0.1	1.2%
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes	1.5	19.8%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	5.8	79.0%
Totals for Area of Interest		**7.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

CmE2—Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded

Map Unit Setting

National map unit symbol: hb9t
Elevation: 500 to 4,000 feet
Mean annual precipitation: 8 to 35 inches
Mean annual air temperature: 45 to 64 degrees F
Frost-free period: 110 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Cieneba and similar soils: 60 percent
Rock outcrop: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cieneba

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and granodiorite

Typical profile

H1 - 0 to 8 inches: coarse sandy loam
H2 - 8 to 12 inches: weathered bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 4 to 20 inches to paralithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R019XD060CA - SHALLOW LOAMY (1975)
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile
H1 - 0 to 4 inches: unweathered bedrock

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Vista
Percent of map unit: 5 percent
Hydric soil rating: No

Las posas
Percent of map unit: 5 percent
Hydric soil rating: No

OhC—Olivenhain cobbly loam, 2 to 9 percent slopes

Map Unit Setting
National map unit symbol: hbfb
Elevation: 100 to 600 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 290 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition
Olivenhain and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olivenhain

Setting
Landform: Marine terraces
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly alluvium derived from mixed sources

Typical profile
H1 - 0 to 10 inches: cobbly loam
H2 - 10 to 42 inches: very cobbly clay
H3 - 42 to 60 inches: cobbly clay loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA - CLAYPAN (1975)
Hydric soil rating: No

Minor Components

Diablo

Percent of map unit: 4 percent
Hydric soil rating: No

Linne

Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Huerhuero

Percent of map unit: 2 percent
Hydric soil rating: No

PfC—Placentia sandy loam, thick surface, 2 to 9 percent slo pes

Map Unit Setting

National map unit symbol: hbfn
Elevation: 50 to 2,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Placentia and similar soils: 85 percent
Minor components: 11 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placentia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 34 inches: clay

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA - CLAYPAN (1975)
Hydric soil rating: No

Minor Components

Ramona

Percent of map unit: 5 percent
Hydric soil rating: No

Bonsall

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

San Diego County Area, California

Oak Knoll South, Poway, CA

June 8, 2022

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Soil Map

Map Scale: 1:410 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slopes	0.4	73.4%
VaA	Visalia sandy loam, 0 to 2 percent slopes	0.2	26.6%
Totals for Area of Interest		**0.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

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Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

PfC—Placentia sandy loam, thick surface, 2 to 9 percent slo pes

Map Unit Setting

National map unit symbol: hbfn
Elevation: 50 to 2,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Placentia and similar soils: 85 percent
Minor components: 11 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placentia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 34 inches: clay

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA - CLAYPAN (1975)
Hydric soil rating: No

Minor Components

Ramona

Percent of map unit: 5 percent

Hydric soil rating: No

Bonsall

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

VaA—Visalia sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hbh2
Elevation: 600 to 1,200 feet
Mean annual precipitation: 15 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 200 to 350 days
Farmland classification: Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Visalia and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Visalia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Riser, flat
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 12 inches: sandy loam
H2 - 12 to 40 inches: fine sandy loam
H3 - 40 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare

Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: A
Ecological site: R019XG911CA - Loamy Fan
Hydric soil rating: No

Minor Components

Grangeville

Percent of map unit: 5 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 5 percent
Hydric soil rating: No

Placentia

Percent of map unit: 2 percent
Hydric soil rating: No

Tujunga

Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

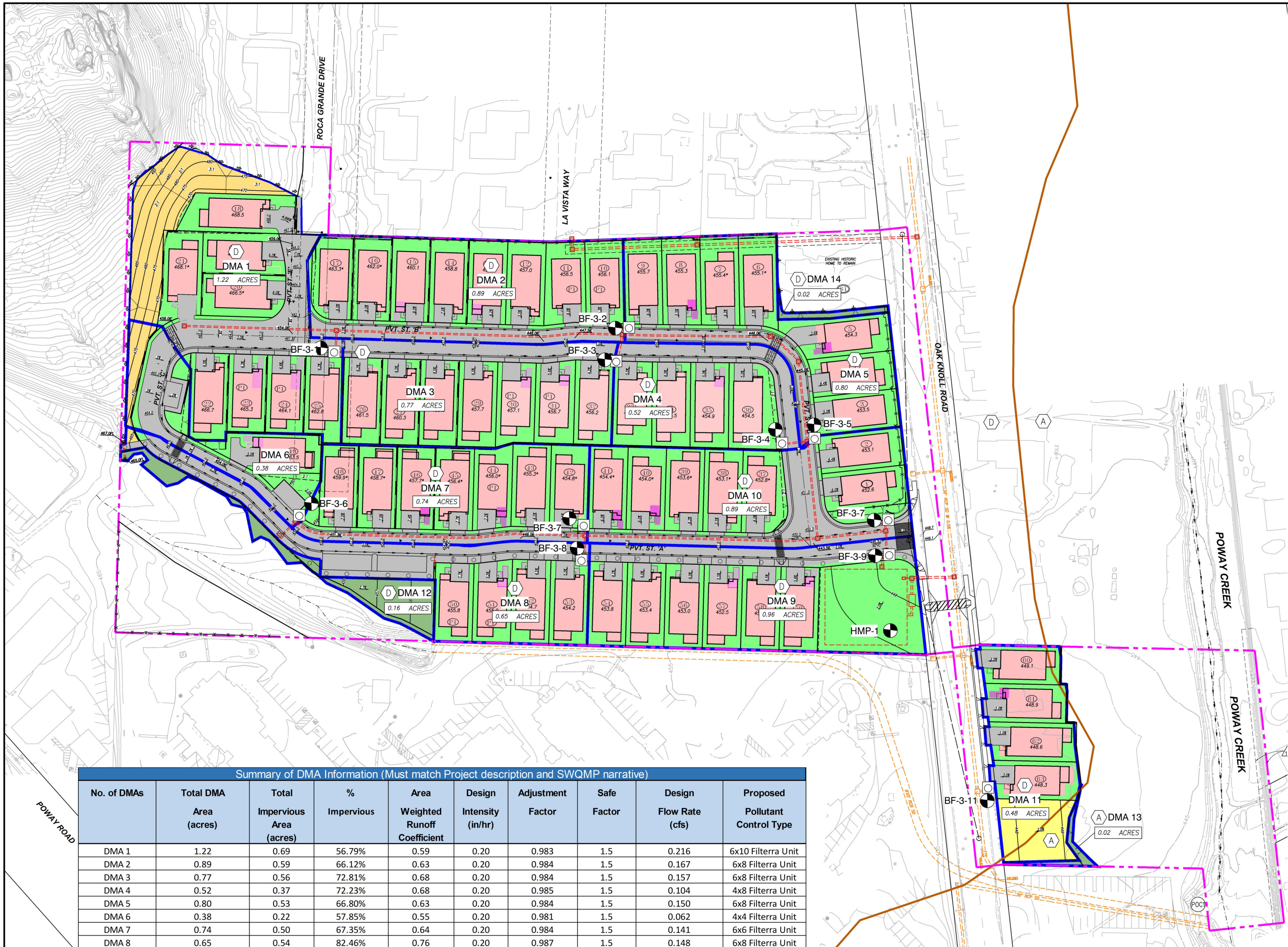
ATTACHMENT 1C

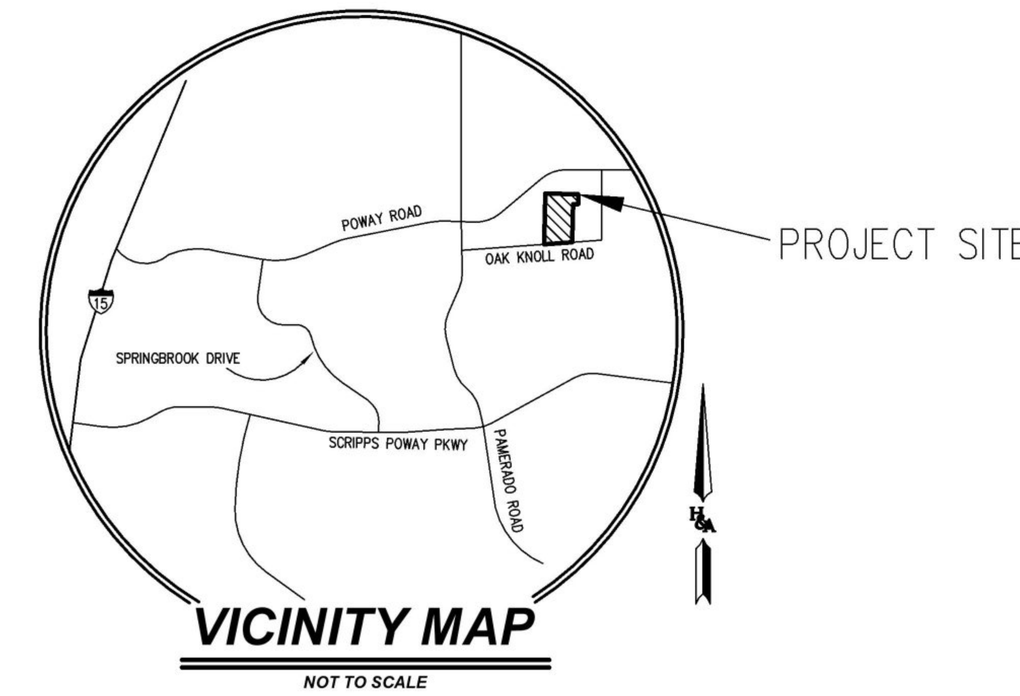
Use this checklist to ensure the required information has been included on the DMA Exhibit. Include checklist in submittal and check all boxes that are applicable. Provide justification for items not included.

The DMA Exhibit must identify:

☒ Underlying hydrologic soil group
☒ Approximate depth to groundwater
☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐ Critical coarse sediment yield areas to be protected
☒ Existing topography and impervious areas
☒ Existing and proposed site drainage network and connections to drainage offsite
☐ Proposed demolition
☒ Proposed grading
☒ Proposed impervious features
☒ Proposed design features and surface treatments used to minimize imperviousness
☒ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
☒ Structural BMPs (identify location, structural BMP ID#, type of BMP, and size/detail)

Justification for items not included in DMA Exhibit:





LEGEND: SYMBOL:

- PROJECT BOUNDARY
- DMA BOUNDARY
- DAYLIGHT
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- FLOW LINE
- SUBAREA ACREAGE — 00.00 ACRES
- DMA ICON — DMA 1
- IMPERVIOUS - ROOF
- IMPERVIOUS - CONCRETE/ASPHALT
- SEMI PERVIOUS - OPEN SPACE
- PERVIOUS - LANDSCAPE
- PERVIOUS - SLOPES
- PERVIOUS SELF-MITIGATING
- HYDROLOGIC SOIL BOUNDARY
- INLET
- HYDROLOGIC SOIL TYPE — D
- POINT OF COMPLIANCE — 1
- STRUCTURAL BMP\ FILTERRA UNIT
- IMPERVIOUS AREA DIRECTED TO DISPERSSION AREA
- LANDSCAPED AREA SERVING AS DISPERSSION AREA

SITE DESIGN BMPs:

SD-1 MAINTAIN NATURAL HYDROLOGIC FEATURES
SD-2 CONSERVE NATURAL AREAS, SOILS, VEGETATION
SD-3 MINIMIZE IMPERVIOUS AREAS
SD-4 MINIMIZE SOIL COMPACTION
SD-5 IMPERVIOUS AREA DISPERSION
SD-6 RUNOFF COLLECTION
SD-7 LANDSCAPING WITH NATIVE OR DROUGHT TOLERANT SPECIES

SOURCE CONTROL BMPs:

SC-1 PREVENTION OF ILLICIT DISCHARGES TO MS4
SC-2 STORM DRAIN STENCILING OR SIGNAGE
SC-6 ADDITIONAL BMPS BASED ON POTENTIAL SOURCES OF RUNOFF POLLUTANTS
SC-6A ON-SITE STORM DRAIN INLETS
SC-6E LANDSCAPE/OUTDOOR PESTICIDE USE
SC-6O FIRE SPRINKLER TEST WATER
SC-6P MISCELLANEOUS DRAIN OR WASH WATER
SC-6Q PLAZAS, SIDEWALKS, AND PARKING LOTS

UNDERLYING SOIL GROUP : D & A
5 FEET < APPROXIMATE DEPTH TO GROUNDWATER< 10 FEET
NO CRITICAL COARSE AREAS REQUIRE PRESERVATION

50 0 50 100 150
SCALE 1"= 50'

Summary of DMA Information (Must match Project description and SWQMP narrative)

No. of DMAs	Total DMA Area (acres)	Total Impervious Area (acres)	% Impervious	Area Weighted Runoff Coefficient	Design Intensity (in/hr)	Adjustment Factor	Safe Factor	Design Flow Rate (cfs)	Proposed Pollutant Control Type
DMA 1	1.22	0.69	56.79%	0.59	0.20	0.983	1.5	0.216	6x10 Filterra Unit
DMA 2	0.89	0.59	66.12%	0.63	0.20	0.984	1.5	0.167	6x8 Filterra Unit
DMA 3	0.77	0.56	72.81%	0.68	0.20	0.984	1.5	0.157	6x8 Filterra Unit
DMA 4	0.52	0.37	72.23%	0.68	0.20	0.985	1.5	0.104	4x8 Filterra Unit
DMA 5	0.80	0.53	66.80%	0.63	0.20	0.984	1.5	0.150	6x8 Filterra Unit
DMA 6	0.38	0.22	57.85%	0.55	0.20	0.981	1.5	0.062	4x4 Filterra Unit
DMA 7	0.74	0.50	67.35%	0.64	0.20	0.984	1.5	0.141	6x6 Filterra Unit
DMA 8	0.65	0.54	82.46%	0.76	0.20	0.987	1.5	0.148	6x8 Filterra Unit
DMA 9	0.96	0.54	56.39%	0.55	0.20	0.988	1.5	0.158	6x8 Filterra Unit
DMA 10	0.89	0.64	72.19%	0.68	0.20	0.985	1.5	0.180	6x8 Filterra Unit
DMA 11	0.48	0.26	55.09%	0.54	0.20	0.981	1.5	0.076	4x6 Filterra Unit
DMA 12	0.16	0.00	0.00%	0.30	N/A	N/A	N/A	N/A	Self Mitigating Area
DMA 13	0.02	0.00	0.00%	0.30	N/A	N/A	N/A	N/A	Self Mitigating Area
DMA 14	0.02	0.00	0.00%	0.10	N/A	N/A	N/A	N/A	Self Mitigating Area
Σ =	**8.50**	**5.45**	**64.17%**	**0.61**					

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DMA MAP
HARMON OAKS

CITY OF POWAY, CALIFORNIA

MAP 1 OF 1

W.O.# 2167-0225

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Filterra Sizing Spreadsheet
San Diego Region
Uniform Intensity Approach
Storm Intensity = 0.20 in/hr

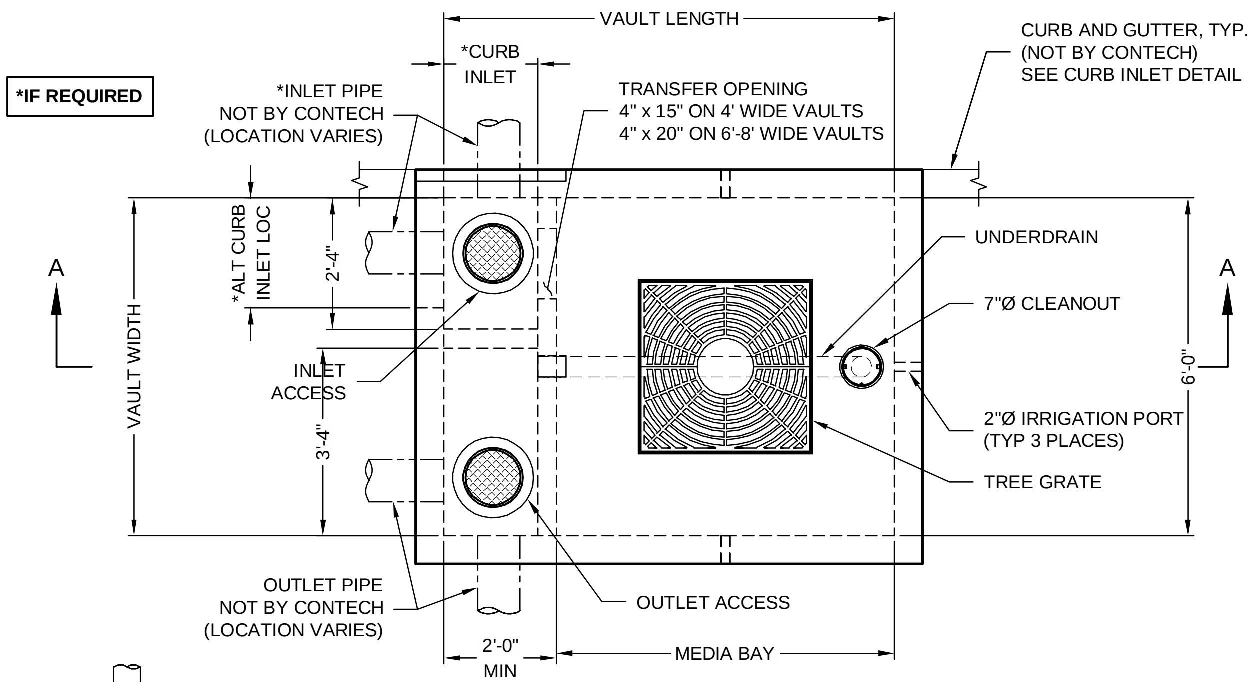
Filterra Infiltration Rate =	175	(in/hr)
Filterra Flow per Square Foot =	0.00405	(ft3/sec/ft2)

Filterra Flow Rate, Q = 0.00405 ft3/sec x Filterra Surface Area
Rational Method, Q = C x I x A
San Diego Multiplier, M = 1.5

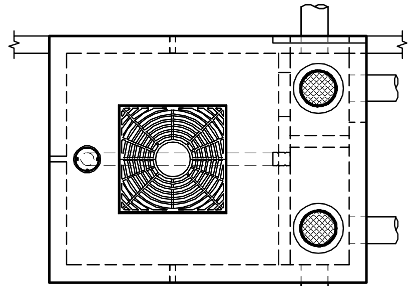
Site Flowrate, Q = (C x DI x DA x M x 43560) / (12 x3600)
OR DA = (12 x 3600 x Q) / (C x 43560 x DI x M)

where
Q = Flow (ft3/sec)
DA = Drainage Area (acres)
DI = Design Intensity (in/hr)
C = Runoff coefficient (dimensionless)
M = Multiplier (dimensionless)

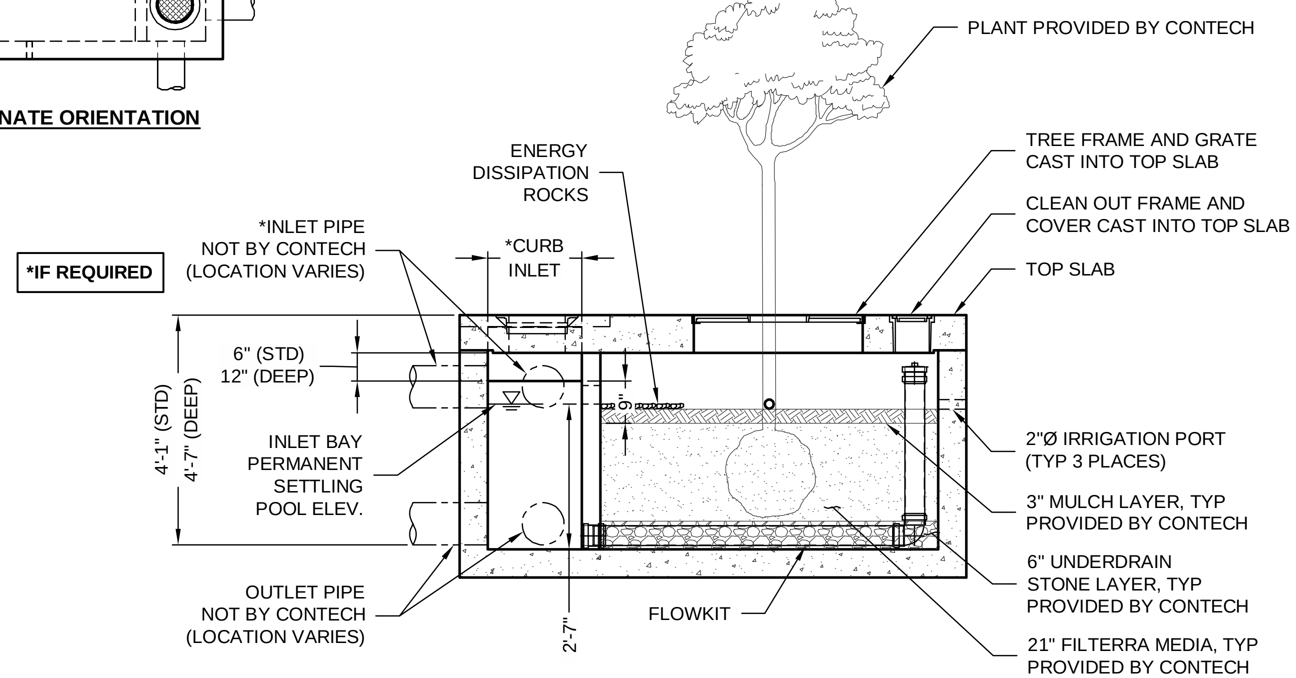
			DI 0.2	C 0.95	C 0.85	C 0.50
Available Filterra Box Sizes						
L (ft)	W (ft)	Filterra Surface Area (ft2)	Filterra Flow Rate, Q (ft3/sec)	100% Imperv. DA (acres)	Commercial max DA (acres)	Residential max DA (acres)
4	4	16	0.0648	0.226	0.252	0.429
6	4	24	0.0972	0.338	0.378	0.643
6.5	4	26	0.1053	0.367	0.410	0.696
8	4	32	0.1296	0.451	0.504	0.857
12	4	48	0.1944	0.677	0.756	1.286
6	6	36	0.1458	0.507	0.567	0.964
8	6	48	0.1944	0.677	0.756	1.286
10	6	60	0.2431	0.846	0.945	1.607
12	6	72	0.2917	1.015	1.134	1.928
13	7	91	0.3686	1.283	1.434	2.437
12	8	96	0.3889	1.353	1.512	2.571
14	8	112	0.4537	1.579	1.765	3.000
16	8	128	0.5185	1.804	2.017	3.428
18	8	144	0.5833	2.030	2.269	3.857
20	8	160	0.6481	2.255	2.521	4.285
22	8	176	0.7130	2.481	2.773	4.714



PLAN VIEW



ALTERNATE ORIENTATION



SECTION A-A
(STANDARD DEPTH SHOWN)

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING UPON OUTLET LOCATION.

FTPD STANDARD HEIGHT CONFIGURATION

DESIGNATION (OPTIONS: -P, -T, -PT)	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	WEIR LENGTH/ MAX CURB OPENING	*MAX BYPASS FLOW (CFS)	INLET/ OUTLET ACCESS DIA	TREE GRATE QTY & SIZE
FTPD0404	N/A CA	4 x 4	4 x 6	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD04045	CA ONLY	4 x 4.5	4 x 6.5	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0406	N/A DE, MD, NJ, PA, VA, WV	4 x 6	4 x 8	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD045058	DE, MD, NJ, PA, VA, WV ONLY	4.5 x 5.83	4.5 x 7.83	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0604	ALL	6 x 4	6 x 6	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0606	ALL	6 x 6	6 x 8	1'-8"	1.4	12"/12"	(1) 3' x 3'
FTPD0608	ALL	6 x 8	6 x 10	1'-8"	1.4	12"/12"	(1) 4' x 4'
FTPD0610	ALL	6 x 10	6 x 12	1'-8"	1.4	12"/12"	(1) 4' x 4'
FTPD0710	ALL	7 x 10	7 x 13	2'-6"	2.1	24"/24"	(1) 4' x 4'
FTPD08105	ALL	8 x 10.5	8 x 14	3'-0"	2.5	24"/24"	(1) 4' x 4'
FTPD08125	N/A OR, WA	8 x 12.5	8 x 16	3'-0"	2.5	24"/24"	(2) 4' x 4'
FTPD09115	OR, WA ONLY	9 x 11.5	9 x 15	3'-0"	2.5	24"/24"	(2) 4' x 4'

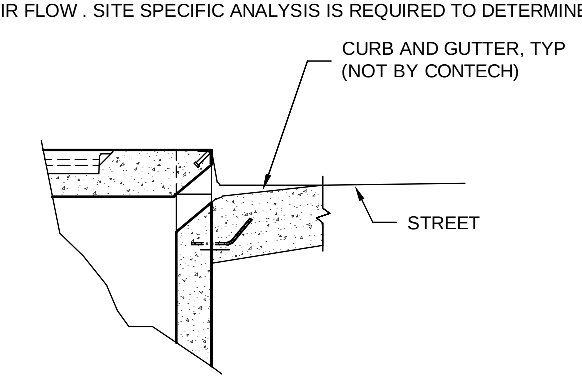
N/A = NOT AVAILABLE

FTPD-D DEEP OPTION CONFIGURATION

DESIGNATION (OPTIONS: -P, -T, -PT)	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	WEIR LENGTH/ MAX CURB OPENING	*MAX BYPASS FLOW (CFS)	INLET/ OUTLET ACCESS DIA	TREE GRATE QTY & SIZE
FTPD0404-D	N/A CA	4 x 4	4 x 6	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD04045-D	CA ONLY	4 x 4.5	4 x 6.5	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0406-D	N/A DE, MD, NJ, PA, VA, WV	4 x 6	4 x 8	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD045058-D	DE, MD, NJ, PA, VA, WV ONLY	4.5 x 5.83	4.5 x 7.83	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0604-D	ALL	6 x 4	6 x 6	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0606-D	ALL	6 x 6	6 x 8	1'-8"	4.6	12"/12"	(1) 3' x 3'
FTPD0608-D	ALL	6 x 8	6 x 10	1'-8"	4.6	12"/12"	(1) 4' x 4'
FTPD0610-D	ALL	6 x 10	6 x 12	1'-8"	4.6	12"/12"	(1) 4' x 4'
FTPD0710-D	ALL	7 x 10	7 x 13	2'-6"	6.8	24"/24"	(1) 4' x 4'
FTPD08105-D	ALL	8 x 10.5	8 x 14	3'-0"	8.2	24"/24"	(1) 4' x 4'
FTPD08125-D	N/A OR, WA	8 x 12.5	8 x 16	3'-0"	8.2	24"/24"	(2) 4' x 4'
FTPD09115-D	OR, WA ONLY	9 x 11.5	9 x 15	3'-0"	8.2	24"/24"	(2) 4' x 4'

N/A = NOT AVAILABLE

*MAX BYPASS FLOW IS INTERNAL WEIR FLOW . SITE SPECIFIC ANALYSIS IS REQUIRED TO DETERMINE CURB INLET FLOW CAPACITY



CURB INLET DETAIL

filterra

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 6,277,274; 6,569,321; 7,625,485; 7,425,261; 7,833,412; RELATED FOREIGN PATENTS.

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FILTERRA PEAK DIVERSION (FTPD)
CONFIGURATION DETAIL

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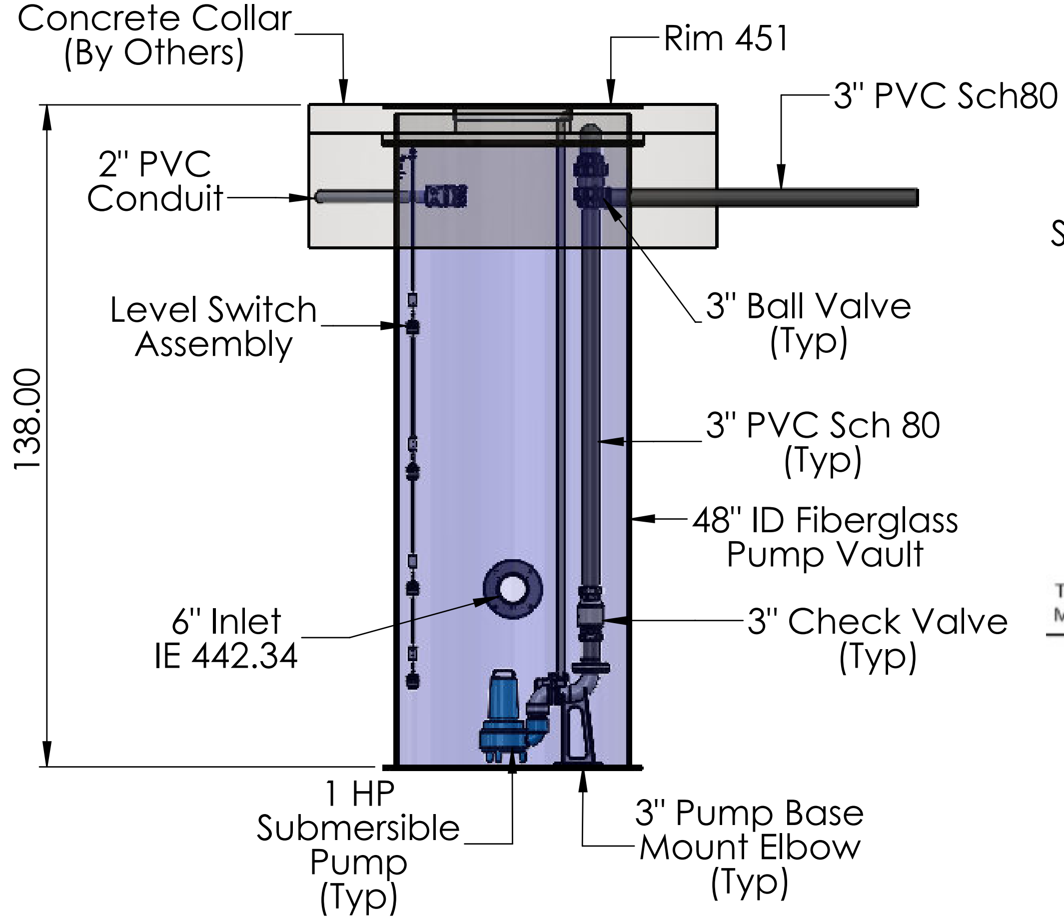
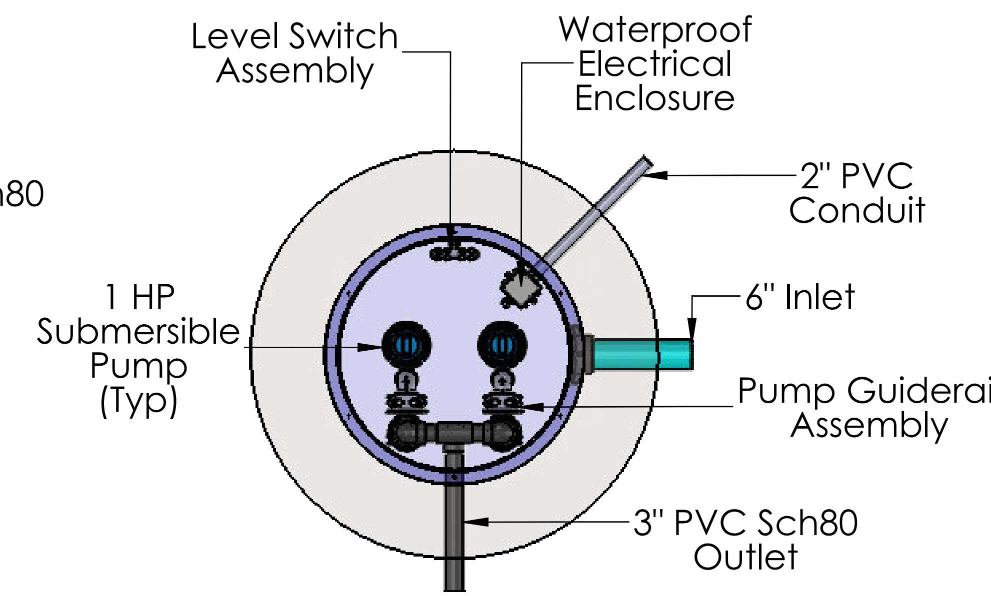
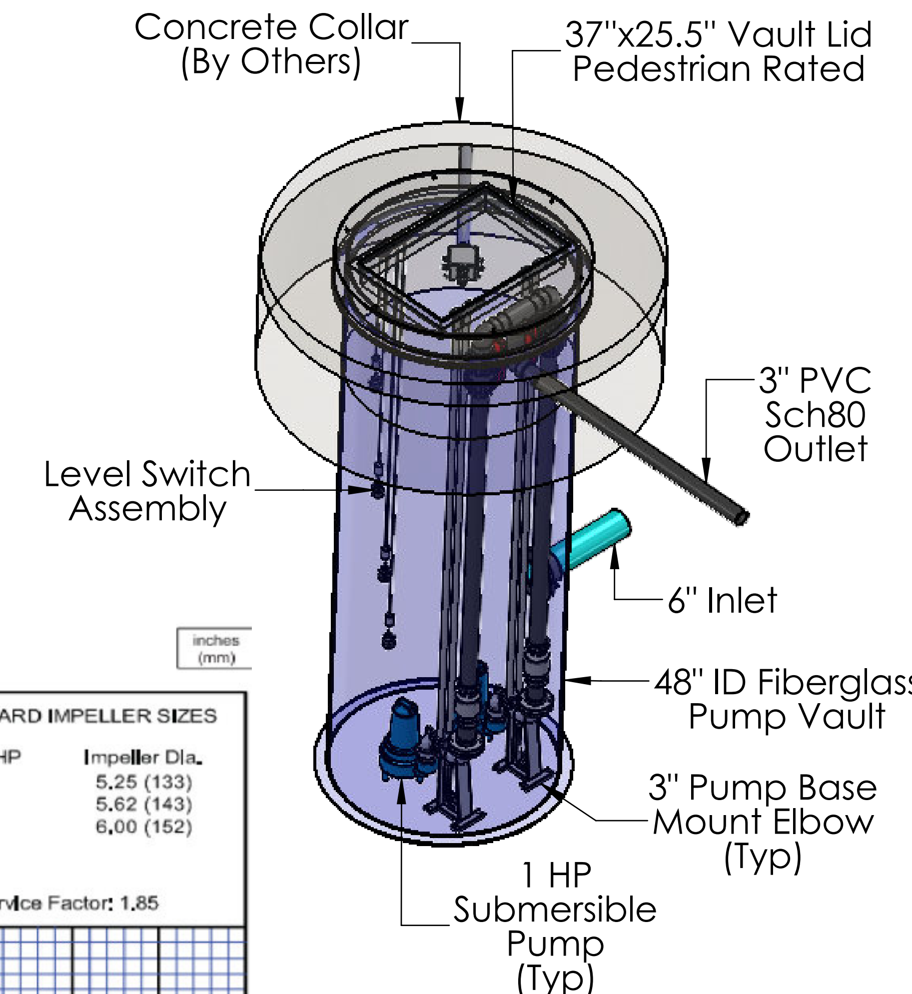
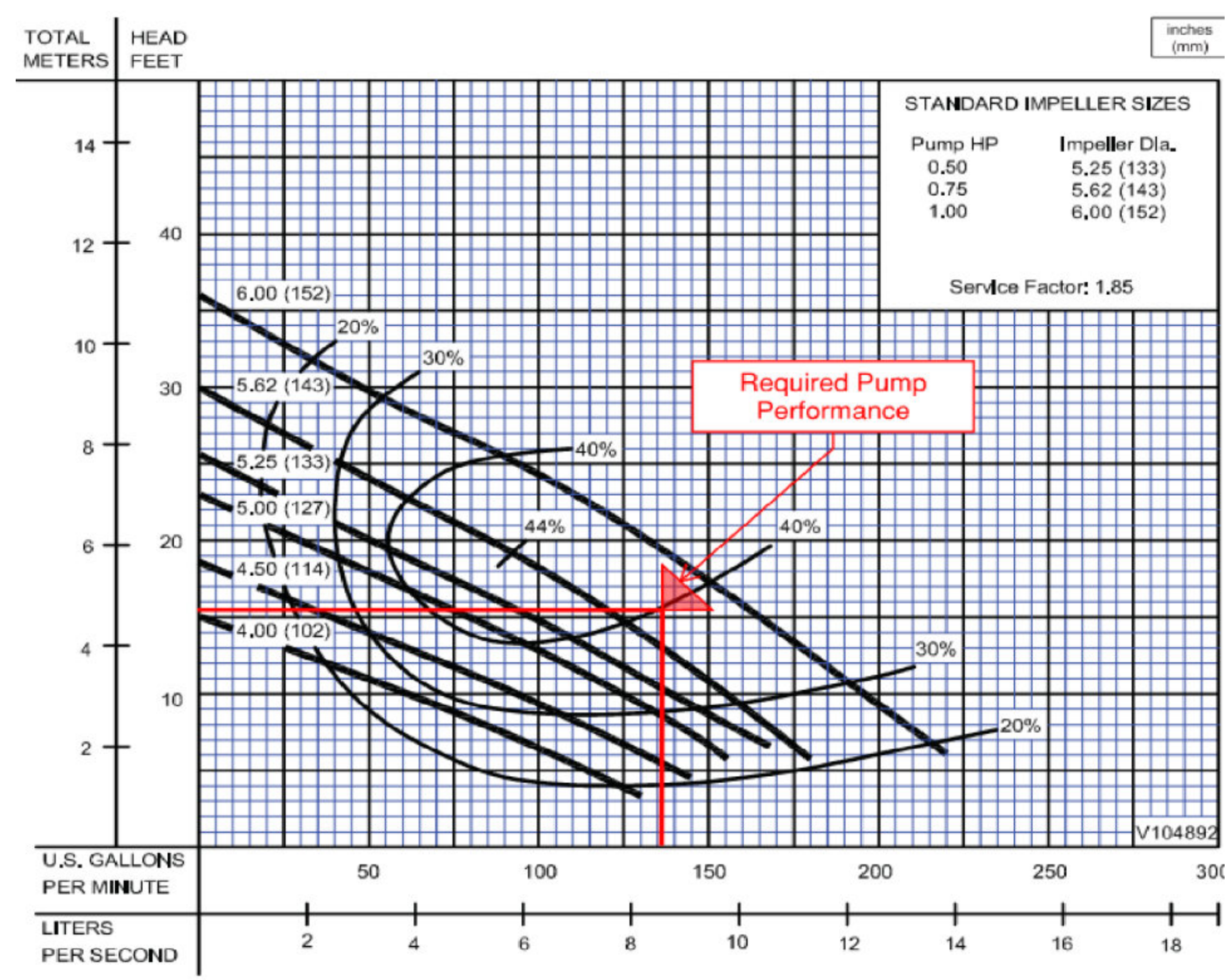








NOTES:

1. All materials shown on this sheet shall be supplied by Santa Fe WinWater Company, Santa Fe Springs, CA, except where noted. Pumps shall be SFWW SWP-10, 200 - 240v, 1 phase, 8.8A max. Substitution of any component may void warranty.
2. Locate Pump Controller as required for site conditions or Owner direction. Route power and signal cable conduit to vault from controller accordingly. Connections shall be provided by Contractor.
3. Route 3" pump system outlet pipe as shown on Civil Sheets.
4. Contractor to provide concrete collar around manhole cover suitable for surface loading conditions.
5. Anti-Floatation flange to be provided on pump vault where required for groundwater conditions.
6. Pump performance requirements based on Civil Engineer's design calculations = 137 gpm.

Headloss Calculations		
Fitting	Qty / Length	Headloss
Pipe (2")	21	1.19'
Check Valve	1	1.72'
90 Elbow	2	0.96'
Tee	1	1.24'
45 Elbow	2	0.41'
Exit	1	0.69'
Elevation Head		9.17'
Total Headloss @ 137 gpm		15.37'

SANTA FE Winwater COMPANY

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

	NAME	DATE
DRAWN	SRG	7/01/22
CHECKED	MDF	7/01/22
ENG APPR.	CKL	7/01/22
REV		

TITLE:
Harmon Oaks - Poway, CA
Stormwater Treatment
Discharge Pump

SIZE B

SHEET 1 OF 1

ATTACHMENT 2 – BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 2a	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary (Required) See Chapter 6 and Appendix G of the BMP Design Manual	☐ Included ☒ Submitted as separate stand-alone document
Attachment 2b	Hydromodification Management Exhibit (Required)	☒ Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2c	Management of Critical Coarse Sediment Yield Areas See Section 6.2 and Appendix H of the BMP Design Manual. **(No CCSYAs on or around the site)**	☐ Exhibit depicting onsite and/or upstream sources of critical coarse sediment as mapped by Regional or Jurisdictional approaches outlined in Appendix H.1 AND, ☐ Demonstration that the project effectively avoids and bypasses sources of mapped critical coarse sediment per approaches outlined in Appendix H.2 and H.3. OR, ☐ Demonstration that project does not generate a net impact on the receiving water per approaches outlined in Appendix H.4.
Attachment 2d	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☒ Not performed ☐ Included ☐ Submitted as separate stand-alone document
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included ☒ Not required because BMPs will drain in less than 96 hours

Attachment 2a

Hydromodification Management Plan

INTRODUCTION

This report summarizes the approach used to model Harmon Oaks project site in the City of Poway to achieve flow control requirements for hydromodification management using the Environmental Protection Agency (EPA) Storm Water Management Model 5.1 (SWMM). SWMM models is provided for the pre and post developed conditions at the site in order to determine if the proposed detention/Hydromodifcatation facility has sufficient storage volume to meet the current Hydromodification Management Plan (HMP) requirements from the Regional Water Quality Control Board (RWQCB).

SWMM MODEL DEVELOPMENT

The Farm development plan proposes the construction of single family homes, and associated. One Point of Compliance (POC) will be analyzed in the SWMM analysis.

The proposed vault is modeled as a storage unit associated with a storage curve. The storm water quality requirements for the project are met by the proposed proprietary biofiltration Filterra Units upstream of the vault, which are not included in the hydromodifcation model as their volume is negligible. The proposed vault is designed for hydromodifcation and detention purposes.

Two SWMM models will be prepared for the POC, one for the pre, and one for the post development.

The inputs required to run a SWMM analysis are rainfall, evaporation rate, area, drainage soil, and any BMP configuration applicable to the project based on the 2018/ revised 2022 BMP DM. The rain gauge used is the Poway Gage as it is the most representative of the area based on location. Evaporation for the project site will be taken from BMP DM for Zone 9 for the monthly average evapotranspiration. Hydrologic soil type D and A will be assumed for the entire site based on the web soil survey.

HMP MODELING

POC 1

POC 1 is located offsite southwest of the southern lot at the discharge location of the existing storm drain (8' X 5' RCP) into Poway Creek. Runoff from the site in both pre and post developed conditions is conveyed via stated storm drain and ultimately discharges into Poway Creek. No added imperviousness or increasing in area is proposed to the open channel northeast of the northern lot. The POC receives runoff from Area1-6:

- Area 1- Soil Type D: Project's Northern lot that will be disturbed in proposed conditions. In existing conditions, the site consists of single-family residential structures, driveways, equipment yard (Construction stage area), northern slope and vacant area. In proposed conditions, the site will be developed with roads, sidewalk, landscaped areas, slopes, open space, single-family homes and driveways. In proposed conditions, runoff from Area1 will be captured via curb type proprietary biofiltration units (Filterra units or equivalent) to address water quality requirements, and then routed via proposed storm drain to the underground vault, before discharging to POC-1.

• Area 2 - Soil Type D: 2.86 acres (69.1% imperviousness) consists of existing development that will not be disturbed in proposed conditions. It includes offsite development west of the project's northern lot, historical home, and the northern portion of Oak Knoll Road. Runoff from this area is captured by inlets and conveyed via existing 36" RCP public SD that runs in an eastwest direction under Oak Knoll Road, where it comingles with the treated and mitigated discharge from the project area, prior entering the existing 8'X5' RCP storm drain, which routes the total runoff to Poway Creek at POC1.
This area routed directly to POC-1

- Area 3 Soil Type D: Consists of 0.80 acres of northern offsite slope, which drains through the site. Runoff from this area will be bypassed in proposed conditions. 0.18 ac of self-mitigating slopes is added to this area. This area enters the existing 8'X5' RCP storm drain west of the northern lot and travels southerly, where it comingles with the discharge from the existing 36" RCP SD, and continues to discharge into Poway Creek at POC1. This area routed directly to POC-1.

- Area 4- Soil Type D: Offsite existing development that will not be disturbed in proposed conditions and drains southerly ,with the runoff from the project's southern lot, to discharge directly into Poway Creek at POC1. It consists of building structures and driveways east of the project's southern lot. Southern portion of Oaknoll Road was modeled as part of Area 4 as well. This portion drains westerly to be captured via curb inlet and enters the existing 36" RCP storm drain, then to 8'X5' RCP storm drain that discharges into Poway Creek at POC1. This area routed directly to POC-1.

- Area 5- Soil Type-D: The northern portion of project's southern lot that will be developed in the proposed conditions (0.475 ac). In existing conditions, this area is vacant and drains southerly to comingle with Area-6 and Area-4 flows before discharging into Poway Creek at POC1. In proposed conditions, this area drains northerly to Oak Knoll road, where it's captured via proposed curb type proprietary biofiltraton unit (Filterra unit or equivalent) that will address water quality requirements before discharging into the existing 36" RCP SD. This area is routed directly to POC-1. The proposed vault within Area 1 will over detain the flows from Area-1 to account for the unmitigated flows from Area-5 to meet hydromodification requirements.

  • Area 6- Soil Type A: Offsite and onsite natural slopes not to be disturbed in proposed conditions. This Area drains southerly to discharge directly into Poway Creek to POC-1

POC1 Watershed Parameters - Existing Conditions																	
Area 3			Area 2*			Area 1			Area 5			Area 4*			Area 6		
Northern-Undeveloped			Northern-Developed			Northern-Disturbed			Southern-Disturbed			Southern-D			Southern-A		
L=	846	ft	L=	1250	ft	L=	681	ft	L=	220	ft	L=	378	ft	L=	392	ft
A=	0.98	ac	A=	2.86	ac	A=	7.819	ac	A=	0.475	ac	A=	0.44	ac	A=	1.11	ac
% Impervious	0.0%		% Impervious	69.1%		% Impervious	0.0%		% Impervious	0.0%		% Impervious	79.2%		% Impervious	0.0%	
W=	50	ft	W=	100	ft	W=	500	ft	W=	94	ft	W=	51	ft	W=	123	ft
US Elev=	544.0	ft	US Elev=	467.0	ft	US Elev=	495.0	ft	US Elev=	449.1	ft	US Elev=	449.5	ft	US Elev=	446.0	ft
DS Elev=	457.0	ft	DS Elev=	448.5	ft	DS Elev=	457.6	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft
S=	10.28%		S=	1.48%		S=	5.49%		S=	2.32%		S=	1.46%		S=	0.51%	

POC1 Watershed Parameters - Proposed Conditions																	
Area 3			Area 2			Area 1			Area 5			Area 4			Area 6		
Northern-Undeveloped			Northern-Developed			Northern-Disturbed			Southern-Disturbed			Southern-D			Southern-A		
L=	846	ft	L=	1250	ft	L=	1000	ft	L=	220	ft	L=	378	ft	L=	392	ft
A=	0.98	ac	A=	2.860	ac	A=	7.819	ac	A=	0.475	ac	A=	0.44	ac	A=	1.11	ac
% Impervious	0.0%		% Impervious	69.1%		% Impervious	66.4%		% Impervious	55.1%		% Impervious	79.2%		% Impervious	0.0%	
W=	50	ft	W=	100	ft	W=	341	ft	W=	94	ft	W=	51	ft	W=	123	ft
US Elev=	544.0	ft	US Elev=	467.0	ft	US Elev=	495.0	ft	US Elev=	449.1	ft	US Elev=	449.5	ft	US Elev=	446.0	ft
DS Elev=	457.0	ft	DS Elev=	448.5	ft	DS Elev=	448.5	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft
S=	10.28%		S=	1.48%		S=	4.65%		S=	2.32%		S=	1.46%		S=	0.51%	

*For Area 2 and Area 4 Pre-developed Conditions per section 6.3.3 from BMP Manual :Runoff from offsite impervious area (not a part of the project disturbed area) that co-mingles with project site runoff prior to discharge to the POC, the offsite impervious area may be modeled as impervious in both the pre- and post- condition models.

BMP MODELING FOR HMP PURPOSES

Vault Discussion:

One detention vault is located within the project's northern lot (Area 1) and is responsible for handling hydromodification requirements for the project. Flow control in the vault is achieved using multiple orifices on the outlet structure located at the downstream end of the vault. The size, number and location of the orifices are presented in the Table 1. The outlet structure contains an emergency overflow opening that is only utilized in storm events equal to or larger than the 100-year storm, such that peak flows can be safely discharged to the receiving storm drain system. Sizing and further peak flow discussion is in the "Drainage Report for Harmon Oaks". One rating curve has been modeled to represent the flows from orifices and spillway weir.

The detention vault has been modeled using the storage unit feature, and the riser structure has been modeled using the outlet feature in SWMM.

It should be noted that detailed outlet structure location and elevations will be shown on the construction plans based on the recommendations of this study.

FLOW DURATION CURVE COMPARISON

The Flow Duration Curves (FDC) for the site were compared at POC-1 by exporting the hourly runoff time series results from SWMM to a spreadsheet. The FDC was compared between 10% of the existing condition Q2 (based on accepting an assumption of high susceptibility for downstream channel erosion as required if no soils tests are completed) up to the existing condition Q10. The Q2 and Q10 were determined using a partial duration statistical analysis of the runoff time series in an Excel spreadsheet. The SWMM Model is a statistical analysis based on the Weibull Plotting Position Method.

The range between 10% of Q2 and Q10 was divided into 100 equal time intervals; the number of hours that each flow rate was exceeded was counted from the hourly series. Additionally, the intermediate peaks with a return period "i" were obtained (Qi with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate.

The FDC comparison for POC1 is illustrated in Figure 1. POC 1 corresponds with the point located at the discharge point of existing 8' X 5' RCP storm drain into Poway Creek southwest of the project.

As can be seen in Figures 1, the FDC for the proposed condition with vault is within 110% of the curve for the existing condition. The additional runoff volume generated from developing the site will be released to the downstream storm drain at a flow rate equals or below the 10% Q2 lower threshold. Additionally, the project will not increase peak flow rates between the Q2 and the Q10, as shown in the graphic and also in the attached table.

SUMMARY & CONCLUSION

A summary/comparison of existing and proposed areas draining to each point of compliance (POC) are shown in the table below. The model includes onsite project areas and offsite drainage areas. One underground vault is proposed to mitigate increased flow frequencies as a result of development.

AREA SUMMARY		
	Existing (AC)	Proposed (AC)
POC 1	13.68	13.68

The study has demonstrated that the proposed detention vault and riser meet current HMP requirements.

Key Assumptions

1. D & A soils are representative of the entire site.

2. The Proprietary biofiltration units' volume is negligible.

3. The discharge from the low flow orifice will be pumped to the proposed manhole down-stream of the proposed vault. This manhole receives the discharge from the middle, top orifices, and over flow emergency weir flows (outlet riser structure), and discharges into the existing storm drain system. However, for modeling purposes the discharge from the low orifice was used, not the pump discharge rating curve.

ATTACHMENTS

1. Flow Duration Curve Analysis
2. Elevation vs. Area Curves vs. Discharge Curves to be used in SWMM
3. Vault and Outlet Structure Details
4. SWMM Input Data (Pre-developed and Proposed Models)
5. SWMM Screens and Explanation of Significant Variables
6. Drying Time of the Vault

Attachment -1 Flow Duration Curve Analysis

Flow duration curve shall not exceed the pre-developed conditions by more than 10% neither in peak flow nor duration.

The figure on the following page illustrates that the flow duration curve in post-development conditions after the proposed BMP is below the existing flow duration curve. The flow duration curve table following the curve shows that if the interval $0.10Q_2 – Q_{10}$ is divided in 100 sub-intervals, then a) the post development divided by pre-development durations are never larger than 110% (the permit allows up to 110%); and b) there are no more than 10 intervals in the range 101%-110% which would imply an excess over 10% of the length of the curve (the permit allows less than 10% of excesses measured as 101-110%).

Consequently, the design passes the hydromodification test.

It is important to note that the flow duration curve can be expressed in the "x" axis as percentage of time, hours per year, total number of hours, or any other similar time variable. As those variables only differ by a multiplying constant, their plot in logarithmic scale is going to look exactly the same and compliance can be observed regardless of the variable selected. The selection of a logarithmic scale in lieu of the normal scale is preferred, as differences between the pre-development and post-development curves can be seen more clearly in the entire range of analysis. Both graphics are presented for reference.

In terms of the "y" axis, the peak flow value is the variable of choice. As an additional analysis performed by H&A, not only the range of analysis is clearly depicted (10% of Q_2 to Q_{10}) but also all intermediate flows are shown (30% of Q_2, 50% of Q_2, Q_2, Q_3, Q_4, Q_5, Q_6, Q_7, Q_8 and Q_9) in order to demonstrate compliance at any range $Q_x – Q_{x+1}$. It must be pointed out that one of the limitations of both the SWMM and SDHM models is that the intermediate analysis is not performed (to obtain Q_i from i = 2 to 10).

The largest "n" peak flows are attached in this appendix, as well as the values of Q_i with a return period "i", from i=2 to 10. The Q_i values are also added into the flow-duration plot.

Low-flow Threshold:	10%	
0.1xQ2 (Pre):	0.468	cfs
Q10 (Pre):	7.174	cfs
Ordinate #:	100	
Incremental Q (Pre):	0.06706	cfs
Total Hourly Data:	400032	hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	0.468	1190	2.97E-03	1282	3.20E-03	108%	Pass
1	0.535	1054	2.63E-03	1080	2.70E-03	102%	Pass
2	0.602	969	2.42E-03	944	2.36E-03	97%	Pass
3	0.669	877	2.19E-03	816	2.04E-03	93%	Pass
4	0.736	797	1.99E-03	726	1.81E-03	91%	Pass
5	0.803	726	1.81E-03	645	1.61E-03	89%	Pass
6	0.870	657	1.64E-03	576	1.44E-03	88%	Pass
7	0.938	605	1.51E-03	527	1.32E-03	87%	Pass
8	1.005	541	1.35E-03	470	1.17E-03	87%	Pass
9	1.072	492	1.23E-03	413	1.03E-03	84%	Pass
10	1.139	454	1.13E-03	371	9.27E-04	82%	Pass
11	1.206	418	1.04E-03	338	8.45E-04	81%	Pass
12	1.273	385	9.62E-04	316	7.90E-04	82%	Pass
13	1.340	366	9.15E-04	295	7.37E-04	81%	Pass
14	1.407	344	8.60E-04	275	6.87E-04	80%	Pass
15	1.474	324	8.10E-04	256	6.40E-04	79%	Pass
16	1.541	302	7.55E-04	238	5.95E-04	79%	Pass
17	1.608	275	6.87E-04	225	5.62E-04	82%	Pass
18	1.675	249	6.22E-04	208	5.20E-04	84%	Pass
19	1.742	231	5.77E-04	195	4.87E-04	84%	Pass
20	1.809	215	5.37E-04	184	4.60E-04	86%	Pass
21	1.876	197	4.92E-04	174	4.35E-04	88%	Pass
22	1.943	185	4.62E-04	162	4.05E-04	88%	Pass
23	2.010	174	4.35E-04	143	3.57E-04	82%	Pass
24	2.078	161	4.02E-04	134	3.35E-04	83%	Pass
25	2.145	146	3.65E-04	122	3.05E-04	84%	Pass
26	2.212	132	3.30E-04	112	2.80E-04	85%	Pass
27	2.279	128	3.20E-04	99	2.47E-04	77%	Pass
28	2.346	120	3.00E-04	88	2.20E-04	73%	Pass
29	2.413	115	2.87E-04	81	2.02E-04	70%	Pass
30	2.480	109	2.72E-04	75	1.87E-04	69%	Pass
31	2.547	104	2.60E-04	71	1.77E-04	68%	Pass
32	2.614	102	2.55E-04	64	1.60E-04	63%	Pass
33	2.681	96	2.40E-04	63	1.57E-04	66%	Pass
34	2.748	92	2.30E-04	59	1.47E-04	64%	Pass
35	2.815	86	2.15E-04	53	1.32E-04	62%	Pass
36	2.882	81	2.02E-04	53	1.32E-04	65%	Pass
37	2.949	78	1.95E-04	52	1.30E-04	67%	Pass
38	3.016	75	1.87E-04	49	1.22E-04	65%	Pass
39	3.083	73	1.82E-04	45	1.12E-04	62%	Pass
40	3.150	73	1.82E-04	41	1.02E-04	56%	Pass
41	3.217	71	1.77E-04	40	1.00E-04	56%	Pass
42	3.285	70	1.75E-04	40	1.00E-04	57%	Pass
43	3.352	60	1.50E-04	37	9.25E-05	62%	Pass
44	3.419	58	1.45E-04	35	8.75E-05	60%	Pass
45	3.486	55	1.37E-04	32	8.00E-05	58%	Pass
46	3.553	55	1.37E-04	31	7.75E-05	56%	Pass
47	3.620	53	1.32E-04	30	7.50E-05	57%	Pass
48	3.687	51	1.27E-04	29	7.25E-05	57%	Pass
49	3.754	48	1.20E-04	26	6.50E-05	54%	Pass
50	3.821	47	1.17E-04	25	6.25E-05	53%	Pass

Low-flow Threshold:	10%	
0.1xQ2 (Pre):	0.468	cfs
Q10 (Pre):	7.174	cfs
Ordinate #:	100	
Incremental Q (Pre):	0.06706	cfs
Total Hourly Data:	400032	hours

The proposed BMP: PASSED

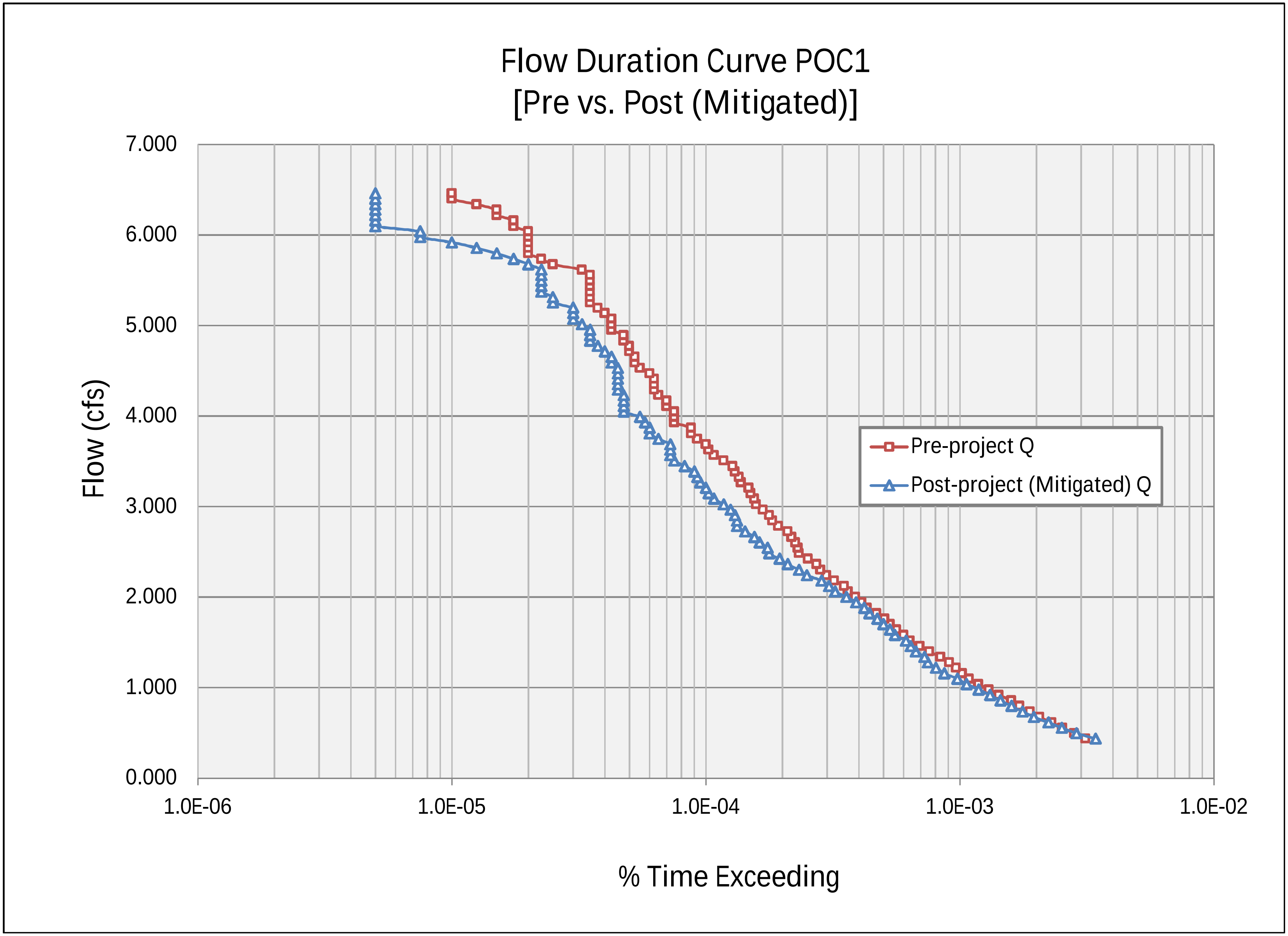
Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
51	3.888	47	1.17E-04	25	6.25E-05	53%	Pass
52	3.955	43	1.07E-04	24	6.00E-05	56%	Pass
53	4.022	41	1.02E-04	23	5.75E-05	56%	Pass
54	4.089	40	1.00E-04	19	4.75E-05	48%	Pass
55	4.156	36	9.00E-05	19	4.75E-05	53%	Pass
56	4.223	35	8.75E-05	19	4.75E-05	54%	Pass
57	4.290	32	8.00E-05	18	4.50E-05	56%	Pass
58	4.357	28	7.00E-05	18	4.50E-05	64%	Pass
59	4.425	28	7.00E-05	18	4.50E-05	64%	Pass
60	4.492	27	6.75E-05	18	4.50E-05	67%	Pass
61	4.559	25	6.25E-05	18	4.50E-05	72%	Pass
62	4.626	25	6.25E-05	17	4.25E-05	68%	Pass
63	4.693	25	6.25E-05	17	4.25E-05	68%	Pass
64	4.760	25	6.25E-05	16	4.00E-05	64%	Pass
65	4.827	23	5.75E-05	16	4.00E-05	70%	Pass
66	4.894	23	5.75E-05	14	3.50E-05	61%	Pass
67	4.961	22	5.50E-05	14	3.50E-05	64%	Pass
68	5.028	22	5.50E-05	13	3.25E-05	59%	Pass
69	5.095	22	5.50E-05	13	3.25E-05	59%	Pass
70	5.162	21	5.25E-05	13	3.25E-05	62%	Pass
71	5.229	20	5.00E-05	12	3.00E-05	60%	Pass
72	5.296	19	4.75E-05	11	2.75E-05	58%	Pass
73	5.363	19	4.75E-05	10	2.50E-05	53%	Pass
74	5.430	19	4.75E-05	10	2.50E-05	53%	Pass
75	5.497	18	4.50E-05	9	2.25E-05	50%	Pass
76	5.565	16	4.00E-05	9	2.25E-05	56%	Pass
77	5.632	16	4.00E-05	9	2.25E-05	56%	Pass
78	5.699	16	4.00E-05	9	2.25E-05	56%	Pass
79	5.766	15	3.75E-05	7	1.75E-05	47%	Pass
80	5.833	14	3.50E-05	6	1.50E-05	43%	Pass
81	5.900	12	3.00E-05	6	1.50E-05	50%	Pass
82	5.967	11	2.75E-05	4	1.00E-05	36%	Pass
83	6.034	11	2.75E-05	4	1.00E-05	36%	Pass
84	6.101	11	2.75E-05	3	7.50E-06	27%	Pass
85	6.168	11	2.75E-05	2	5.00E-06	18%	Pass
86	6.235	10	2.50E-05	2	5.00E-06	20%	Pass
87	6.302	9	2.25E-05	2	5.00E-06	22%	Pass
88	6.369	9	2.25E-05	2	5.00E-06	22%	Pass
89	6.436	9	2.25E-05	2	5.00E-06	22%	Pass
90	6.503	7	1.75E-05	2	5.00E-06	29%	Pass
91	6.570	6	1.50E-05	2	5.00E-06	33%	Pass
92	6.637	6	1.50E-05	2	5.00E-06	33%	Pass
93	6.705	6	1.50E-05	2	5.00E-06	33%	Pass
94	6.772	5	1.25E-05	2	5.00E-06	40%	Pass
95	6.839	5	1.25E-05	1	2.50E-06	20%	Pass
96	6.906	5	1.25E-05	1	2.50E-06	20%	Pass
97	6.973	5	1.25E-05	1	2.50E-06	20%	Pass
98	7.040	5	1.25E-05	1	2.50E-06	20%	Pass
99	7.107	4	1.00E-05	1	2.50E-06	25%	Pass
100	7.174	4	1.00E-05	1	2.50E-06	25%	Pass

Peak Flow Frequency Summary

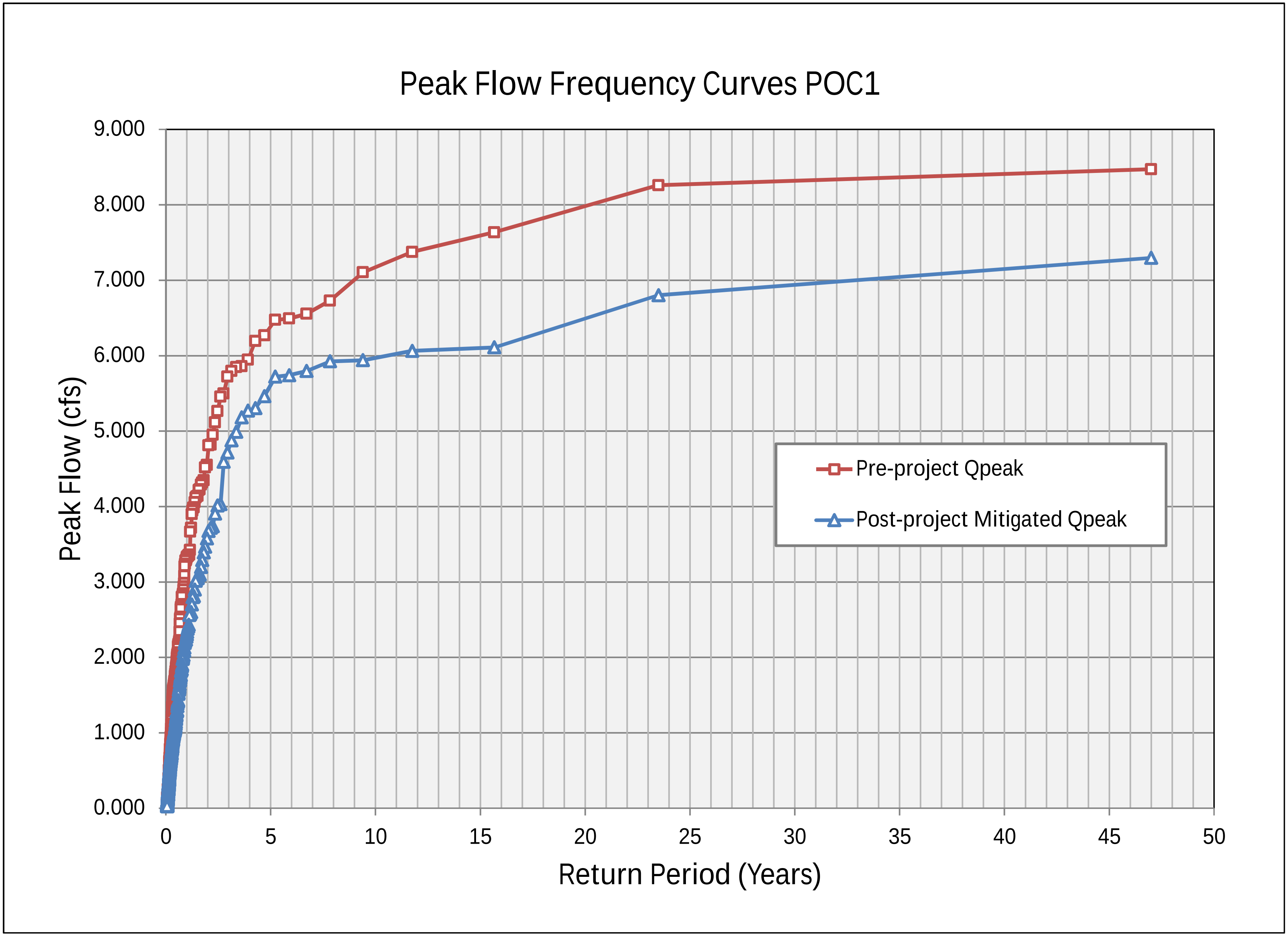
Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)	Reduction Q (cfs)
LF = 0.1xQ2	0.468	0.363	0.106
2-year	4.681	3.626	1.056
5-year	6.388	5.612	0.775
10-year	7.174	5.971	1.203

ATTACHMENT 1 - Flow Duration Curve Analysis, Plot & Table

Figures 1a & 1b– Flow Duration Curve Comparison & Peak Flow Frequency Curves Comparison



Flow Duration Curve POC1
[Pre vs. Post (Mitigated)]
Flow (cfs)
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
1.0E-06
1.0E-05
1.0E-04
1.0E-03
1.0E-02
% Time Exceeding
Pre-project Q
Post-project (Mitigated) Q



Peak Flow Frequency Curves POC1
Peak Flow (cfs)
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0
5
10
15
20
25
30
35
40
45
50
Return Period (Years)
Pre-project Qpeak
Post-project Mitigated Qpeak

ATTACHMENT 2 - Elevation vs. Area Curves vs. Discharge Curves to be used in SWMM

Elevation vs. Area

For the detention vault, a pond is used to route the hydrographs, the elevation vs area curve in the model is calculated in excel and imported into the model at a 0.10 interval range

Elevation vs Discharge

The total discharge peak flow is imported from an excel spreadsheet that calculated the elevation vs discharge of the multiple outlet system.

The orifice configurations have been selected to maximize their size while restricting flow to conform to the required 10% of the Q2 event flow. While we acknowledge that these orifices are small, to increase the size of these outlets would impact the basins' ability to restrict flow beneath the HMP thresholds, thus preventing the BMP from conforming to HMP requirements.

Vault 1					
Vault #1 Stage Storage					
depth	area	area (ac)	elevation	volume (cf)	volume (acft)
0.0	7440.0	0.1708	0.0	0	0.00
0.1	7440	0.1708	0.1	744	0.02
0.2	7440	0.1708	0.2	1,488	0.03
0.3	7440	0.1708	0.3	2,232	0.05
0.4	7440	0.1708	0.4	2,976	0.07
0.5	7440.0	0.1708	0.5	3,720	0.09
0.6	7440.0	0.1708	0.6	4,464	0.10
0.7	7440.0	0.1708	0.7	5,208	0.12
0.8	7440.0	0.1708	0.8	5,952	0.14
0.9	7440.0	0.1708	0.9	6,696	0.15
1.0	7440.0	0.1708	1.0	7,440	0.17
1.1	7440.0	0.1708	1.1	8,184	0.19
1.2	7440.0	0.1708	1.2	8,928	0.20
1.3	7440.0	0.1708	1.3	9,672	0.22
1.4	7440.0	0.1708	1.4	10,416	0.24
1.5	7440.0	0.1708	1.5	11,160	0.26
1.6	7440.0	0.1708	1.6	11,904	0.27
1.7	7440.0	0.1708	1.7	12,648	0.29
1.8	7440.0	0.1708	1.8	13,392	0.31
1.9	7440.0	0.1708	1.9	14,136	0.32
2.0	7440.0	0.1708	2.0	14,880	0.34
2.1	7440.0	0.1708	2.1	15,624	0.36
2.2	7440.0	0.1708	2.2	16,368	0.38
2.3	7440.0	0.1708	2.3	17,112	0.39
2.4	7440.0	0.1708	2.4	17,856	0.41
2.5	7440.0	0.1708	2.5	18,600	0.43
2.6	7440.0	0.1708	2.6	19,344	0.44
2.7	7440.0	0.1708	2.7	20,088	0.46
2.8	7440.0	0.1708	2.8	20,832	0.48
2.9	7440.0	0.1708	2.9	21,576	0.50
3.0	7440.0	0.1708	3.0	22,320	0.51
3.1	7440.0	0.1708	3.1	23,064	0.53
3.2	7440.0	0.1708	3.2	23,808	0.55
3.3	7440.0	0.1708	3.3	24,552	0.56
3.4	7440.0	0.1708	3.4	25,296	0.58
3.5	7440.0	0.1708	3.5	26,040	0.60
3.6	7440.0	0.1708	3.6	26,784	0.61
3.7	7440.0	0.1708	3.7	27,528	0.63
3.8	7440.0	0.1708	3.8	28,272	0.65
3.9	7440.0	0.1708	3.9	29,016	0.67
4.0	7440.0	0.1708	4.0	29,760	0.68
4.1	7440.0	0.1708	4.1	30,504	0.70
4.2	7440.0	0.1708	4.2	31,248	0.72
4.3	7440.0	0.1708	4.3	31,992	0.73
4.4	7440.0	0.1708	4.4	32,736	0.75
4.5	7440.0	0.1708	4.5	33,480	0.77
4.6	7440.0	0.1708	4.6	34,224	0.79
4.7	7440.0	0.1708	4.7	34,968	0.80
4.8	7440.0	0.1708	4.8	35,712	0.82
4.9	7440.0	0.1708	4.9	36,456	0.84
5.0	7440.0	0.1708	5.0	37,200	0.85
5.1	7440.0	0.1708	5.1	37,944	0.87
5.2	7440.0	0.1708	5.2	38,688	0.89
5.3	7440.0	0.1708	5.3	39,432	0.91
5.4	7440.0	0.1708	5.4	40,176	0.92
5.5	7440.0	0.1708	5.5	40,920	0.94
5.6	7440.0	0.1708	5.6	41,664	0.96
5.67	7440.0	0.1708	5.67	42,185	0.97
5.8	7440.0	0.1708	5.8	43,152	0.99
5.9	7440.0	0.1708	5.9	43,896	1.01
6.0	7440.0	0.1708	6.0	44,640	1.02

Vault #1 Discharge HMP Riser

Discharge vs Elevation Table

Low orifice:	1.75 "	Top orifice:	6 "
Number:	1	Number:	2
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	2.80 ft
Middle orifice:	6 "	Emergency inlet:	
number of orif:	2	Rim height:	5.00 ft
Cg-middle:	0.61	Riser Box D	3X2
invert elev:	2.05 ft	Weir Length	10.00 ft

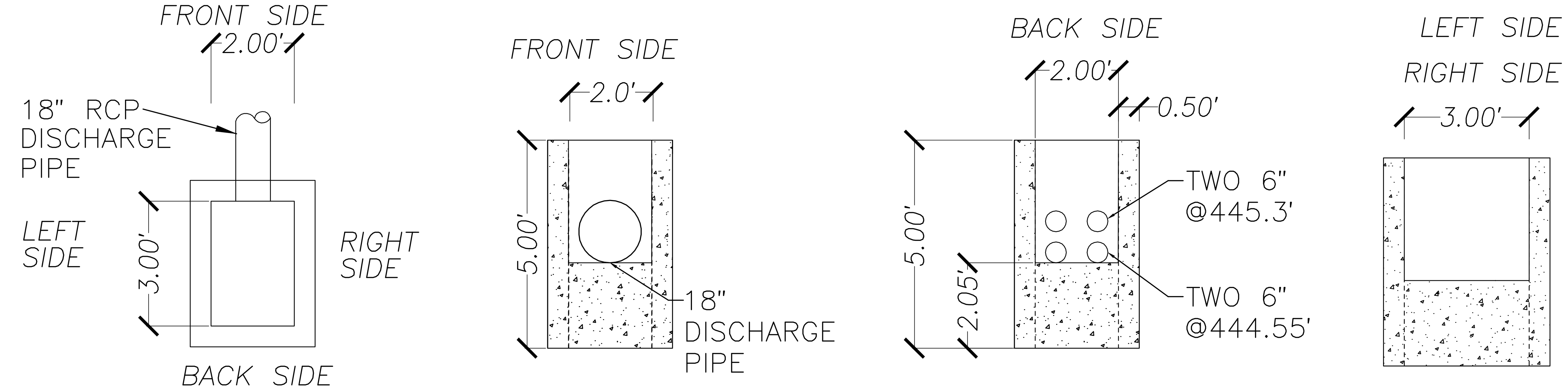
Flow to be pumped

h	H/D-low	H/D-mid	H/D-top	Qlow-orif	Qlow-weir	Qtot-low	Qmid-orif	Qmid-weir	Qtot-med	Qtop-orif	Qtop-weir	Qtot-top	Qpeak-top	Qtot
(ft)	-	-	-	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.0	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.1	0.69	0.00	0.00	0.013	0.011	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0111
0.2	1.37	0.00	0.00	0.029	0.034	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0291
0.3	2.06	0.00	0.00	0.039	0.052	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0390
0.4	2.74	0.00	0.00	0.047	0.057	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0468
0.5	3.43	0.00	0.00	0.053	0.062	0.053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0534
0.6	4.11	0.00	0.00	0.059	0.110	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0594
0.7	4.80	0.00	0.00	0.065	0.290	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0647
0.8	5.49	0.00	0.00	0.070	0.746	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0697
0.9	6.17	0.00	0.00	0.074	1.688	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0744
1.0	6.86	0.00	0.00	0.079	3.408	0.079	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0787
1.1	7.54	0.00	0.00	0.083	6.288	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0829
1.2	8.23	0.00	0.00	0.087	10.812	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0868
1.3	8.91	0.00	0.00	0.091	17.580	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0906
1.4	9.60	0.00	0.00	0.094	27.318	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0942
1.5	10.29	0.00	0.00	0.098	40.891	0.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0977
1.6	10.97	0.00	0.00	0.101	59.316	0.101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1010
1.7	11.66	0.00	0.00	0.104	83.768	0.104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1043
1.8	12.34	0.00	0.00	0.107	115.600	0.107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1075
1.9	13.03	0.00	0.00	0.111	156.348	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1105
2.0	13.71	0.00	0.00	0.114	207.749	0.114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1135
2.1	14.40	0.10	0.00	0.116	271.745	0.116	0.000	0.012	0.012	0.000	0.000	0.000	0.000	0.1285
2.2	15.09	0.30	0.00	0.119	350.503	0.119	0.000	0.103	0.103	0.000	0.000	0.000	0.000	0.2221
2.3	15.77	0.50	0.00	0.122	446.422	0.122	0.000	0.271	0.271	0.000	0.000	0.000	0.000	0.3930
2.4	16.46	0.70	0.00	0.125	562.146	0.125	0.608	0.500	0.500	0.000	0.000	0.000	0.000	0.6250
2.5	17.14	0.90	0.00	0.127	700.574	0.127	0.860	0.772	0.772	0.000	0.000	0.000	0.000	0.8997
2.6	17.83	1.10	0.00	0.130	864.878	0.130	1.053	1.068	1.053	0.000	0.000	0.000	0.000	1.1829
2.7	18.51	1.30	0.00	0.133	1058.505	0.133	1.216	1.367	1.216	0.000	0.000	0.000	0.000	1.3483
2.8	19.20	1.50	0.00	0.135	1285.200	0.135	1.359	1.653	1.359	0.000	0.000	0.000	0.000	1.4943
2.9	19.89	1.70	0.20	0.137	1549.007	0.137	1.489	1.909	1.489	0.000	0.047	0.047	0.000	1.6735
3.0	20.57	1.90	0.40	0.140	1854.288	0.140	1.608	2.123	1.608	0.000	0.178	0.178	0.000	1.9265
3.1	21.26	2.10	0.60	0.142	2205.735	0.142	1.719	2.286	1.719	0.430	0.379	0.379	0.000	2.2408
3.2	21.94	2.30	0.80	0.145	2608.377	0.145	1.824	2.396	1.824	0.745	0.632	0.632	0.000	2.6004
3.3	22.63	2.50	1.00	0.147	3067.593	0.147	1.922	2.458	1.922	0.961	0.918	0.918	0.000	2.9876
3.4	23.31	2.70	1.20	0.149	3589.130	0.149	2.016	2.482	2.016	1.137	1.218	1.137	0.000	3.3026
3.5	24.00	2.90	1.40	0.151	4179.106	0.151	2.106	2.489	2.106	1.290	1.513	1.290	0.000	3.5468
3.6	24.69	3.10	1.60	0.154	4844.028	0.154	2.192	2.510	2.192	1.426	1.786	1.426	0.000	3.7710
3.7	25.37	3.30	1.80	0.156	5590.801	0.156	2.275	2.586	2.275	1.550	2.022	1.550	0.000	3.9801
3.8	26.06	3.50	2.00	0.158	6426.741	0.158	2.354	2.770	2.354	1.665	2.211	1.665	0.000	4.1770
3.9	26.74	3.70	2.20	0.160	7359.586	0.160	2.432	3.128	2.432	1.772	2.348	1.772	0.000	4.3639
4.0	27.43	3.90	2.40	0.162	8397.508	0.162	2.506	3.742	2.506	1.874	2.433	1.874	0.000	4.5422
4.1	28.11	4.10	2.60	0.164	9549.127	0.164	2.579	4.707	2.579	1.970	2.473	1.970	0.000	4.7130
4.2	28.80	4.30	2.80	0.166	10823.518	0.166	2.650	6.136	2.650	2.061	2.486	2.061	0.000	4.8774
4.3	29.49	4.50	3.00	0.168	12230.228	0.168	2.719	8.158	2.719	2.149	2.496	2.149	0.000	5.0360
4.4	30.17	4.70	3.20	0.170	13779.284	0.170	2.786	10.921	2.786	2.234	2.538	2.234	0.000	5.1894
4.5	30.86	4.90	3.40	0.172	15481.209	0.172	2.851	14.595	2.851	2.315	2.661	2.315	0.000	5.3382
4.6	31.54	5.10	3.60	0.174	17347.028	0.174	2.915	19.366	2.915	2.393	2.923	2.393	0.000	5.4827
4.7	32.23	5.30	3.80	0.176	19388.286	0.176	2.978	25.447	2.978	2.469	3.398	2.469	0.000	5.6233
4.8	32.91	5.50	4.00	0.178	21617.054	0.178	3.040	33.070	3.040	2.543	4.174	2.543	0.000	5.7603
4.9	33.60	5.70	4.20	0.180	24045.946	0.180	3.100	42.492	3.100	2.615	5.356	2.615	0.000	5.8940
5.0	34.29	5.90	4.40	0.181	26688.127	0.181	3.159	53.998	3.159	2.684	7.064	2.684	0.000	6.0247
5.1	34.97	6.10	4.60	0.183	29557.329	0.183	3.217	67.894	3.217	2.752	9.437	2.752	1.053	7.2055
5.2	35.66	6.30	4.80	0.185	32667.857	0.185	3.274	84.517	3.274	2.819	12.633	2.819	2.978	9.2560
5.3	36.34	6.50	5.00	0.187	36034.605	0.187	3.330	104.231	3.330	2.884	16.830	2.884	5.472	11.8718
5.4	37.03	6.70	5.20	0.189	39673.069	0.189	3.385	127.430	3.385	2.947	22.229	2.947	8.424	14.9446
5.5	37.71	6.90	5.40	0.190	43599.355	0.190	3.439	154.538	3.439	3.009	29.050	3.009	11.773	18.4116
5.6	38.40	7.10	5.60	0.192	47830.191	0.192	3.492	186.011	3.492	3.070	37.539	3.070	15.476	22.2305
5.70	39.09	7.30	5.80	0.194	52382.944	0.194	3.545	222.338	3.545	3.129	47.966	3.129	19.503	26.3705
5.8	39.77	7.50	6.00	0.196	57275.625	0.196	3.596	264.040	3.596	3.188	60.626	3.188	23.828	30.8075
5.9	40.46	7.70	6.20	0.197	62526.905	0.197	3.647	311.676	3.647	3.245	75.842	3.245	28.432	35.5221
6.0	41.14	7.90	6.40	0.199	68156.127	0.199	3.698	365.837	3.698	3.302	93.963	3.302	33.300	40.4985

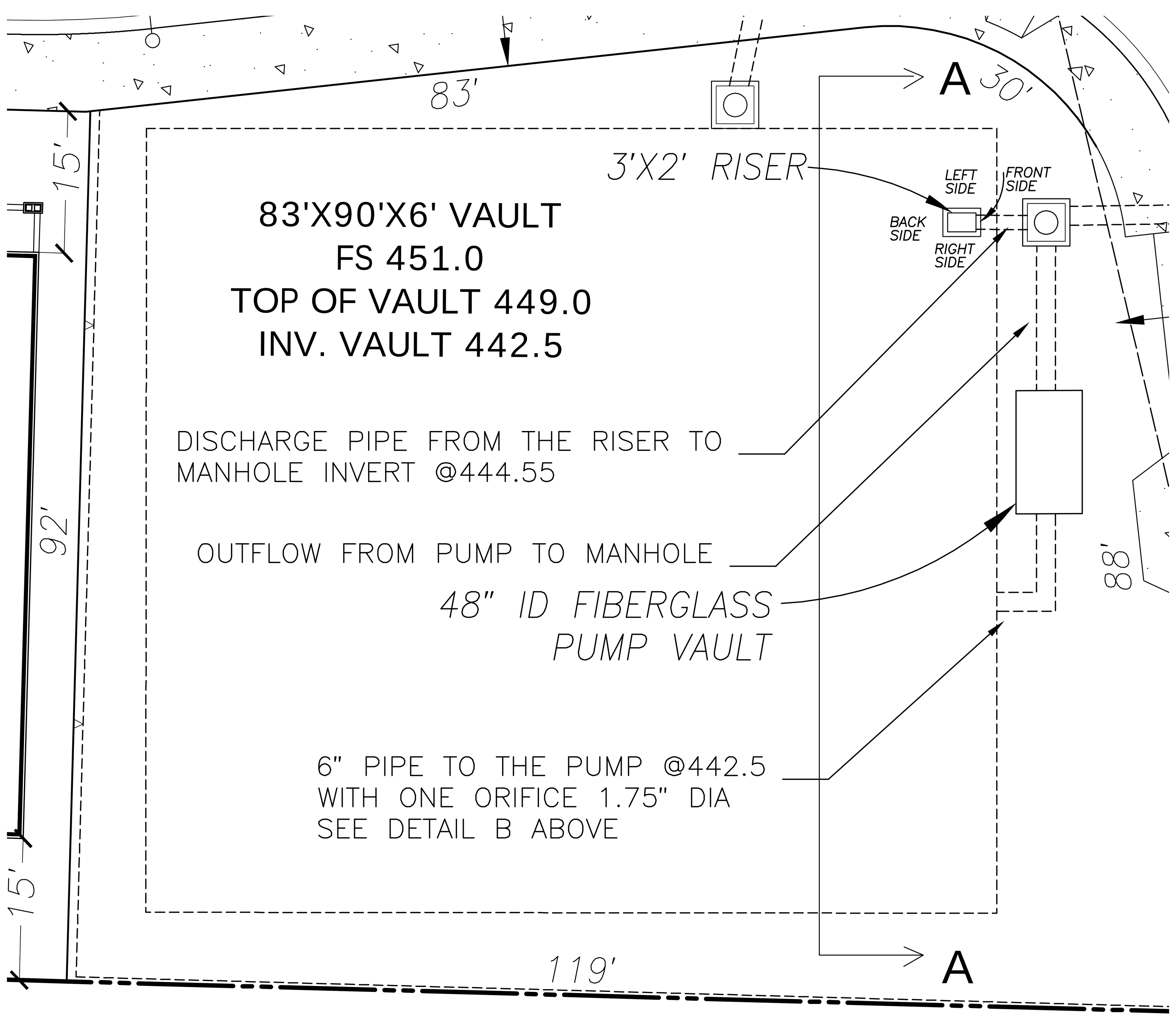
ATTACHMENT 3 – Vault and Riser Detail

DETENTION VAULT 1
LOW ORIFICE DETAIL (B)

SCALE 1"=0.5'

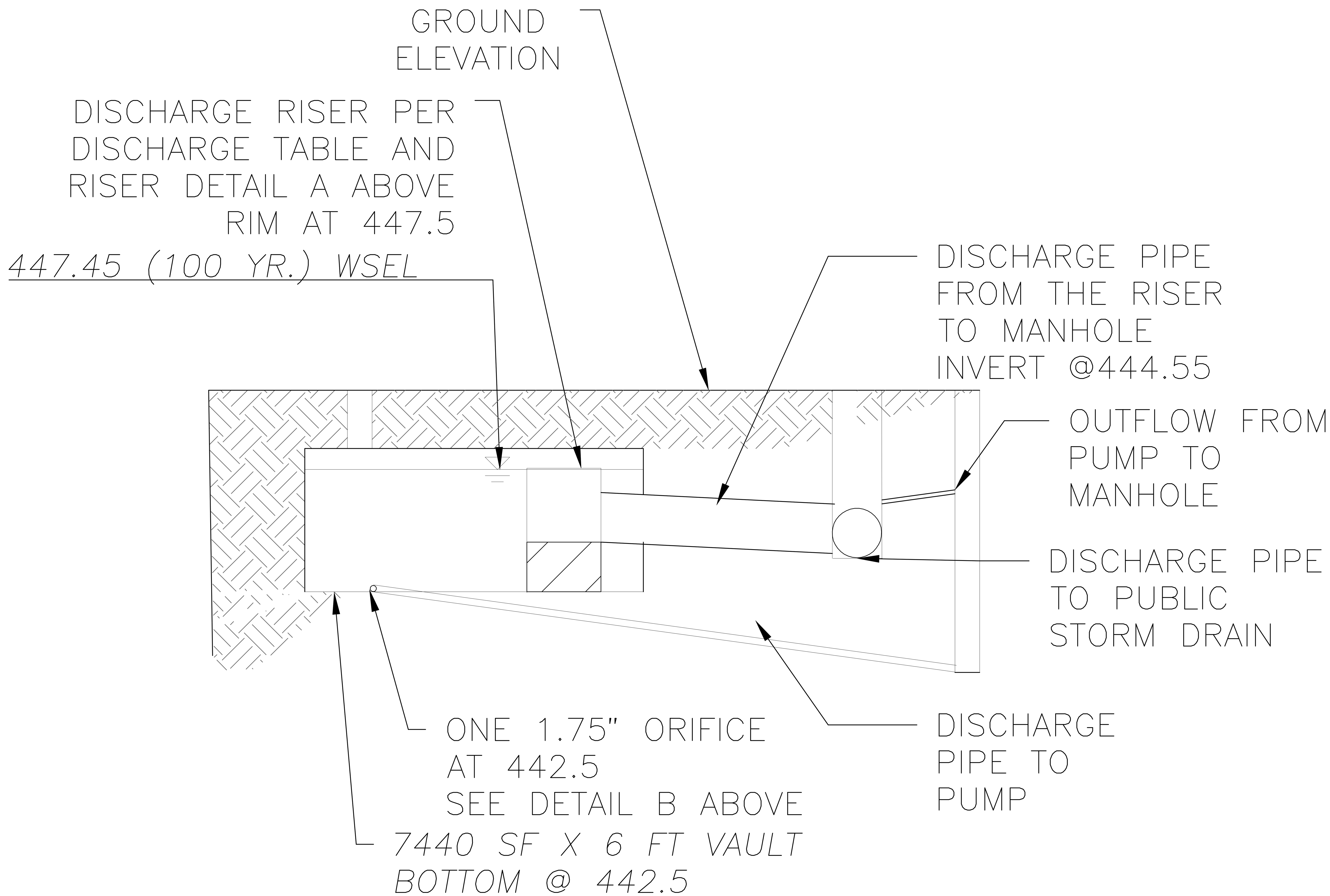


DETENTION VAULT 1
RISER DETAIL (A)



DETENTION VAULT 1
PLAN VIEW

SCALE 1" =10'



DETENTION VAULT 1
DETAIL A-A

NOT TO SCALE

VAULT OUTLET STRUCTURE DETAILS
HARMON OAKS

CITY OF POWAY, CALIFORNIA

ATTACHMENT 4 - SWMM Input and Output Data (pre-deveoped and Proposed Models)

ATTACHMENT 5 - SWMM Explanation of Significant Variables

In the prior section the viewer can view the associated input and output parameters within the EPA-SWMM Model in both pre-development and post-development conditions. Each portion, i.e., sub-catchments, outfalls, storage units, weir as a discharge, and outfalls (point of compliance), are also shown.

Variables for modeling are associated with typical recommended values by the EPA-SWMM model. Recommended values for the SWMM model have been attained from City of Poway BMP Design Manual-Appendix G (San Diego County HMP Permit for the SWMM Model).

Soil characteristics of the existing soils were determined from the USGS sources.

Description of model parameters and assumptions:

N-Imperv – Manning's N for impervious surfaces

 0.012 (typical)

N-Perv – Manning's N for pervious surfaces

 0.15 (typical)

Dstore-Imperv – Depth of depression storage on impervious area (in)

 0.05 (typical)

Dstore-Perv – Depth of depression storage on pervious area (in)

 0.1 (typical)

%Zero-Imperv – Percentage of impervious area with no depression storage (%)

 25 (typical)

Suction Head – Soil capillary suction head (in)

Conductivity – Soil saturated hydraulic conductivity (in/hr)

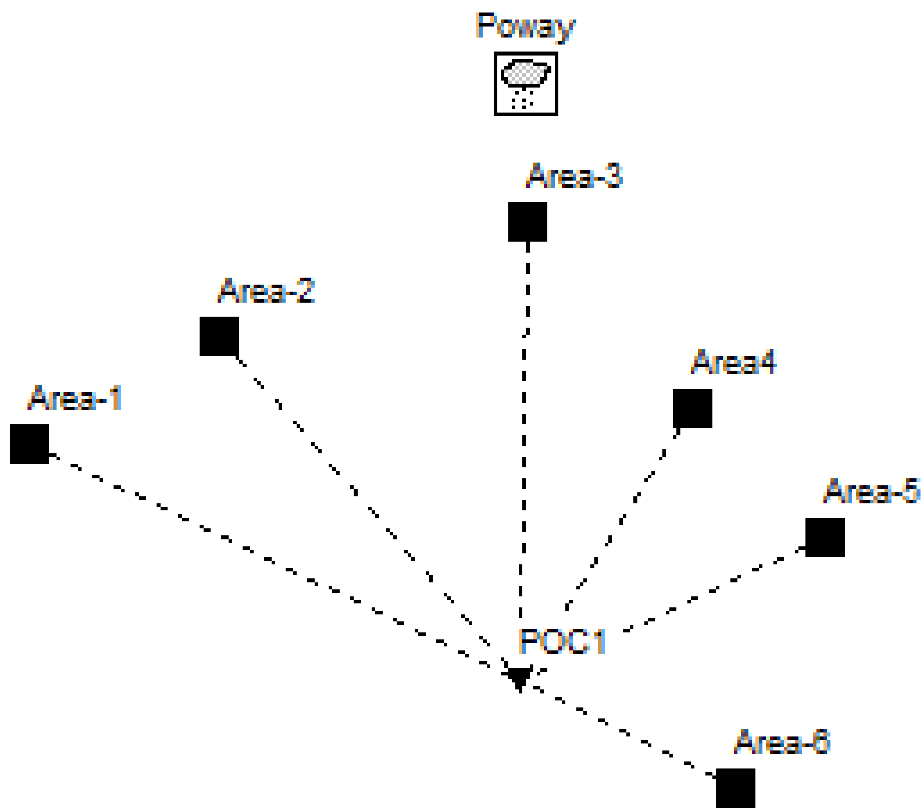
 -75% of these values if subcatchment has concrete or asphalt

Initial Deficit – Initial moisture deficit (fraction)

Soil Type	Suction Head	Conductivity	Initial Deficit
A	1.5	0.3	0.30
B	3	0.2	0.31
C	6	0.1	0.32
D	9	0.025	0.33

NOTE: These values are based on City Poway's BMP Manual in Appendix G.

POC 1 – Pre-Developed Condition



```
[TITLE]
;;Project Title/Notes
Harmon Oaks,Pre-develped Conditions

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           10/04/1962
START_TIME           15:00:00
REPORT_START_DATE    10/04/1962
REPORT_START_TIME    15:00:00
END_DATE             05/23/2008
END_TIME             15:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.566
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.07   0.1    0.13   0.17   0.19   0.22   0.24   0.22   0.19   0.13   0.09   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
Poway            INTENSITY 1:00     1.0      TIMESERIES Poway
```

```
[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Offsite slope drains through the site and not to be disturbed in proposed conditions-Soil Type D
;(Runoff to be bypassed in proposed conditions)
Area-3           Poway            POC1             0.98     0        50       10.28    0
;Offsite Developed area not to be disturbed in proposed conditions- Soil Type D
;(Offsite runoff not to be commingled with the on site flows in proposed conditions)
Area4            Poway            POC1             0.44     79.2     51       1.46     0
;Area to be disturbed in the proposed conditions- Soil Type D
;(Southern Project Area)
Area-5           Poway            POC1             0.475    0        94       2.32     0
;Area to be disturbed in the proposed conditions- Soil Type D
Area-1           Poway            POC1             7.819    0        500      5.49     0
;Existing Development not to be disturbed in proposed conditions - Soil T
;(Offsite area and A historic home to remain- Runoff to be bypassed in proposed conditions)
Area-2           Poway            POC1             2.86     69.1     100      1.48     0
;Offsite and onsite natural slopes not to be disturbed in proposed conditions- Soil Type A
;(drains away from the proposed development)
Area-6           Poway            POC1             1.11     0        123      0.51     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
Area-3           0.012      0.15       0.05       0.1        25         OUTLET
Area4            0.012      0.15       0.05       0.1        25         OUTLET
Area-5           0.012      0.15       0.05       0.1        25         OUTLET
Area-1           0.012      0.15       0.05       0.1        25         OUTLET
Area-2           0.012      0.15       0.05       0.1        25         OUTLET
Area-6           0.012      0.15       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
Area-3           9          0.025      0.33
Area4            9          0.01875    0.33
Area-5           9          0.01875    0.33
Area-1           9          0.01875    0.33
Area-2           9          0.01875    0.33
Area-6           1.5        0.3        0.3

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC1             0          FREE                        NO

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Stage-Discharge  Rating     0.00       0.0000
Stage-Discharge             0.05       0.0021
```

Stage-Discharge	0.10	0.0064
Stage-Discharge	0.15	0.0088
Stage-Discharge	0.20	0.0106
Stage-Discharge	0.25	0.0122
Stage-Discharge	0.30	0.0136
Stage-Discharge	0.35	0.0148
Stage-Discharge	0.40	0.0160
Stage-Discharge	0.45	0.0171
Stage-Discharge	0.50	0.0181
Stage-Discharge	0.55	0.0190
Stage-Discharge	0.60	0.0200
Stage-Discharge	0.65	0.0208
Stage-Discharge	0.70	0.0217
Stage-Discharge	0.75	0.0225
Stage-Discharge	0.80	0.0233
Stage-Discharge	0.85	0.0240
Stage-Discharge	0.90	0.0247
Stage-Discharge	0.95	0.0254
Stage-Discharge	1.00	0.0261
Stage-Discharge	1.05	0.0268
Stage-Discharge	1.10	0.0275
Stage-Discharge	1.15	0.0281
Stage-Discharge	1.20	0.0287
Stage-Discharge	1.25	0.0293
Stage-Discharge	1.30	0.0300
Stage-Discharge	1.35	0.0305
Stage-Discharge	1.40	0.0311
Stage-Discharge	1.45	0.0317
Stage-Discharge	1.50	0.0322
Stage-Discharge	1.55	0.0328
Stage-Discharge	1.60	0.0333
Stage-Discharge	1.65	0.0339
Stage-Discharge	1.70	0.0344
Stage-Discharge	1.75	0.0349
Stage-Discharge	1.80	0.0354
Stage-Discharge	1.85	0.0480
Stage-Discharge	1.90	0.0833
Stage-Discharge	1.95	0.1398
Stage-Discharge	2.00	0.2156
Stage-Discharge	2.05	0.3088
Stage-Discharge	2.10	0.4174
Stage-Discharge	2.15	0.5390
Stage-Discharge	2.20	0.6713
Stage-Discharge	2.25	0.8120
Stage-Discharge	2.30	0.9584
Stage-Discharge	2.35	1.0935
Stage-Discharge	2.40	1.1783
Stage-Discharge	2.45	1.2572
Stage-Discharge	2.50	1.3314
Stage-Discharge	2.55	1.4016
Stage-Discharge	2.60	1.4684
Stage-Discharge	2.65	1.5382

Stage-Discharge	2.70	1.6168
Stage-Discharge	2.75	1.7037
Stage-Discharge	2.80	1.7983
Stage-Discharge	2.85	1.8996
Stage-Discharge	2.90	2.0070
Stage-Discharge	2.95	2.1194
Stage-Discharge	3.00	2.2357
Stage-Discharge	3.05	2.3548
Stage-Discharge	3.10	2.4757
Stage-Discharge	3.15	2.5897
Stage-Discharge	3.20	2.6776
Stage-Discharge	3.25	2.7616
Stage-Discharge	3.30	2.8422
Stage-Discharge	3.35	2.9200
Stage-Discharge	3.40	2.9953
Stage-Discharge	3.45	3.0684
Stage-Discharge	3.50	3.1394
Stage-Discharge	3.55	3.2086
Stage-Discharge	3.60	3.2761
Stage-Discharge	3.65	3.3420
Stage-Discharge	3.70	3.4065
Stage-Discharge	3.75	3.4697
Stage-Discharge	3.80	3.5316
Stage-Discharge	3.85	3.5924
Stage-Discharge	3.90	3.6520
Stage-Discharge	3.95	3.7107
Stage-Discharge	4.00	3.7683
Stage-Discharge	4.05	3.8250
Stage-Discharge	4.10	3.8808
Stage-Discharge	4.15	3.9358
Stage-Discharge	4.20	3.9899
Stage-Discharge	4.25	4.0434
Stage-Discharge	4.30	4.0960
Stage-Discharge	4.35	4.1480
Stage-Discharge	4.40	4.1993
Stage-Discharge	4.45	4.2500
Stage-Discharge	4.50	4.3000
Stage-Discharge	4.55	4.3494
Stage-Discharge	4.60	4.3983
Stage-Discharge	4.65	4.4466
Stage-Discharge	4.70	4.4943
Stage-Discharge	4.75	4.5416
Stage-Discharge	4.80	4.5883
Stage-Discharge	4.85	4.6346
Stage-Discharge	4.90	4.6803
Stage-Discharge	4.95	4.7257
Stage-Discharge	5.00	4.7706
Stage-Discharge	5.05	5.1129
Stage-Discharge	5.10	5.7015
Stage-Discharge	5.15	6.4503
Stage-Discharge	5.20	7.3287
Stage-Discharge	5.25	8.3188

```
Stage-Discharge              5.30       9.4087
Stage-Discharge              5.35       10.5895
Stage-Discharge              5.40       11.8546
Stage-Discharge              5.45       13.1984
Stage-Discharge              5.50       14.6163
Stage-Discharge              5.55       16.1046
Stage-Discharge              5.60       17.6600
Stage-Discharge              5.65       19.2796
Stage-Discharge              5.70       20.9608
Stage-Discharge              5.75       22.7015
Stage-Discharge              5.80       24.4996
Stage-Discharge              5.85       26.3532
Stage-Discharge              5.90       28.2608
Stage-Discharge              5.95       30.2207
Stage-Discharge              6.00       32.2317
;
Stage-Storage    Storage     0.00       7200
Stage-Storage                0.05       7200
Stage-Storage                0.10       7200
Stage-Storage                0.15       7200
Stage-Storage                0.20       7200
Stage-Storage                0.25       7200
Stage-Storage                0.30       7200
Stage-Storage                0.35       7200
Stage-Storage                0.40       7200
Stage-Storage                0.45       7200
Stage-Storage                0.50       7200
Stage-Storage                0.55       7200
Stage-Storage                0.60       7200
Stage-Storage                0.65       7200
Stage-Storage                0.70       7200
Stage-Storage                0.75       7200
Stage-Storage                0.80       7200
Stage-Storage                0.85       7200
Stage-Storage                0.90       7200
Stage-Storage                0.95       7200
Stage-Storage                1.00       7200
Stage-Storage                1.05       7200
Stage-Storage                1.10       7200
Stage-Storage                1.15       7200
Stage-Storage                1.20       7200
Stage-Storage                1.25       7200
Stage-Storage                1.30       7200
Stage-Storage                1.35       7200
Stage-Storage                1.40       7200
Stage-Storage                1.45       7200
Stage-Storage                1.50       7200
Stage-Storage                1.55       7200
Stage-Storage                1.60       7200
Stage-Storage                1.65       7200
Stage-Storage                1.70       7200
Stage-Storage                1.75       7200
```

Stage-Storage	1.80	7200
Stage-Storage	1.85	7200
Stage-Storage	1.90	7200
Stage-Storage	1.95	7200
Stage-Storage	2.00	7200
Stage-Storage	2.05	7200
Stage-Storage	2.10	7200
Stage-Storage	2.15	7200
Stage-Storage	2.20	7200
Stage-Storage	2.25	7200
Stage-Storage	2.30	7200
Stage-Storage	2.35	7200
Stage-Storage	2.40	7200
Stage-Storage	2.45	7200
Stage-Storage	2.50	7200
Stage-Storage	2.55	7200
Stage-Storage	2.60	7200
Stage-Storage	2.65	7200
Stage-Storage	2.70	7200
Stage-Storage	2.75	7200
Stage-Storage	2.80	7200
Stage-Storage	2.85	7200
Stage-Storage	2.90	7200
Stage-Storage	2.95	7200
Stage-Storage	3.00	7200
Stage-Storage	3.05	7200
Stage-Storage	3.10	7200
Stage-Storage	3.15	7200
Stage-Storage	3.20	7200
Stage-Storage	3.25	7200
Stage-Storage	3.30	7200
Stage-Storage	3.35	7200
Stage-Storage	3.40	7200
Stage-Storage	3.45	7200
Stage-Storage	3.50	7200
Stage-Storage	3.55	7200
Stage-Storage	3.60	7200
Stage-Storage	3.65	7200
Stage-Storage	3.70	7200
Stage-Storage	3.75	7200
Stage-Storage	3.80	7200
Stage-Storage	3.85	7200
Stage-Storage	3.90	7200
Stage-Storage	3.95	7200
Stage-Storage	4.00	7200
Stage-Storage	4.05	7200
Stage-Storage	4.10	7200
Stage-Storage	4.15	7200
Stage-Storage	4.20	7200
Stage-Storage	4.25	7200
Stage-Storage	4.30	7200
Stage-Storage	4.35	7200

```
Stage-Storage              4.40       7200
Stage-Storage              4.45       7200
Stage-Storage              4.50       7200
Stage-Storage              4.55       7200
Stage-Storage              4.60       7200
Stage-Storage              4.65       7200
Stage-Storage              4.70       7200
Stage-Storage              4.75       7200
Stage-Storage              4.80       7200
Stage-Storage              4.85       7200
Stage-Storage              4.90       7200
Stage-Storage              4.95       7200
Stage-Storage              5.00       7200
Stage-Storage              5.05       7200
Stage-Storage              5.10       7200
Stage-Storage              5.15       7200
Stage-Storage              5.20       7200
Stage-Storage              5.25       7200
Stage-Storage              5.30       7200
Stage-Storage              5.35       7200
Stage-Storage              5.40       7200
Stage-Storage              5.45       7200
Stage-Storage              5.50       7200
Stage-Storage              5.55       7200
Stage-Storage              5.60       7200
Stage-Storage              5.65       7200
Stage-Storage              5.70       7200
Stage-Storage              5.75       7200
Stage-Storage              5.80       7200
Stage-Storage              5.85       7200
Stage-Storage              5.90       7200
Stage-Storage              5.95       7200
Stage-Storage              6.00       7200

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
Poway            FILE "R:\1713\Hyd\HMP\Calcs\SWMM\02nd 12-01-2022\poway.dat"

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
```

```
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC1             4925.865           5453.048

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Area-3           4958.814           7767.710
Area4            5783.451           6830.986
Area-5           6461.268           6188.380
Area-1           2447.034           6652.542
Area-2           3397.887           7191.901
Area-6           6004.942           4917.628

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Poway            4975.288           8443.163
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

Harmon Oaks,Pre-develped Conditions


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 10/04/1962 15:00:00
Ending Date .............. 05/23/2008 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       636.511       558.180
Evaporation Loss .........        44.910        39.383
Infiltration Loss ........       418.229       366.760
Surface Runoff ...........       177.857       155.969
Final Storage ............         0.016         0.014
Continuity Error (%) .....        -0.707


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       177.855        57.957
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
```

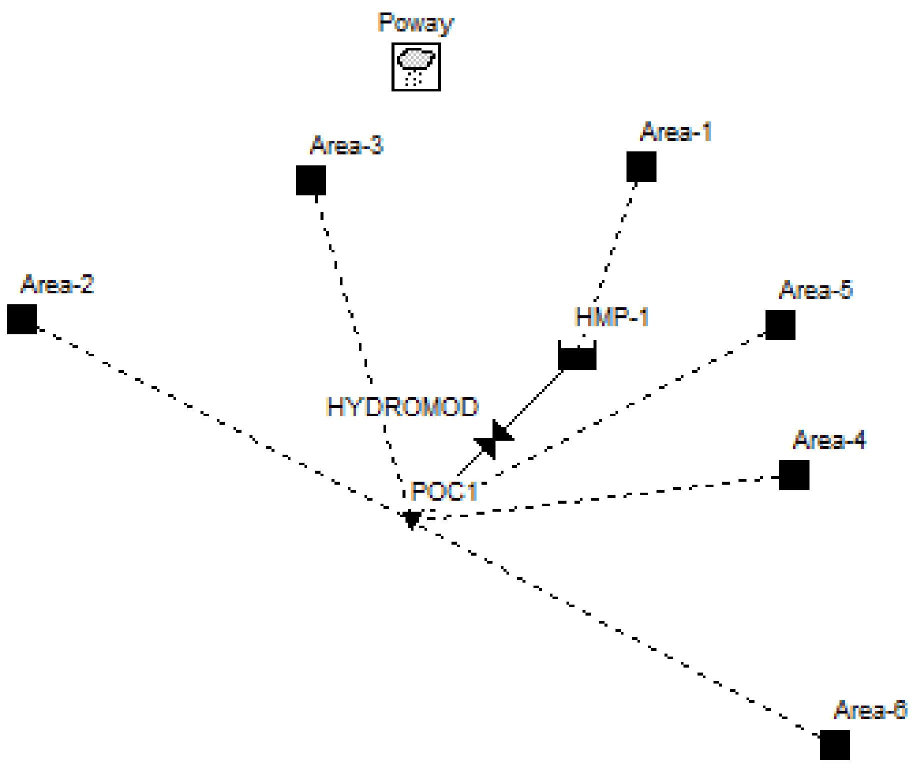
External Outflow	177.855	57.957
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
Area-3	558.18	0.00	21.83	454.01	0.00	85.57	85.57	2.28	0.61	0.153
Area4	558.18	0.00	89.18	86.48	362.80	25.28	388.08	4.64	0.35	0.695
Area-5	558.18	0.00	26.67	421.56	0.00	114.54	114.54	1.48	0.34	0.205
Area-1	558.18	0.00	28.00	427.10	0.00	107.64	107.64	22.85	4.90	0.193
Area-2	558.18	0.00	86.07	132.24	310.51	32.94	343.45	26.67	2.12	0.615
Area-6	558.18	0.00	0.45	556.62	0.00	1.23	1.23	0.04	0.22	0.002

Analysis begun on: Thu Dec 1 13:09:13 2022
Analysis ended on: Thu Dec 1 13:09:30 2022
Total elapsed time: 00:00:17

POC 1 – Developed Condition



```
[TITLE]
;;Project Title/Notes
Harmon Oaks,Post-develped Conditions

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           10/04/1962
START_TIME           15:00:00
REPORT_START_DATE    10/04/1962
REPORT_START_TIME    15:00:00
END_DATE             05/23/2008
END_TIME             15:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.566
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.07   0.1    0.13   0.17   0.19   0.22   0.24   0.22   0.19   0.13   0.09   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
Poway            INTENSITY 1:00     1.0      TIMESERIES Poway
```

```
[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Offsite slope drains through the site and not to be disturbed in proposed conditions+ Self Mitigating proposed  slopes-Soil Type D
;Runoff to be bypassed
Area-3           Poway            POC1             0.98     0        50       10.28    0
;Offsite Developed area not to be disturbed in proposed conditions- Soil Type D
;(Offsite runoff not to be commingled with the on site flows in proposed conditions)
Area-4           Poway            POC1             0.44     79.2     51       1.46     0
;Disturbed Area - Soil Type D
; (Southern Project Area)
Area-5           Poway            POC1             0.475    55.1     94       2.32     0
;Disturbed area- Soil Type D
;(Northern Project Area)
Area-1           Poway            HMP-1            7.819    66.4     341      4.65     0
;Existing Development not to be disturbed in proposed conditions - Soil Type D
;Offsite area and historic home to remain- Runoff to be bypassed in proposed conditions
Area-2           Poway            POC1             2.86     69.1     100      1.48     0
;Offsite and onsite natural slopes not to be disturbed in proposed conditions- Soil Type A
;(drains away from the proposed development)
Area-6           Poway            POC1             1.11     0        123      0.51     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
Area-3           0.012      0.15       0.05       0.1        25         OUTLET
Area-4           0.012      0.15       0.05       0.1        25         OUTLET
Area-5           0.012      0.15       0.05       0.1        25         OUTLET
Area-1           0.012      0.15       0.05       0.1        25         OUTLET
Area-2           0.012      0.15       0.05       0.1        25         OUTLET
Area-6           0.012      0.15       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
Area-3           9          0.025      0.33
Area-4           9          0.01875    0.33
Area-5           9          0.01875    0.33
Area-1           9          0.01875    0.33
Area-2           9          0.01875    0.33
Area-6           1.5        0.3        0.3

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC1             0          FREE                        NO
100Year-Vault-discharge 0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------          -------- --------
```

```
HMP-1            0        5.67       0          TABULAR    Stage-Storage                0        0
Detention-Node-74 0        6          0          TABULAR    Stage-Storage                0        0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ---------- --------
HYDROMOD         HMP-1            POC1             0          TABULAR/HEAD    Stage-Discharge             NO
vault-OutletStructure Detention-Node-74 100Year-Vault-discharge 0          TABULAR/DEPTH   Stage-Discharge             NO

[INFLOWS]
;;Node           Constituent      Time Series      Type     Mfactor  Sfactor  Baseline Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
Detention-Node-74 FLOW             100-Year-Inflow-Hydrograph FLOW     1.0      1.0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Stage-Discharge  Rating     0.0        0.0000
Stage-Discharge             0.1        0.0111
Stage-Discharge             0.2        0.0291
Stage-Discharge             0.3        0.0390
Stage-Discharge             0.4        0.0468
Stage-Discharge             0.5        0.0534
Stage-Discharge             0.6        0.0594
Stage-Discharge             0.7        0.0647
Stage-Discharge             0.8        0.0697
Stage-Discharge             0.9        0.0744
Stage-Discharge             1.0        0.0787
Stage-Discharge             1.1        0.0829
Stage-Discharge             1.2        0.0868
Stage-Discharge             1.3        0.0906
Stage-Discharge             1.4        0.0942
Stage-Discharge             1.5        0.0977
Stage-Discharge             1.6        0.1010
Stage-Discharge             1.7        0.1043
Stage-Discharge             1.8        0.1075
Stage-Discharge             1.9        0.1105
Stage-Discharge             2.0        0.1135
Stage-Discharge             2.1        0.1285
Stage-Discharge             2.2        0.2221
Stage-Discharge             2.3        0.3930
Stage-Discharge             2.4        0.6250
Stage-Discharge             2.5        0.8997
Stage-Discharge             2.6        1.1829
Stage-Discharge             2.7        1.3483
Stage-Discharge             2.8        1.4943
Stage-Discharge             2.9        1.6735
Stage-Discharge             3.0        1.9265
Stage-Discharge             3.1        2.2408
Stage-Discharge             3.2        2.6004
Stage-Discharge             3.3        2.9876
Stage-Discharge             3.4        3.3026
```

```
Stage-Discharge             3.5        3.5468
Stage-Discharge             3.6        3.7710
Stage-Discharge             3.7        3.9801
Stage-Discharge             3.8        4.1770
Stage-Discharge             3.9        4.3639
Stage-Discharge             4.0        4.5422
Stage-Discharge             4.1        4.7130
Stage-Discharge             4.2        4.8774
Stage-Discharge             4.3        5.0360
Stage-Discharge             4.4        5.1894
Stage-Discharge             4.5        5.3382
Stage-Discharge             4.6        5.4827
Stage-Discharge             4.7        5.6233
Stage-Discharge             4.8        5.7603
Stage-Discharge             4.9        5.8940
Stage-Discharge             5.0        6.0247
Stage-Discharge             5.1        7.2055
Stage-Discharge             5.2        9.2560
Stage-Discharge             5.3        11.8718
Stage-Discharge             5.4        14.9446
Stage-Discharge             5.5        18.4116
Stage-Discharge             5.6        22.2305
Stage-Discharge             5.70       26.3705
Stage-Discharge             5.8        30.8075
Stage-Discharge             5.9        35.5221
Stage-Discharge             6.0        40.4985
;
Stage-Storage    Storage    0.0        7440
Stage-Storage               6          7440

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
Poway            FILE "R:\1713\Hyd\HMP\Calcs\SWMM\02nd 12-01-2022\poway.dat"
;
100-Year-Inflow-Hydrograph 10/4/1962  15:00      0
100-Year-Inflow-Hydrograph 10/4/1962  15:08      0.9
100-Year-Inflow-Hydrograph 10/4/1962  15:16      0.9
100-Year-Inflow-Hydrograph 10/4/1962  15:24      1
100-Year-Inflow-Hydrograph 10/4/1962  15:32      1
100-Year-Inflow-Hydrograph 10/4/1962  15:40      1
100-Year-Inflow-Hydrograph 10/4/1962  15:48      1
100-Year-Inflow-Hydrograph 10/4/1962  15:56      1.1
100-Year-Inflow-Hydrograph 10/4/1962  16:04      1.1
100-Year-Inflow-Hydrograph 10/4/1962  16:12      1.1
100-Year-Inflow-Hydrograph 10/4/1962  16:20      1.2
100-Year-Inflow-Hydrograph 10/4/1962  16:28      1.2
100-Year-Inflow-Hydrograph 10/4/1962  16:36      1.2
100-Year-Inflow-Hydrograph 10/4/1962  16:44      1.3
100-Year-Inflow-Hydrograph 10/4/1962  16:52      1.3
100-Year-Inflow-Hydrograph 10/4/1962  17:00      1.4
100-Year-Inflow-Hydrograph 10/4/1962  17:08      1.4
```

```
100-Year-Inflow-Hydrograph 10/4/1962  17:16      1.5
100-Year-Inflow-Hydrograph 10/4/1962  17:24      1.6
100-Year-Inflow-Hydrograph 10/4/1962  17:32      1.7
100-Year-Inflow-Hydrograph 10/4/1962  17:40      1.8
100-Year-Inflow-Hydrograph 10/4/1962  17:48      1.9
100-Year-Inflow-Hydrograph 10/4/1962  17:56      2
100-Year-Inflow-Hydrograph 10/4/1962  18:04      2.2
100-Year-Inflow-Hydrograph 10/4/1962  18:12      2.4
100-Year-Inflow-Hydrograph 10/4/1962  18:20      2.7
100-Year-Inflow-Hydrograph 10/4/1962  18:28      2.9
100-Year-Inflow-Hydrograph 10/4/1962  18:36      3.6
100-Year-Inflow-Hydrograph 10/4/1962  18:44      4.1
100-Year-Inflow-Hydrograph 10/4/1962  18:52      6
100-Year-Inflow-Hydrograph 10/4/1962  19:00      8.1
100-Year-Inflow-Hydrograph 10/4/1962  19:08      30.6
100-Year-Inflow-Hydrograph 10/4/1962  19:16      4.8
100-Year-Inflow-Hydrograph 10/4/1962  19:24      3.2
100-Year-Inflow-Hydrograph 10/4/1962  19:32      2.5
100-Year-Inflow-Hydrograph 10/4/1962  19:40      2.1
100-Year-Inflow-Hydrograph 10/4/1962  19:48      1.8
100-Year-Inflow-Hydrograph 10/4/1962  19:56      1.6
100-Year-Inflow-Hydrograph 10/4/1962  20:04      1.5
100-Year-Inflow-Hydrograph 10/4/1962  20:12      1.4
100-Year-Inflow-Hydrograph 10/4/1962  20:20      1.3
100-Year-Inflow-Hydrograph 10/4/1962  20:28      1.2
100-Year-Inflow-Hydrograph 10/4/1962  20:36      1.1
100-Year-Inflow-Hydrograph 10/4/1962  20:44      1.1
100-Year-Inflow-Hydrograph 10/4/1962  20:52      1
100-Year-Inflow-Hydrograph 10/4/1962  21:00      1
100-Year-Inflow-Hydrograph 10/4/1962  21:08      0

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC1             4925.865           5453.048
100Year-Vault-discharge 13019.900          4895.522
HMP-1            5996.705           6540.362
Detention-Node-74 12930.348          6348.259

[VERTICES]
```

```
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Area-3           4255.319           7730.496
Area-4           7447.183           5774.648
Area-5           7359.155           6760.563
Area-1           6436.170           7819.149
Area-2           2340.426           6790.780
Area-6           7728.873           3978.873

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Poway            4975.288           8443.163
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

Harmon Oaks,Post-develped Conditions


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 10/04/1962 15:00:00
Ending Date .............. 05/23/2008 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       636.511       558.180
Evaporation Loss .........        80.385        70.493
Infiltration Loss ........       223.125       195.666
Surface Runoff ...........       337.826       296.252
Final Storage ............         0.048         0.042
Continuity Error (%) .....        -0.766


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       337.817       110.083
```

Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	1.287	0.419
External Outflow	339.034	110.479
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.017	0.006
Continuity Error (%)	0.016	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
Area-3	558.18	0.00	21.83	454.01	0.00	85.57	85.57	2.28	0.61	0.153
Area-4	558.18	0.00	89.18	86.48	362.80	25.28	388.08	4.64	0.35	0.695
Area-5	558.18	0.00	67.66	186.68	256.27	54.56	310.83	4.01	0.37	0.557
Area-1	558.18	0.00	79.96	141.93	303.05	38.17	341.22	72.45	6.05	0.611
Area-2	558.18	0.00	86.07	132.24	310.51	32.94	343.45	26.67	2.12	0.615
Area-6	558.18	0.00	0.45	556.62	0.00	1.23	1.23	0.04	0.22	0.002

****
Node Depth Summary
****

Average Maximum Maximum Time of Max Reported

Node	Type	Depth Feet	Depth Feet	HGL Feet	Occurrence days hr:min	Max Depth Feet
POC1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
100Year-Vault-discharge	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
HMP-1	STORAGE	0.07	3.64	3.64	6348 09:10	3.54
Detention-Node-74	STORAGE	0.00	4.99	4.99	0 04:17	4.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
POC1	OUTFALL	3.68	7.36	6348 09:01	37.6	110	0.000
100Year-Vault-discharge	OUTFALL	0.00	6.01	0 04:17	0	0.419	0.000
HMP-1	STORAGE	6.05	6.05	6348 09:01	72.4	72.4	0.024
Detention-Node-74	STORAGE	30.60	30.60	0 04:09	0.419	0.419	0.079

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
HMP-1	0.487	1	0	0	27.069	64	6348 09:09	3.85
Detention-Node-74	0.002	0	0	0	37.120	83	0 04:17	6.01

****
Outfall Loading Summary
****

	Flow Freq	Avg Flow	Max Flow	Total Volume

Outfall Node	Pcnt	CFS	CFS	10^6 gal
POC1	17.32	0.06	7.36	110.052
100Year-Vault-discharge	0.03	0.13	6.01	0.419
System	8.68	0.19	6.01	110.471

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
HYDROMOD	DUMMY	3.85	6348 09:10			
vault-OutletStructure	DUMMY	6.01	0 04:17			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Dec 1 16:41:15 2022
Analysis ended on: Thu Dec 1 16:41:45 2022
Total elapsed time: 00:00:30

EXPLANATION OF SELECTED VARIABLES

Parameters for the pre- and post-developed models include soil types A & D in accordance with the USGS Soil Survey Map (attached at the end of this appendix). Suction head, conductivity and initial deficit corresponds to average values expected for the soil types, according to sources consulted, professional experience, and approximate values obtained by City of Poway BMP Design Manual Appendix G.

Selection of a Kinematic Approach: As the continuous model is based on hourly rainfall, and the time of concentration for the pre-development and post-development conditions is significantly smaller than 60 minutes, precise routing of the flows through the impervious surfaces, the underdrain pipe system, and the discharge pipe was considered unnecessary. The truncation error of the precipitation into hourly steps is much more significant than the precise routing in a system where the time of concentration is much smaller than 1 hour.

Explanation of Significant Variables

Height:
The storage depth variable within the SWMM model is representative of the storage volume provided in the vault.

Seepage Rate:
The seepage rate is directly input from the geotechnical report. Equals to 0 in no infiltration\ closed bottom vault

Orifice Equation:

The general orifice equation can be expressed as:

$$Q = \frac{\pi}{4} c_g \frac{D^2}{144} \sqrt{2g \frac{(H-H_D)}{12}} \qquad (1)$$

where Q is the peak flow in cfs, D is the diameter in inches, c_g is the typical discharge coefficient for orifices (0.61-0.63 for thin walls and around 0.75-0.8 for thick walls), g is the acceleration of gravity in ft/s^2, H_D is the elevation of the centroid of the orifice in inches, and H is the depth of the water in inches in Equation (1).

Note:
The complete storage and rating curves and the respective explanation is shown at the end of this appendix. A variable area vs. elevation storage curve was used for the proposed model, and a discharge that is a function of the outlet structure in the surface was used also.

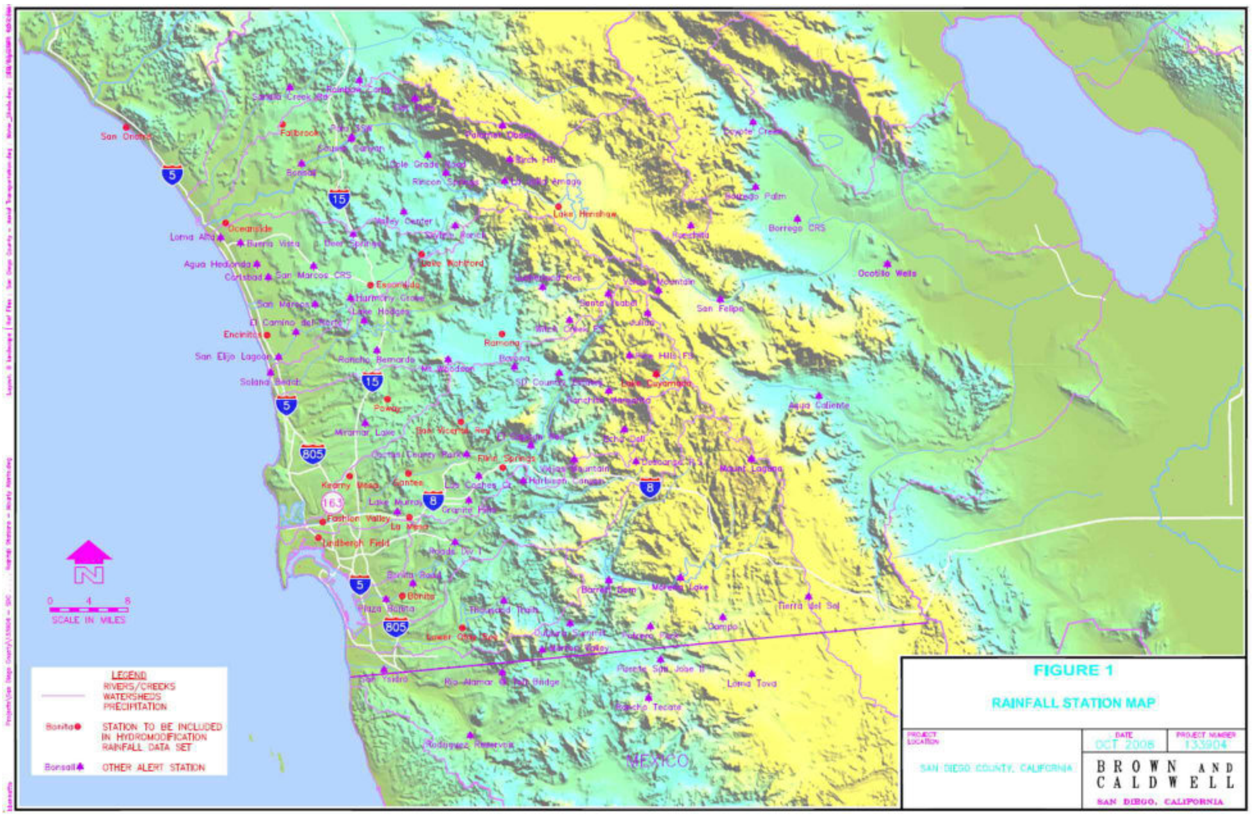


Figure G.1-1: Rainfall Station Map

Project applicants preparing continuous simulation models shall select the most appropriate rainfall data set from the rainfall record files provided on the Project Clean Water website. For a given project location, the following factors should be considered in the selection of the appropriate rainfall data set:

- In most cases, the rainfall data set in closest proximity to the project site will be the appropriate choice (refer to the rainfall station map).
- In some cases, the rainfall data set in closest proximity to the project site may not be the most applicable data set. Such a scenario could involve a data set with an elevation significantly different from the project site. In addition to a simple elevation comparison, the project proponent may also consult with the San Diego County's average annual precipitation isopluvial map, which is provided in the San Diego County Hydrology Manual (2003). Review of this map could provide an initial estimate as to whether the project site is in a similar rainfall zone as compared to the rainfall stations. Generally, precipitation totals in San Diego County increase with increasing elevation.
- Where possible, rainfall data sets should be chosen so that the data set and the project location are both located in the same topographic zone (coastal, foothill, mountain) and major

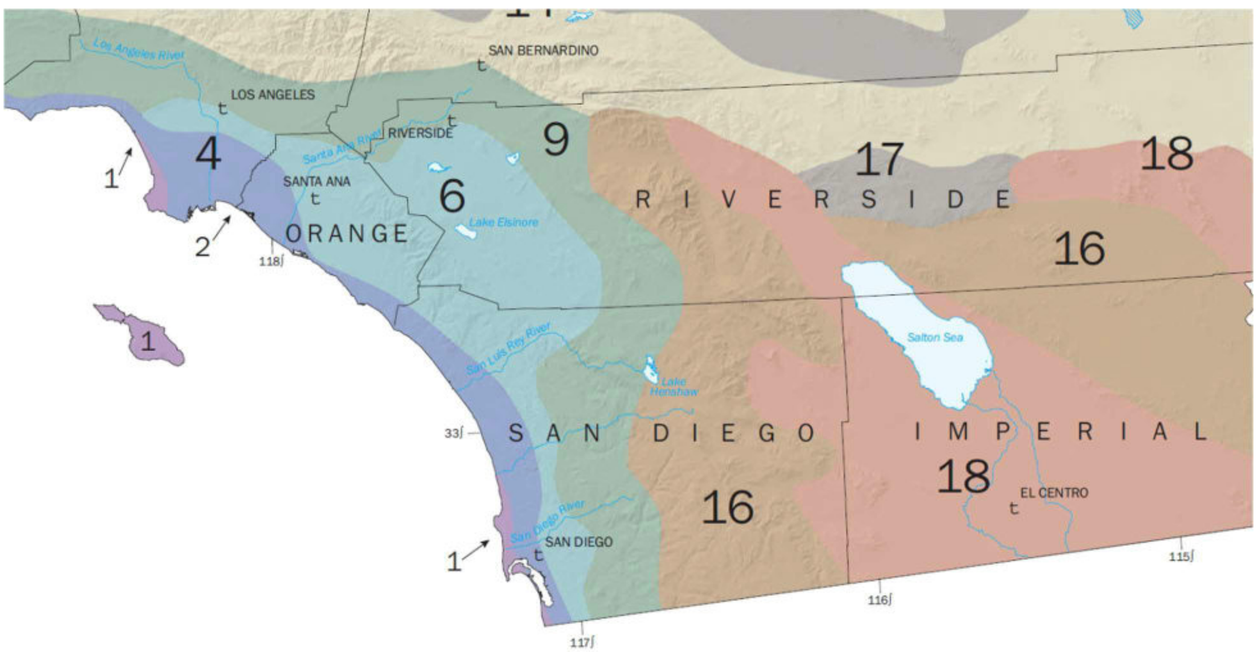


Figure G.1-2: California Irrigation Management Information System "Reference Evapotranspiration Zones"

Table G.1-1: Monthly Average Reference Evapotranspiration by ETo Zone (inches/month and inches/day) for use in SWMM Models for Hydromodification Management Studies in San Diego County CIMIS Zones 1, 4, 6, 9, and 16 (See CIMIS ETo Zone Map)

	January	February	March	April	May	June	July	August	September	October	November	December
Zone	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month
1	0.93	1.4	2.48	3.3	4.03	4.5	4.65	4.03	3.3	2.48	1.2	0.62
4	1.86	2.24	3.41	4.5	5.27	5.7	5.89	5.58	4.5	3.41	2.4	1.86
6	1.86	2.24	3.41	4.8	5.58	6.3	6.51	6.2	4.8	3.72	2.4	1.86
9	2.17	2.8	4.03	5.1	5.89	6.6	7.44	6.82	5.7	4.03	2.7	1.86
16	1.55	2.52	4.03	5.7	7.75	8.7	9.3	8.37	6.3	4.34	2.4	1.55
	January	February	March	April	May	June	July	August	September	October	November	December
Days	31	28	31	30	31	30	31	31	30	31	30	31
Zone	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day
1	0.030	0.050	0.080	0.110	0.130	0.150	0.150	0.130	0.110	0.080	0.040	0.020
4	0.060	0.080	0.110	0.150	0.170	0.190	0.190	0.180	0.150	0.110	0.080	0.060
6	0.060	0.080	0.110	0.160	0.180	0.210	0.210	0.200	0.160	0.120	0.080	0.060
9	0.070	0.100	0.130	0.170	0.190	0.220	0.240	0.220	0.190	0.130	0.090	0.060
16	0.050	0.090	0.130	0.190	0.250	0.290	0.300	0.270	0.210	0.140	0.080	0.050

Table G.1-4: Subcatchment Parameters for SWMM Studies for Hydromodification Management in San Diego

SWMM Parameter Name	Unit	Range	Use in San Diego
Name X-Coordinate Y-Coordinate Description Tag Rain Gage Outlet	N/A	N/A – project-specific	Project-specific
Area	acres (ac)	Project-specific	Project-specific
Width	feet (ft)	Project-specific	Project-specific
% Slope	percent (%)	Project-specific	Project-specific
% Imperv	percent (%)	Project-specific	Project-specific
N-imperv	--	0.011 – 0.024 presented in Table A.6 of SWMM Manual	default use 0.012 for smooth concrete, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
N-Perv	--	0.05 – 0.80 presented in Table A.6 of SWMM Manual	default use 0.15 for short prairie grass, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
Dstore-Imperv	inches	0.05 – 0.10 inches presented in Table A.5 of SWMM Manual	0.05
Dstore-Perv	inches	0.10 – 0.30 inches presented in Table A.5 of SWMM Manual	0.10
%ZeroImperv	percent (%)	0% – 100%	25%
Subarea routing	--	OUTLET IMPERVIOUS PERVIOUS	Project-specific, typically OUTLET
Percent Routed	%	0% – 100%	Project-specific, typically 100%
Infiltration	Method	HORTON GREEN_AMPT CURVE_NUMBER	GREEN_AMPT

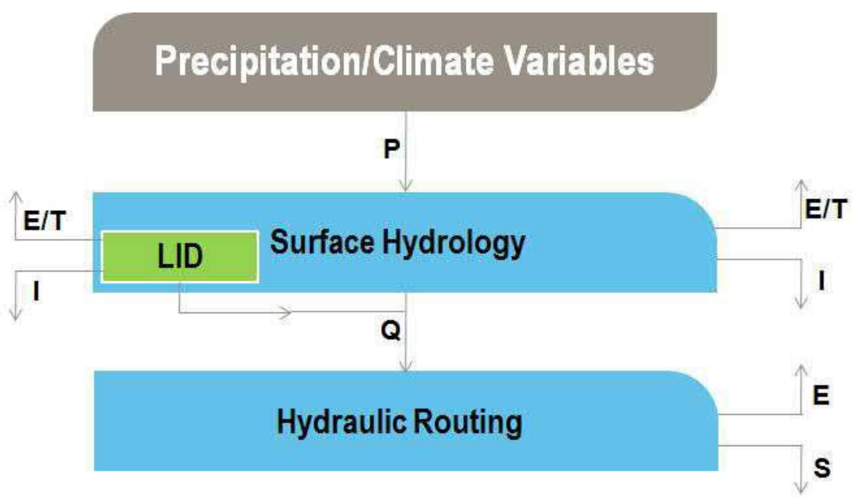
SWMM Parameter Name	Unit	Range	Use in San Diego
Suction Head (Green-Ampt)	Inches	1.93 – 12.60 presented in Table A.2 of SWMM Manual	Hydrologic Soil Group A: 1.5 Hydrologic Soil Group B: 3.0 Hydrologic Soil Group C: 6.0 Hydrologic Soil Group D: 9.0
Conductivity (Green-Ampt)	Inches per hour	0.01 – 4.74 presented in Table A.2 of SWMM Manual by soil texture class 0.00 – ≥0.45 presented in Table A.3 of SWMM Manual by hydrologic soil group	Hydrologic Soil Group A: 0.3 Hydrologic Soil Group B: 0.2 Hydrologic Soil Group C: 0.1 Hydrologic Soil Group D: 0.025 Note: reduce conductivity by 25% in the post-project condition when native soils will be compacted. Conductivity may also be reduced by 25% in the pre-development condition model for redevelopment areas that are currently concrete or asphalt but must be modeled according to their underlying soil characteristics. For fill soils in post-project condition, see Section G.1.4.3.
Initial Deficit (Green-Ampt)		The difference between soil porosity and initial moisture content. Based on the values provided in Table A.2 of SWMM Manual, the range for completely dry soil would be 0.097 to 0.375	Hydrologic Soil Group A: 0.33 Hydrologic Soil Group B: 0.32 Hydrologic Soil Group C: 0.31 Hydrologic Soil Group D: 0.30 Note: in long-term continuous simulation, this value is not important as the soil will reach equilibrium after a few storm events regardless of the initial moisture content specified.
Groundwater	yes/no	yes/no	NO
LID Controls			Project Specific

SWMM Parameter Name	Unit	Range	Use in San Diego
Snow Pack Land Uses Initial Buildup Curb Length			Not applicable to hydromodification management studies

A schematic of the basic SWMM setup for hydromodification management studies is shown below, with the LID module is shown as a feature within the hydrology computational block. Surface water hydrology is distinguished from groundwater, however the groundwater module is not typically used in hydromodification management studies.

The rainfall and climatology input time series data are used to generate surface runoff which in turn is hydraulically routed through the collection system and storage/treatment facilities. The figure includes the following terms in the water balance equation:

- P = Precipitation
- E/T = Evaporation / Transpiration
- I/S = Infiltration / Seepage
- Q = Runoff



Evapotranspiration was previously addressed above; the remainder of this section discusses the other hydrologic losses and parameters.

Map Scale: 1:2,290 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 30, 60, 120, 180

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 22, 2018—Aug 31, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded	D	0.1	1.3%
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes	D	2.1	19.8%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	D	7.2	66.6%
VaA	Visalia sandy loam, 0 to 2 percent slopes	A	1.3	12.3%
Totals for Area of Interest			**10.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT 6 - Drying Time of the Surface Layer of the Vault

The drying time interval between an elevation yi and another elevation $yi - \Delta y$ can be obtained by:

$$\Delta t_i(hours) = \frac{(Q(yi)+Q(yi-\Delta y))}{7200\ (V(yi)-V(yi-\Delta y))} = \frac{Q_{ave}}{3600\ \Delta V}$$

$$t = \sum_{i=1}^{n} \Delta t_i \ \ (hours)$$

Q_{ave} represents the average discharge between elevation y_i and y_{i+1} obtained by $\frac{Q(yi)+Q(yi-\Delta y)}{2}$ where ΔV represents the fraction of the volume that must be discharged at a peak flow $Q_{ave}(V(yi) - V(yi - \Delta y))$.

The volume and the discharge change as the elevation changes; the calculation takes into account this change.

HMP Drawdown @				87.24
Elevation	Q_{AVG} (CFS)	DV (CF)	DT (HR)	Total T
0.10	0.01108	744	18.66	87.24
0.20	0.02011	744	10.28	68.59
0.30	0.03406	744	6.07	58.31
0.40	0.04286	744	4.82	52.24
0.50	0.05010	744	4.13	47.42
0.60	0.05640	744	3.66	43.30
0.70	0.06206	744	3.33	39.63
0.80	0.06724	744	3.07	36.30
0.90	0.07204	744	2.87	33.23
1.00	0.07655	744	2.70	30.36
1.10	0.08080	744	2.56	27.66
1.20	0.08484	744	2.44	25.10
1.30	0.08869	744	2.33	22.67
1.40	0.09239	744	2.24	20.34
1.50	0.09594	744	2.15	18.10
1.60	0.09936	744	2.08	15.95
1.70	0.10267	744	2.01	13.87
1.80	0.10588	744	1.95	11.85
1.90	0.10899	744	1.90	9.90
2.00	0.11202	744	1.84	8.00
2.10	0.12103	744	1.71	6.16
2.20	0.17534	744	1.18	4.45
2.30	0.30758	744	0.67	3.27
2.40	0.50900	744	0.41	2.60
2.50	0.76233	744	0.27	2.20
2.60	1.04128	744	0.20	1.92
2.70	1.26561	744	0.16	1.73
2.80	1.42133	744	0.15	1.56
2.90	1.58390	744	0.13	1.42
3.00	1.79997	744	0.11	1.29
3.10	2.08362	744	0.10	1.17
3.20	2.42058	744	0.09	1.07
3.30	2.79398	744	0.07	0.99
3.40	3.14508	744	0.07	0.91
3.50	3.42468	744	0.06	0.85
3.60	3.65889	744	0.06	0.79
3.70	3.87558	744	0.05	0.73
3.80	4.07859	744	0.05	0.68
3.90	4.27047	744	0.05	0.63
4.00	4.45302	744	0.05	0.58
4.10	4.62758	744	0.04	0.53
4.20	4.79520	744	0.04	0.49
4.30	4.95668	744	0.04	0.44
4.40	5.11269	744	0.04	0.40
4.50	5.26379	744	0.04	0.36
4.60	5.41042	744	0.04	0.32
4.70	5.55298	744	0.04	0.28
4.80	5.69180	744	0.04	0.25
4.90	5.82717	744	0.04	0.21
5.00	5.95934	744	0.03	0.18
5.10	6.61506	744	0.03	0.14
5.20	8.23071	744	0.03	0.11
5.30	10.56389	744	0.02	0.08
5.40	13.40821	744	0.02	0.06
5.50	16.67808	744	0.01	0.05
5.60	20.32106	744	0.01	0.04
5.70	24.30053	521	0.01	0.03
5.80	28.58899	967	0.01	0.02
5.90	33.16480	744	0.01	0.01
6.00	38.01033	744	0.01	0.01

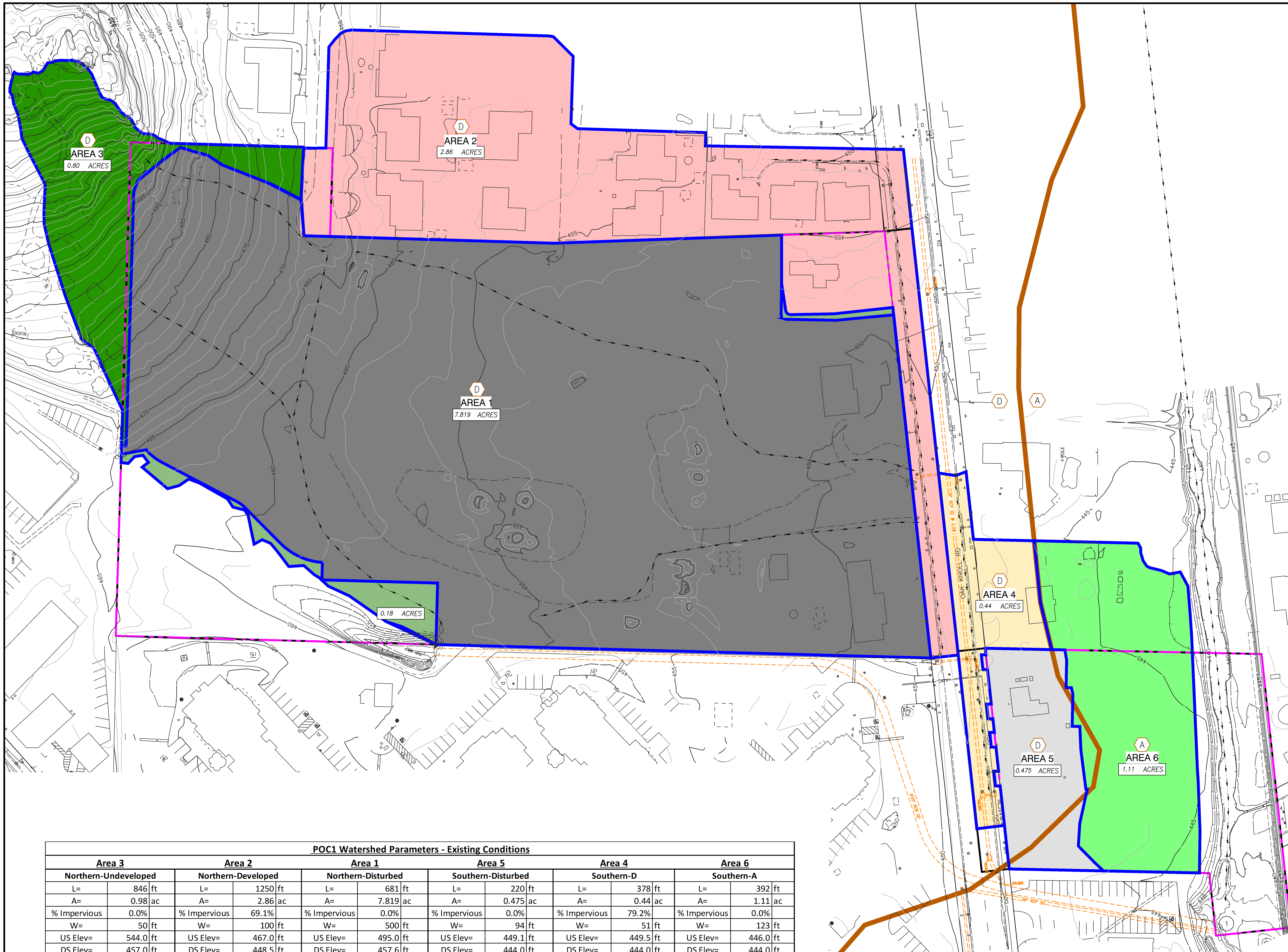
ATTACHMENT 2b – Hydromodification Watershed Maps

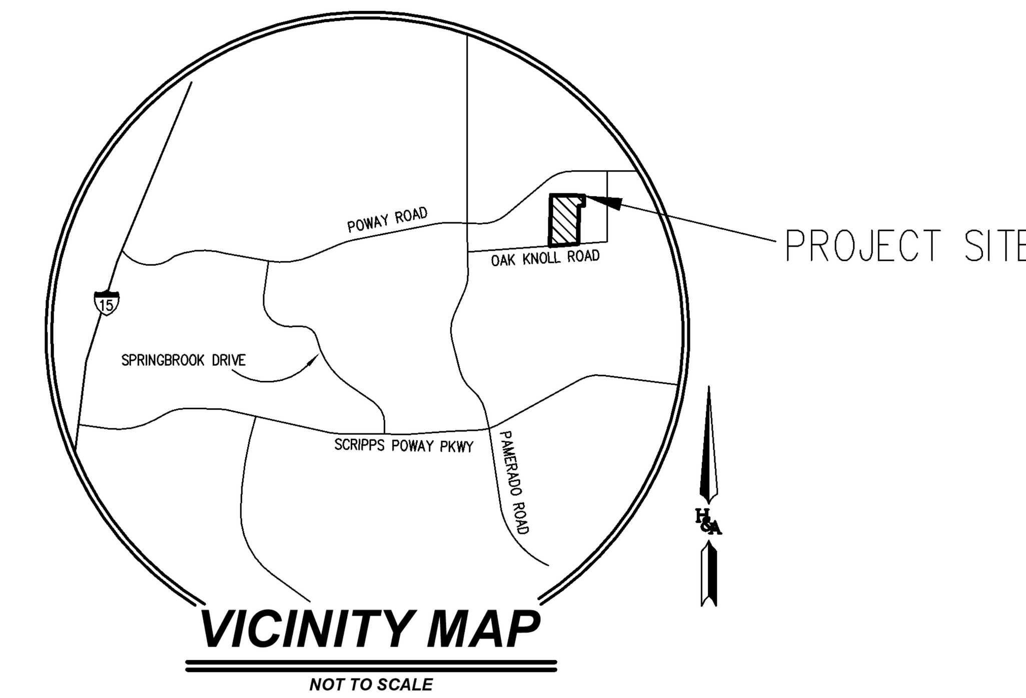
Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit. Include checklist in submittal and check all boxes that are applicable. Provide justification for items not included.

The Hydromodification Management Exhibit must identify:

☒ Underlying hydrologic soil group
☒ Approximate depth to groundwater
☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐ Critical coarse sediment yield areas to be protected
☒ Existing topography
☒ Existing and proposed site drainage network and connections to drainage offsite
☒ Proposed grading
☒ Proposed impervious features
☒ Proposed design features and surface treatments used to minimize imperviousness
☒ Point(s) of Compliance (POC) for Hydromodification Management
☒ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☒ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

Justification for items not included in Hydromodification Management Exhibit:





LEGEND: | SYMBOL:

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- EXISTING STORM DRAIN
- FLOW LINE
- SUBAREA ACREAGE — 00.00 ACRES
- WATERSHED ID — DMA 1
- AREA 1
- AREA 2
- AREA 3
- AREA 4
- AREA 5
- AREA 6
- HYDROLOGIC SOIL BOUNDARY
- HYDROLOGIC SOIL TYPE — D
- POINT OF COMPLIANCE — 1

AREA 1:
AREA TO BE DISTURBED IN THE PROPOSED CONDITIONS- SOIL TYPE D (NORTHERN PROJECT AREA)

AREA 2:
EXISTING DEVELOPMENT NOT TO BE DISTURBED IN PROPOSED CONDITIONS SOIL TYPE D (OFFSITE AREA AND HISTORIC HOME TO REMAIN- RUNOFF TO BE BYPASSED IN PROPOSED CONDITIONS)

AREA 3:
OFFSITE SLOPE DRAINS THROUGH THE SITE AND NOT TO BE DISTURBED IN PROPOSED CONDITIONS-SOIL TYPE D (RUNOFF TO BE BYPASSED IN PROPOSED CONDITIONS)

AREA 4:
OFFSITE DEVELOPED AREA NOT TO BE DISTURBED IN PROPOSED CONDITIONS SOIL TYPE D (OFFSITE RUNOFF NOT TO BE COMMINGLED WITH THE ON SITE FLOWS IN PROPOSED CONDITIONS)

AREA 5:
AREA TO BE DISTURBED IN THE PROPOSED CONDITIONS- SOIL TYPE D (SOUTHERN PROJECT AREA)

AREA 6:
OFFSITE AND ONSITE NATURAL SLOPES NOT TO BE DISTURBED IN PROPOSED CONDITIONS- SOIL TYPE A (DRAINS AWAY FROM THE PROPOSED DEVELOPMENT)

POC1 Watershed Parameters - Existing Conditions

Area 3			Area 2			Area 1			Area 5			Area 4			Area 6		
Northern-Undeveloped			Northern-Developed			Northern-Disturbed			Southern-Disturbed			Southern-D			Southern-A		
L=	846	ft	L=	1250	ft	L=	681	ft	L=	220	ft	L=	378	ft	L=	392	ft
A=	0.98	ac	A=	2.86	ac	A=	7.819	ac	A=	0.475	ac	A=	0.44	ac	A=	1.11	ac
% Impervious	0.0%		% Impervious	69.1%		% Impervious	0.0%		% Impervious	0.0%		% Impervious	79.2%		% Impervious	0.0%	
W=	50	ft	W=	100	ft	W=	500	ft	W=	94	ft	W=	51	ft	W=	123	ft
US Elev=	544.0	ft	US Elev=	467.0	ft	US Elev=	495.0	ft	US Elev=	449.1	ft	US Elev=	449.5	ft	US Elev=	446.0	ft
DS Elev=	457.0	ft	DS Elev=	448.5	ft	DS Elev=	457.6	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft
S=	10.28%		S=	1.48%		S=	5.49%		S=	2.32%		S=	1.46%		S=	0.51%	

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EXISTING HMP MAP
HARMON OAKS

CITY OF POWAY, CALIFORNIA

MAP 1 OF 2

W.O.# 2167-0225

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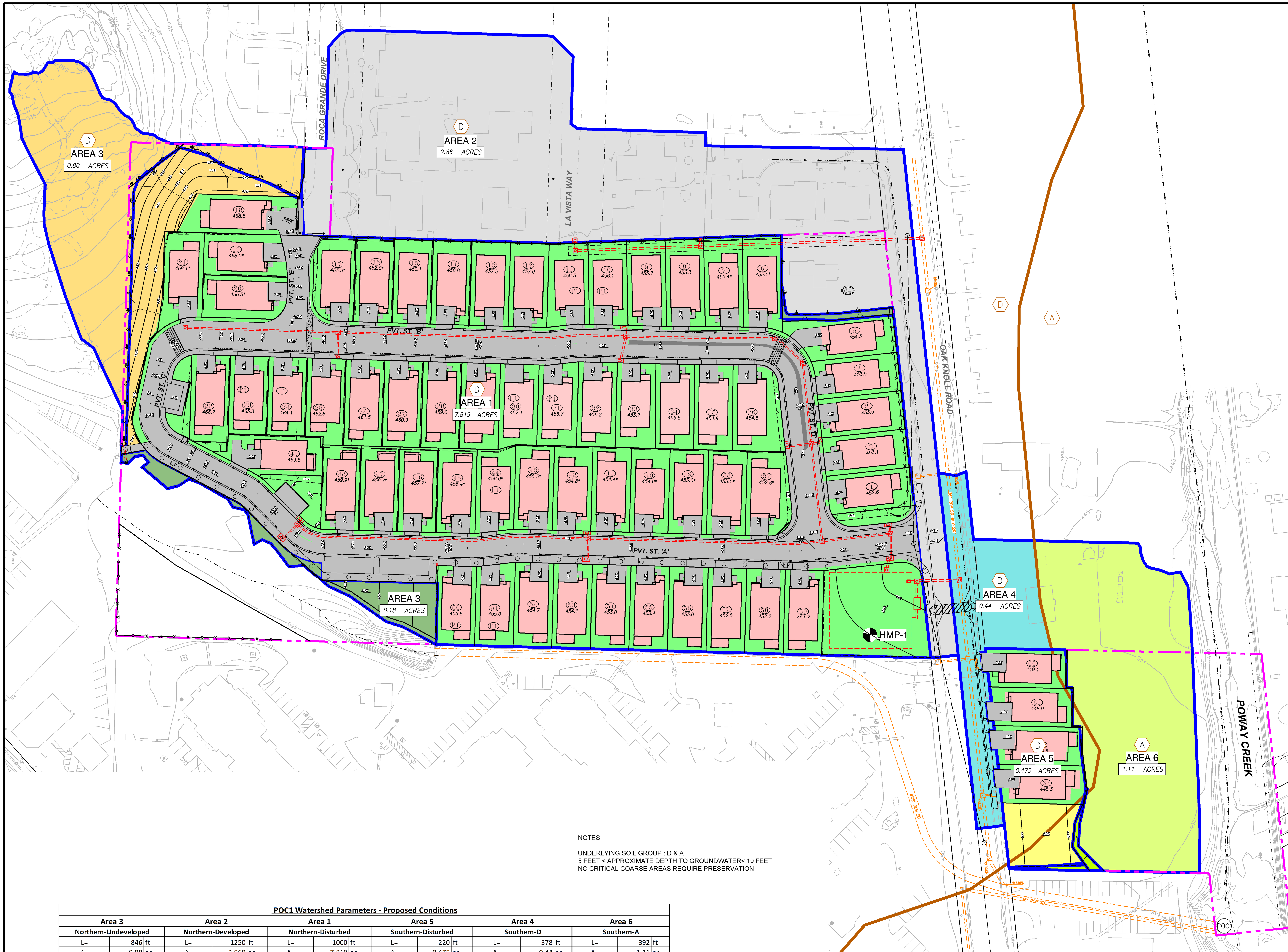

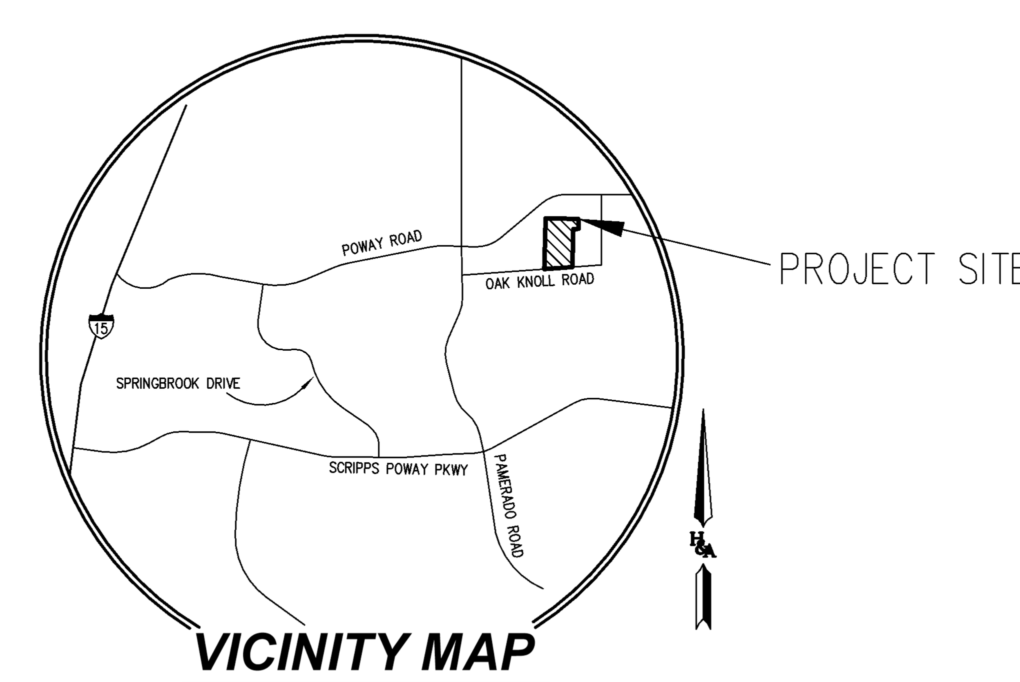

VICINITY MAP

NOT TO SCALE

LEGEND:	SYMBOL:
PROJECT BOUNDARY	
WATERSHED BOUNDARY	
DAYLIGHT	
PROPOSED STORM DRAIN	
EXISTING STORM DRAIN	
FLOW LINE	
SUBAREA ACREAGE	00.00 ACRES
WATERSHED ID	DMA 1
IMPERVIOUS - ROAD	
IMPERVIOUS - CONCRETE/ASPHALT	
OPEN SPACE.(10% IMPERVIOUSNESS)	
PERVIOUS - LANDSCAPE	
PERVIOUS - SLOPES	
AREA-3 PROPOSED PERVIOUS SELF-MITIGATING	
AREA 2	
AREA 3 EXISTING UNDISTURBED SLOPES	
AREA 4	
AREA 6	
HYDROLOGIC SOIL BOUNDARY	
HYDROLOGIC SOIL TYPE	D
POINT OF COMPLIANCE	1
HYDROMOD CONTROL STRUCTURE	

AREA 1:
DISTURBED AREA- SOIL TYPE D (NORTHERN PROJECT AREA)

AREA 2:
EXISTING DEVELOPMENT NOT TO BE DISTURBED IN PROPOSED CONDITIONS - SOIL TYPE D (OFFSITE AREA AND HISTORIC HOME TO REMAIN- RUNOFF TO BE BYPASSED IN PROPOSED CONDITIONS)

AREA 3:
OFFSITE SLOPE DRAINS THROUGH THE SITE AND NOT TO BE DISTURBED IN PROPOSED CONDITIONS+ ON SITE SELF MITIGATING SLOPES -SOIL TYPE D (RUNOFF TO BE BYPASSED IN PROPOSED CONDITIONS)

AREA 4:
OFFSITE DEVELOPED AREA NOT TO BE DISTURBED IN PROPOSED CONDITIONS- SOIL TYPE D (OFFSITE RUNOFF NOT TO BE COMMINGLED WITH THE ON SITE FLOWS IN PROPOSED CONDITIONS)

AREA 5:
DISTURBED AREA - SOIL TYPE D (SOUTHERN PROJECT AREA)

AREA 6:
OFFSITE AND ONSITE NATURAL SLOPES NOT TO BE DISTURBED IN PROPOSED CONDITIONS- SOIL TYPE A (DRAINS AWAY FROM THE PROPOSED DEVELOPMENT)

50 0 50 100 150
SCALE 1"= 50'

NOTES

UNDERLYING SOIL GROUP : D & A
5 FEET < APPROXIMATE DEPTH TO GROUNDWATER< 10 FEET
NO CRITICAL COARSE AREAS REQUIRE PRESERVATION

POC1 Watershed Parameters - Proposed Conditions

Area 3			Area 2			Area 1			Area 5			Area 4			Area 6		
Northern-Undeveloped			Northern-Developed			Northern-Disturbed			Southern-Disturbed			Southern-D			Southern-A		
L=	846	ft	L=	1250	ft	L=	1000	ft	L=	220	ft	L=	378	ft	L=	392	ft
A=	0.98	ac	A=	2.860	ac	A=	7.819	ac	A=	0.475	ac	A=	0.44	ac	A=	1.11	ac
% Impervious	0.0%		% Impervious	69.1%		% Impervious	66.4%		% Impervious	55.1%		% Impervious	79.2%		% Impervious	0.0%	
W=	50	ft	W=	100	ft	W=	341	ft	W=	94	ft	W=	51	ft	W=	123	ft
US Elev=	544.0	ft	US Elev=	467.0	ft	US Elev=	495.0	ft	US Elev=	449.1	ft	US Elev=	449.5	ft	US Elev=	446.0	ft
DS Elev=	457.0	ft	DS Elev=	448.5	ft	DS Elev=	448.5	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft	DS Elev=	444.0	ft
S=	10.28%		S=	1.48%		S=	4.65%		S=	2.32%		S=	1.46%		S=	0.51%	

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PROPOSED HMP MAP
HARMON OAKS

CITY OF POWAY, CALIFORNIA

MAP 2 OF 2

W.O.# 2167-0225

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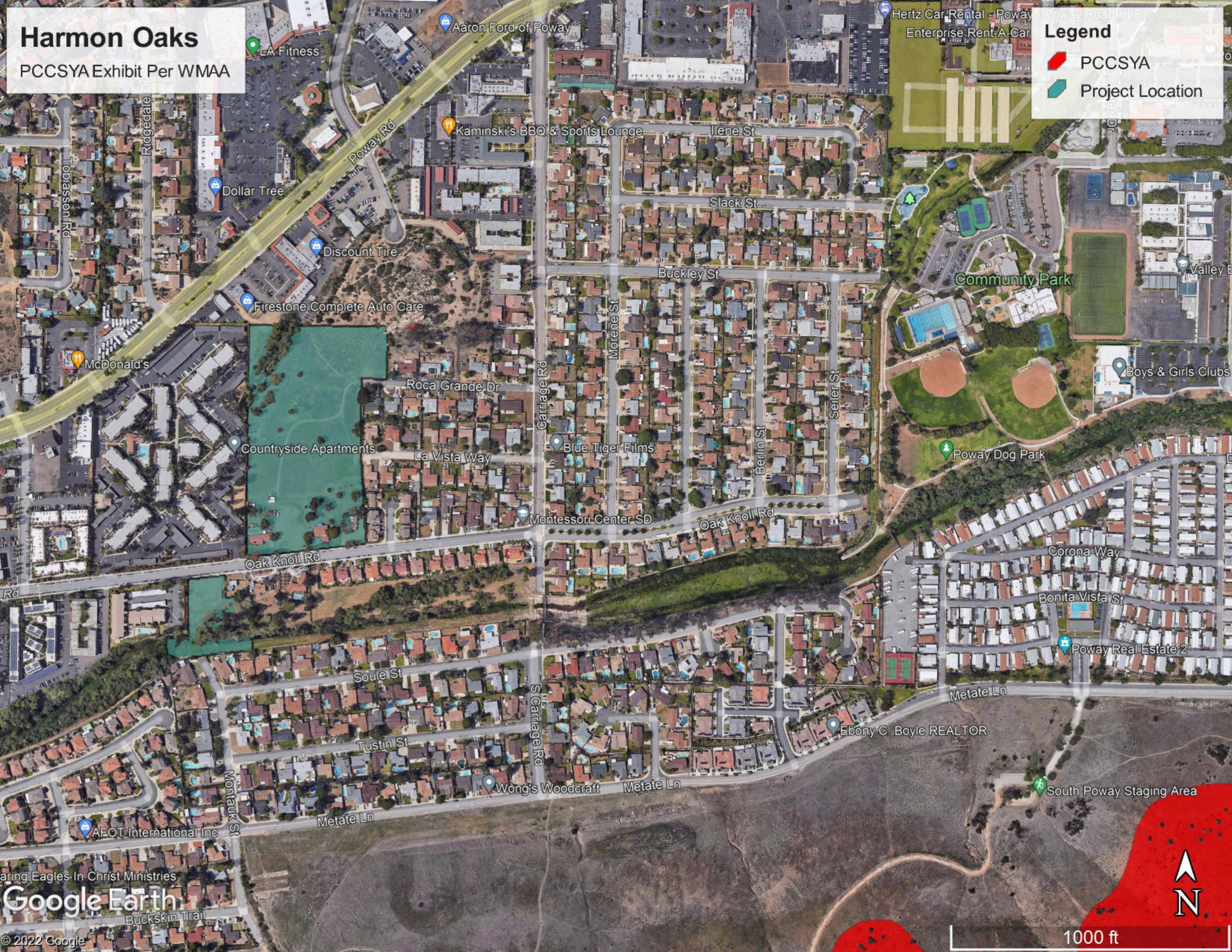
ATTACHMENT 2C – CCSYA EXHIBIT



Harmon Oaks
PCCSYA Exhibit Per WMAA
Legend
PCCSYA
Project Location
Poway Rd
Ilene St
Slack St
Buckley St
Roca Grande Dr
La Vista Way
Oak Knoll Rd
Carriage Rd
Morene St
Berlin St
Seiler St
Corona Way
Bonita Vista St
Metate Ln
Soule St
Tustin St
S Carriage Rd
Montauk St
Buckskin Trail
Tobiasson Rd
Ridgedale Dr
Community Park
Poway Dog Park
Boys & Girls Clubs
South Poway Staging Area
Countryside Apartments
McDonald's
Firestone Complete Auto Care
Discount Tire
Dollar Tree
LA Fitness
Aaron Ford of Poway
Kaminski's BBQ & Sports Lounge
Hertz Car Rental - Poway
Enterprise Rent-A-Car
Blue Tiger Films
Montessori Center SD
Poway Real Estate 2
Ebony C. Boyle REALTOR
Wong's Woodcraft
AFOT International Inc
aring Eagles In Christ Ministries
Google Earth
© 2022 Google
1000 ft
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ATTACHMENT 3 – STRUCTURAL BMP MAINTENANCE INFORMATION

This is the cover sheet for Attachment 3.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 3a	Operations and Maintenance Project Summary	☒ Included
Attachment 3b	Structural BMP Maintenance Plan (Required)	☒ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.

ATTACHMENT 3a

Operations and Maintenance – Project Summary	
Project Name	Harmon Oaks
Project/Permit Number(s)	TBD
Project Address	Oak Knoll Road, in between Pomerado Road and Carriage Road
Assessor's Parcel Number(s) (APN(s))	317-501-01-00,317-500-02, 03,09,10,11,12,13,14
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Penasquitos, Poway, 906.20
Responsible Party for Construction Phase	
Developer's Name	Lennar Homes of California, Inc.
Address	16465 Via Esprillo, Ste 150, San Diego, CA 92127
Email Address	David.Shepherd@lennar.com
Phone Number	(858) 618-4942
Engineer of Work	Alisa S. Vialpando #47945
Engineer's Phone Number	(858) 558-4500
Responsible Party for Ongoing Maintenance	
Owner's Name(s)*	Lennar Homes of California, Inc.
Address	16465 Via Esprillo, Ste 150, San Diego, CA 92127
Email Address	David.Shepherd@lennar.com
Phone Number	(858) 618-4942
*Note: If a corporation or LLC, provide information for principal partner or Agent for Service of Process. If an HOA, provide information for the Board or property manager at time of project closeout.	

ATTACHMENT 3b

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment. Include checklist in submittal and check all boxes that are applicable. Provide justification for items not included.

Attachment 3b must identify:

- ☒ Specific maintenance indicators and actions for proposed structural BMP(s). This must be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
- ☒ How to access the structural BMP(s) to inspect and perform maintenance
- ☒ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☒ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☒ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- ☐ ~~8.5” x 11” Site plan showing BMP locations~~ **(See DMA Map)**
- ☒ 8.5” x 11” Detail Sheets for BMPs – must match details provided on project/permit plans

Justification for items not included in Attachment 3b:

The following inspection and maintenance activities shall be performed and completed as indicated.

Maintenance Program for Inlet Stenciling

Inspection Frequency/Indications:	Regular Maintenance Inspections ❑ Before wet season begins (September); ❑ After wet season (April).
Maintenance Indications	**Maintenance Activities**
❑ Inlet stenciling/signage begins to weather or fade	❑ Re-stamp signage
❑ Broken or damaged structure	❑ Repair or replace signage structure

Maintenance Program for Filterra Biofiltration Units

Inspection Frequency/Indications:	Regular Maintenance Inspections ❑ Monthly during wet season ❑ Annually before wet season (September) Performance Inspection ❑ 72 hrs after rainfall events greater than 0.5 in.
Maintenance Indications	**Maintenance Activities**
❑ Excessive trash, debris, or sediment in unit. (i.e., sump is 85 percent full or sump is 50 percent full during two consecutive monthly inspections)	❑ Remove trash and debris within 15 days. Empty unit when the unit is 85 percent full or 50 percent full during two consecutive monthly inspections, or annually in May.
❑ Presence of trash and debris in weir box.	❑ Remove trash and debris while onsite conducting inspection
❑ When standing water in sump is observed during annual and performance inspection.	❑ If standing water cannot be removed or remains through the wet season, notify vector control.
❑ Minor structural damage (i.e., screen becomes clogged, damaged or loose)	❑ Clean screen, re-fasten screen if appropriate.
❑ Cracked or fatigued neoprene vector seals	❑ Replace damaged seal
❑ Major damage to structures (i.e., holes in screen, large debris, damage to housing or weir box)	❑ Immediately consult with engineer and manufacturer=s representative to develop a course of action and effect repairs prior to the wet season.
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

Maintenance Program for Detention Vault

Inspection Frequency/Indications:	Regular Inspections ❑ Before wet season begins (September); ❑ After wet season (April). Performance Inspections ❑ After rainfall events greater than 0.5 inches, or any rainfall that fills the basin.
Maintenance Indications	**Maintenance Activities**
❑ Standing water in vault during dry weather; basin does not drain within 72 hours after runoff event.	❑ Drain basin. Determine and resolve problems that are causing the basin to drain improperly. If basin cannot be drained, or if standing water persists, notify vector control.
❑ Evidence of rodent infestation	❑ Abate and control rodents as necessary to maintain the performance of the facility.
❑ Trash, debris, or litter present in basin	❑ Remove trash, debris, and litter
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

Attachment 3a: Structural BMP Maintenance Plan

Maintenance Program for Pump	
BMP Access: Starlight Place (pvt.Rd.)	
Inspection Frequency/Indications:	Regular Inspections ❑ Before wet season begins (September); ❑ Every 60 days during wet season (September-April); ❑ After wet season (April). Performance Inspections ❑ After rainfall events greater than 0.5 inch
Maintenance Indications Connections	**Maintenance Activities Connections**
❑ Standing water in pump	❑ Check for clogged outlet pipe. ❑ Check that pump is operational, repair/replace pump as necessary.
❑ Trash, debris, and vegetative litter clogging inlets.	❑ Remove trash, debris, and vegetative litter. ❑ Check for clogged inlet pipe.
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

ATTACHMENT 3b
Maintenance Information for Underground Detention Basin

Maintenance should be conducted during dry weather when no flow is entering the system. Confined space entry is usually required to maintain the Underground Detention Basins. Only personnel that are OSHA Confined Space Entry trained and certified may enter underground structures. Once safety measures such as traffic control have been deployed, the access covers may be removed and the following activities may be conducted to complete maintenance. All access covers will be securely replaced following inspection and/or maintenance

Inspection Activity	Maintenance Indicator(s)	Field Measurement	Minimum Frequency of Inspection	Maintenance Activity	Minimum Maintenance Frequency
Inspect vault twice during the first wet season of operation	N/A	Visual inspection	Post-construction	Set cleaning frequency	Post-construction
Inspect for cracks and inlet/outlet area erosion	Cracks or erosion present	Visual inspection	Semi-annually	Repair cracks/erosion. Consult engineers if immediate solution is not evident.	As needed
Inspect for litter, oil and grease from inlet/outlet areas	Litter, oil or grease present	Visual inspection	Beginning & end of rainy season	Remove litter, oil and grease	Semi-annually
Inspect for accumulated sediment	Sediment on the system floor exceeds 6”	Tape measure	Annually, prior to start of wet season	Remove sediment with vacuum truck. No jetting permitted to loosen sediment.	Bi-annually or as needed
Inspect for trash and debris	Trash and debris present	Visual inspection	Semi-annually	Remove trash and debris (e.g. via vacuum truck)	As needed
Inspect system for movement of modules	Spacing of modules exceeds ¾”	Tape measure	Semi-annually	Consult engineers	As needed
Inspect inlet and outlet for obstruction(s)	Obstruction is present	Visual inspection	Semi-annually	Remove obstruction	Semi-annually or as needed
Report drawdown rate	Drawdown rate exceeds 96 hours	Recording Device (pen & paper, voice recorder, etc.)	96 hours after wet weather	Remove any obstructions. Consult engineers if immediate solution not evident.	As needed

April 2019

STORMTRAP MAINTENANCE MANUAL

1. Introduction

As with any Stormwater system regular inspections are recommended to ensure the long-term function of the system per design. As Stormwater migrates through the system, both sediment and debris could collect or settle within the system invert. Such events would prompt a regular inspection and or maintenance plan. Please call your Authorized StormTrap Representative (877-867-6872) if you have questions regarding the inspection and/or maintenance of the StormTrap system(s). Prior to entry into any underground storm sewer or underground detention systems, appropriate OSHA and local safety regulations and guidelines should be followed.

2. Inspection Schedules

StormTrap Stormwater Management Systems are recommended for inspection whenever the upstream and downstream catch basins and stormwater pipes of the stormwater collection system are inspected and/or maintained. This will economize the cost of the inspection if it is done at the same time the municipal crews are servicing the area.

During the first year of service, StormTrap recommends an accelerated inspection schedule to establish baseline levels of debris and/or sediment within the system. Inspections should be made after each significant rain event or runoff period. We also recommend a quarterly inspection in addition to the event-based inspections for the first 12 months. Based upon the results of the first year of inspections, a more appropriate schedule can be generated.

StormTrap Stormwater Management Systems for a private development are recommended for inspection after construction activities are complete and system is functioning per design and after each major storm water event. Until a cleaning schedule can be established, a quarterly inspection is recommended for the first 12 months. After the first 12 months, a regular schedule can be implemented. If inspected on a biannual basis, the inspection should be conducted before the stormwater season begins to be sure that everything is functioning properly for the upcoming storm season. If inspected on an annual basis, the inspection should be conducted before the stormwater season begins to be sure that everything is functioning properly for the upcoming storm season.

3. Inspection Process

Inspections should be done such that at least 2-3 days has lapsed since the most recent rain event to allow for complete draining. Visually inspect the system at all manhole locations. Utilizing a sediment pole, measure and document the amount of silt at each manhole location (Figure 1). Inspect each pipe opening to ensure that the silt level or any foreign objects are not blocking the pipes. Be sure to inspect the outlet pipe(s) because this is typically the smallest pipe in the system. It is common that most of the larger materials will be collected upstream of the system in catch basins, and it is therefore important at time of inspections to check these structures for large trash or blockages.

Remove any blockages if you can during the inspection process only if you can do so safely from the top of the system without entering into the system**. Do not go into the system under any circumstances** without proper ventilation equipment and confined space training. Pass any information requiring action onto the appropriate maintenance personnel if you cannot remove the blockages from above during the inspection process. Be sure to describe the location of each manhole and the type of material that needs to be removed.

The sediment level of the system should also be measured and recorded during the inspection process. Recording the sediment level at each manhole is very important in order get a history of sediment that can be graphed over time (i.e. years) in order to estimate when the system will need to be maintained next. It is also important to keep these records to verify that the inspection process was actually performed if anyone asks for your records in the future. ***(Please see Appendix A for reference)***

The sediment level in the underground detention system can be determined from the outside of the system by opening up all the manholes and using a sediment pole to measure the amount of sediment at each location. Force the stick to the bottom of the system and then remove it and measure the amount of sediment at that location. Again, do not enter into the system under any circumstances without proper ventilation equipment and training. Please see Appendix A for a sample inspection document.

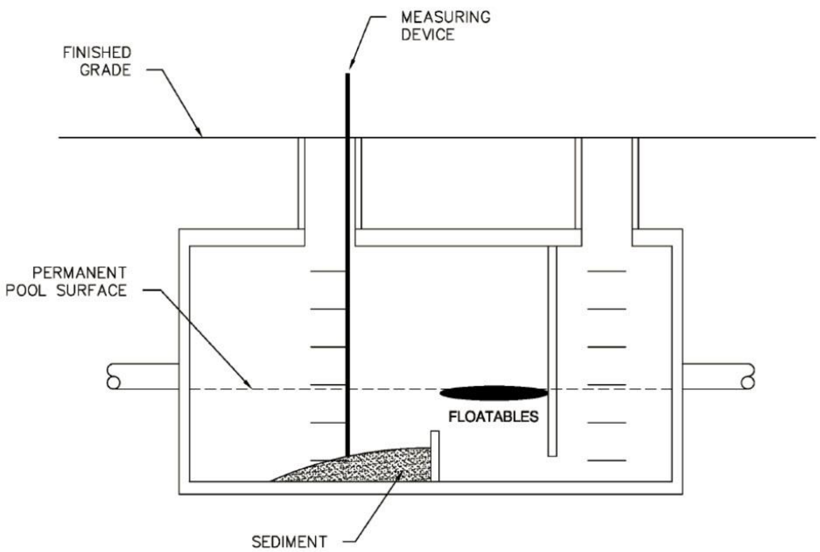

Figure 1. During inspection, measure the distance from finished grade to the top of the sediment inside the system.

4. When to Clean the System

Any blockages should be safely removed as soon as it is safely possible to ensure the StormTrap detention system will fill and drain properly before the next stormwater event.

The dry detention system should be completely cleaned whenever the sediment occupies more than 10% to 15% of the originally designed system's volume. A wet system (sometimes referred to as a wet vault) should be cleaned when the sediment occupies more than 30% or 1/3rd of the originally designed system's volume.

NOTE: Check with your municipality to ensure compliance with local guidelines regarding cleaning criteria, as the allowable sediment before cleaning may different that StormTrap's recommended ranges.

5. How to Clean the StormTrap

StormTrap systems should be completely cleaned back to 100% of the originally designed storage volume whenever the above sediment levels have been reached. Be sure to wait at least 3 days after a stormwater event to be sure that the system is completely drained (if it is a dry detention system), and all the sediments have settled to the bottom of the system (if it is a wet detention system).

There are many maintenance companies that can be contracted to clean your underground stormwater detention systems and water quality units. Please call your StormTrap representative for referrals in your area.

Product Specific Maintenance Recommendations

A. SingleTrap on a Concrete Slab

Maintenance is typically performed using a vacuum truck or jet-vac system. If headroom allows, sediment can be manually gathered near access openings and removed with suction. Shorter systems will require a mobile jet vac system that operates throughout the system to collect and remove sediment.

Sediment should be flushed towards a vacuum hose for thorough removal. For a dry system, remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. If present, open the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

If the system was designed to maintain a permanent pool of water, floatables and any oil should be removed in a separate procedure prior to the removal of all sediment.

The floatable trash is removed first by using a bucket strainer to capture and remove any floating debris.

The floatable oils are then removed off the top of the water by using the vacuum truck to suck off any floatable fluids and liquids.

The next step is to use the vacuum truck to gently remove the clarified water above the sediment layer.

The final step is to clean the sediment for each row as described above. For smaller systems, the vacuum truck can remove all the sediment in the basin without using the sewer jetting equipment because of the smaller space.

B. SingleTrap on Stone

SingleTrap systems on a stone base require a similar cleaning process as a SingleTrap on a concrete slab. However, extra care needs to be taken to make sure the stone base retains levelness. If system headroom allows, manual raking of sediment a debris can be performed. Shorter systems may require jet vac equipment. Adjusting the pressure setting on the jet vac to ensure the stability of the stone base.

Sediment should be flushed towards a vacuum hose for thorough removal. Remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. Access the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

C. DoubleTrap

A DoubleTrap system can be maintained in a similar fashion as a SingleTrap on a concrete slab. Typically, headroom is greater in DoubleTrap systems and access is easier for manual gathering of sediment and debris. Again, maintenance is typically performed using a vacuum truck or jet-vac system. Sediment can be gathered near access openings and removed with suction. Alternately, a jet vac system that operates throughout the system can be used to remove sediment.

Sediment should be flushed towards a vacuum hose for thorough removal. For a dry system, remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. If present, open the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

If the system was designed to maintain a permanent pool of water, floatables and any oil should be removed in a separate procedure prior to the removal of all sediment.

The floatable trash is removed first by using a bucket strainer to capture and remove any floating debris.

The floatable oils are then removed off the top of the water by using the vacuum truck to suck off any floatable fluids and liquids.

The next step is to use the vacuum truck to gently remove the clarified water above the sediment layer.

The final step is to clean the sediment for each row as described above. For smaller systems, the vacuum truck can remove all the sediment in the basin without using the sewer jetting equipment because of the smaller space.

D. ShallowTrap

A ShallowTrap system can be cleaned in a similar fashion as a Single Trap on a stone base. The headroom limitation will not allow for manual entry removal of sediment. Precautions will need to be taken to ensure the stone base retains levelness. Using a jet vac system to flush out the sediment is the recommended method.

Sediment should be flushed towards a vacuum hose for thorough removal. Remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the ShallowTrap system. Access the manhole at the opposite end of the ShallowTrap and use sewer jetting equipment to force water in the same row from one end of the ShallowTrap row to the opposite side. The rows of the ShallowTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

E. SiteSaver

Site Savers have 3 potential components that require maintenance and cleaning. Depending on the specifications of the system, trash nets, oil mats, and sediment removal will all need to be addressed.

Inspections should be done such that a enough time has lapsed since the most recent rain event to allow for a static water condition. Visually inspect the system at all manhole and access opening locations. For debris accumulation, visually inspect the netting or screening basket components (if utilized) to determine the bag or basket capacity. Nets or baskets containing only minor quantities of debris may be retained in place. It is recommended to replace the nets or clean the screening baskets when they appear 1/2 - 2/3 full. Failure to replace nets and/or remove floatables from bypass screening (if applicable) will lead to hydraulic relief, drain down deficiencies, and decrease the long-term functionality of the system.

For sediment accumulation, utilize either a sludge sampler or a sediment pole to measure and document the amount of sediment accumulation. To determine the amount of sediment in the system with a sludge sampler follow the manufacturer's instructions. If utilizing a sediment pole, first insert the pole to the top of the sediment layer and record the depth. Then, insert the pole to the bottom of the system and record the depth. The difference in the two measurements corresponds to the amount of sediment in the system. Finally, inspect the inlet pipe opening to ensure that the silt level or any foreign objects are not blocking the pipe.

Maintenance should be done utilizing proper personal protective equipment such as: safety glasses, hard-hat, gloves, first aid kit, etc. Maintenance should occur only when a sufficient time has lapsed since the most recent rain event to allow for a static water condition for the duration of the maintenance process.

In the case that only trash and floatables need to be removed, and a netting configuration or a removable screening basket is utilized, a vacuum truck is not required. However, a vacuum truck is required if a fixed screening basket configuration is utilized. If the maintenance event is to include oil removal and or sediment removal a vacuum truck or similar equipment would be needed.

Install a new net assembly by sliding the netting frame down the support frame and ensure the netting lays over the plate assembly such that the netting is not restricted. To order additional disposable nets, contact your local SiteSaver representative. New nets come with tie wraps temporarily holding the net material to the frame component for easy handling and storage. It is not recommended to remove the tie wraps until the net is ready to be installed. The frame is tapered from top (widest part) to bottom, and is also tapered from front (towards the sewer) to back. Cut the tie wraps that secures the netting material to the frame for shipment and lower the net down the guide rails. If debris has accumulated in the net support frame, remove the objects so the new net seats fully in the channel when installed.

When lowering the net, the following details should be exercised when placing the net:

- Watch the lowering to make sure that there are no unexpected entanglements.
- Be careful not to let the toe of the net get caught under the frame when it reaches the bottom of the support frame. This is typically accomplished by holding the toe of the net until after the net has started to prop into place.
- Ensure the netting lays over the plate assembly such that the netting is not restricted.

Access to the netting chamber can be achieved via the square grated opening atop the Site Saver unit. Trash net needs to be removed completely (including the frame) with a service vehicle (crane/hoist/boom truck).

For sediment removal, the SiteSaver is designed with clear access at both the inlet and outlet. A vacuum truck, or similar trailer mounted equipment, can be used to remove the sediment, hydrocarbons, and water within the unit. For more effective removal, it is recommended to use sewer jetting equipment or a spray lance to force the sediment to the vacuum hose. When the floor is sufficiently cleaned, fill the system back to its normal water elevation (to the pipe inverts).

Complete a post maintenance inspection to ensure that all components have been replaced and are properly secured within the SiteSaver device. It is a good practice to take time stamped photographs after every maintenance event to include within maintenance logs. After verifying all components, secure the access openings and ensure proper disposal of all pollutants removed during maintenance per local, state, and federal guidelines.
Proof of inspections and maintenance is the responsibility of the owner. All inspection reports and data should be kept on site or at a location where they will be accessible for years in the future. Some municipalities require these inspection and cleaning reports to be forwarded to the proper governmental permitting agency on an annual basis. Refer to your local and national regulations for any additional maintenance requirements and schedules not contained herein. Inspections should be a part of the standard operating procedure. It is good practice to keep records of rainfall events between maintenance events and the weight of material removed, even if no report is required.

F. Sand Filter

Sand filter beds can crust over and become clogged or partially clogged, for this reason we recommend inspecting the sand filters at least annually. To remove this, the upper layer of clogged and / or hardened sand will need to be broken up with a steel rake or a similar device. After breaking up the top 2-5 inches of contaminated media, the lose sand can be scrapped off and removed via a vacuum truck. Replace and regrade the media with the approved material per the original design.

Various contractors specialize in this work. Maintenance methodologies range from manual replacement and removal to robotic devices that require no human entry into the system. Please consult to local maintenance contractors for additional information.

6. Inspection Reports

Proof of these inspections is the responsibility of the property owner. All inspection reports and data should be kept on site or at a location where they will be accessible for years in the future. Some municipalities require these inspection and cleaning reports to be forwarded to the proper governmental permitting agency on an annual basis.

Refer to your local and national regulations for any additional maintenance requirements and schedules not contained herein. Inspections should be a part of your standard operating procedure. Please see Appendix A for a sample Inspection and Maintenance form.

Appendix A

Sample inspection and maintenance log

Underground Detention System Inspection and Maintenance Checklist

Facility:				
Location/Address:				
Date:	**Time:**	**Weather Conditions:**		**Date of Last Inspection:**
Inspector:			**Title:**	
Rain in Last 48 Hours □ Yes □ No **If yes, list amount and timing:**				
Pretreatment: □ vegetated filter strip □ swale □ turf grass □ forebay □ other, specify: □ none				
Site Plan or As-Built Plan Available: □ Yes □ No				

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.
*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.
* Properly dispose of all wastes.

Inspection Item		Comment	Action Needed
1. PRETREATMENT			
Sediment has accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
Trash and debris have accumulated.	☐Yes ☐No ☐N/A		☐Yes ☐No
2. INLETS			
Inlets are in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment, trash, or debris have accumulated and/or is blocking the inlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
3. CHAMBERS			
Sediment accumulation threshold has been reached.	☐Yes ☐No ☐N/A		☐Yes ☐No
Trash and debris have accumulated in chambers.	☐Yes ☐No ☐N/A		☐Yes ☐No
4. OTHER SYSTEM COMPONENTS			
Structural deterioration is evident.	☐Yes ☐No ☐N/A		☐Yes ☐No
5. OUTLETS			
Outlets in poor structural condition.	☐Yes ☐No ☐N/A		☐Yes ☐No
Sediment, trash or debris are blocking outlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
Erosion is occurring around outlets.	☐Yes ☐No ☐N/A		☐Yes ☐No
6. OTHER			
Evidence of ponding water on area draining to system.	☐Yes ☐No ☐N/A		☐Yes ☐No
Evidence that water is not being conveyed through the system.	☐Yes ☐No ☐N/A		☐Yes ☐No
Additional Notes			
Wet weather inspection needed □ Yes □ No			

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Enclosed

Local Area Filterra Plant List

Introduction

Thank you for your purchase of the Filterra® Bioretention System. Filterra is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. The system's biota (vegetation and soil microorganisms) then further breakdown and absorb captured pollutants. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

The Filterra system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra system.

Included with your purchase is Activation of the Filterra system by the manufacturer as well as a 1-year warranty from delivery of the system and 1-year of routine maintenance (mulch replacement, debris removal, and pruning of vegetation) up to twice during the first year after activation.

Design and Installation

Each project presents different scopes for the use of Filterra systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra box sizing (by rainfall region) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra units as shown in approved plans. A comprehensive installation manual is available at www.ContechES.com.

Activation Overview

Activation of the Filterra system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch certified for use in Filterra systems.

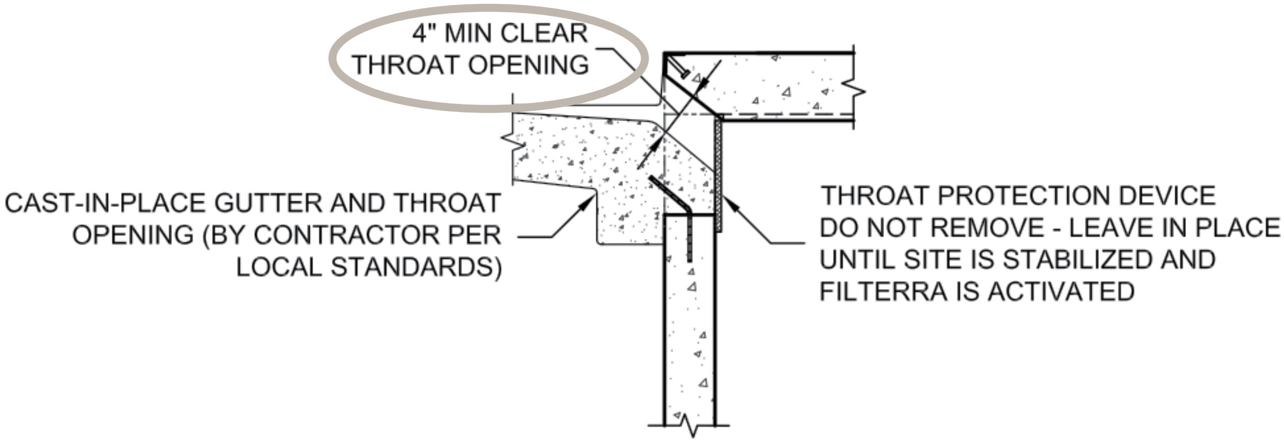
Minimum Requirements

The minimum requirements for Filterra Activation are as follows:

1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.

2. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra system.

3. Filterra throat opening should be at least 4" in order to ensure adequate capacity for inflow and debris.



An Activation Checklist is included on page 12 to ensure proper conditions are met for Contech to perform the Activation services. A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

Filterra Plant Selection Overview

A Plant List has been enclosed with this packet highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra system. Plants installed in the Filterra system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra system.

The "Planting Requirements for Filterra Systems" document is included as an appendix and discusses proper selection and care of the plants within Filterra systems.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra system's warranty and waive the manufacturer provided Activation and Maintenance services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra system or runoff protection devices
- Removal of any Filterra system components
- Failure to prevent construction related runoff from entering the Filterra system
- Failure to properly store and protect any Filterra components (including media and underdrain stone) that may be shipped separately from the vault

Routine Maintenance Guidelines

With proper routine maintenance, the biofiltration media within the Filterra system should last as long as traditional bioretention media. Routine maintenance is included by the manufacturer on all Filterra systems for the first year after activation. This includes a maximum of 2 visits to remove debris, replace pretreatment mulch, and prune the vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra systems also contain pretreatment or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the first year of maintenance, and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan of your Filterra media.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The unit will recycle and accumulate pollutants within the biomass, but is also subjected to other materials entering the inlet. This may include trash, silt and leaves etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra's flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

When to Maintain?

Contech includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two (2) scheduled visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated.

Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency; e.g. some fast food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the (maintenance) Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Supplier (i.e. no pruning or fertilizing) during the first year.

Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the Supplier maintenance contract. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra (where the cleaned runoff drains to, such as drop inlet) and block off the throat of the Filterra. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra and surrounding area
2. Removal of tree grate and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation and pruning or replacement as necessary
6. Clean area around Filterra
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media available from the Supplier.

Box Length	Box Width	Filter Surface Area (ft^2)	Volume at 3” (ft^3)	# of 2 ft^3 Mulch Bags
4	4	16	4	2
6	4	24	6	3
8	4	32	8	4
6	6	36	9	5
8	6	48	12	6
10	6	60	15	8
12	6	72	18	9
13	7	91	23	12

Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.

1. Inspection of Filterra and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

If yes answered to any of these observations, record with close-up photograph (numbered).

2. Removal of tree grate and erosion control stones

- Remove cast iron grates for access into Filterra box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	________

- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	________
Inches of Media Added	________

4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra inlet to allow for entry of trash during a storm event.
- Replace Filterra grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.

5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above Grate	____________________ (ft)
Width at Widest Point	____________________ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no

6. Clean area around Filterra

- Clean area around unit and remove all refuse to be disposed of appropriately.

7. Complete paperwork

- Deliver Maintenance Report and photographs to appropriate location (normally Contech during maintenance contract period).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.
Maintenance is ideally to be performed twice annually.				

Filterra Inspection & Maintenance Log

Filterra System Size/Model:____________________ **Location:** ______________________________

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate	Vegetation Species	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3"*	*Lowe's Premium Brown Mulch*	*4'*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

Appendix 1 – Filterra® Activation Checklist

CONTECH ENGINEERED SOLUTIONS

Project Name:______________________________Company:______________________________

Site Contact Name: ______________________________ Site Contact Phone/Email: ____________________

Site Owner/End User Name:____________________Site Owner/End User Phone/Email: ____________________

Preferred Activation Date: ____________________________(provide 2 weeks minimum from date this form is submitted)

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Attach additional sheets as necessary.

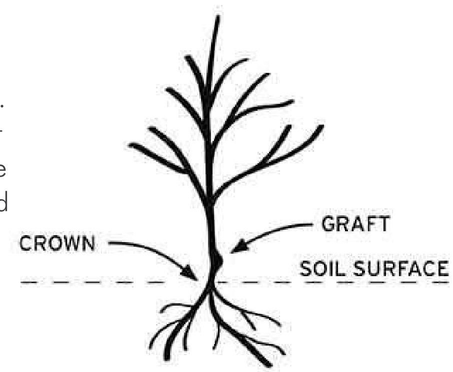
NOTE: A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized Activations will void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

____ ______________________

Signature Date

Appendix 2 – Planting Requirements for Filterra® Systems

Plant Material Selection



- Select plant(s) as specified in the engineering plans and specifications.
- Select plant(s) with full root development but not to the point where root bound.
- Use local nursery container plants only. Ball and burlapped plants are not permitted.
- For precast Filterra systems with a tree grate, plant(s) must not have scaffold limbs at least 14 inches from the crown due to spacing between the top of the mulch and the tree grate. Lower branches can be pruned away provided there are sufficient scaffold branches for tree or shrub development.
- For precast Filterra systems with a tree grate, at the time of installation, it is required that plant(s) must be at least 6" above the tree grate opening at installation for all Filterra configurations. This DOES NOT apply to Full Grate Cover designs.
- Plant(s) shall not have a mature height greater than 25 feet.
- For standard 21" media depth, a 7 – 15 gallon container size shall be used. Media less than 21" (Filterra boxes only) will require smaller container plants.
- For precast Filterra systems, plant(s) should have a single trunk at installation, and pruning may be necessary at activation and maintenance for some of the faster growing species, or species known to produce basal sprouts.

Plant Installation

- During transport protect the plant leaves from wind and excessive jostling.
- Prior to removing the plant(s) from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
- Cut away any roots which are growing out of the container drain holes. Plants with excessive root growth from the drain holes should be rejected.
- Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively the pot can be cut away to minimize root ball disturbance.
- Remove any excess soil from above the root flare after removing plant(s) from container.
- Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
- If plant(s) have any circling roots from being pot bound, gently tease them loose without breaking them.
- If root ball has a root mat on the bottom, it should be shaved off with a knife just above the mat line.
- Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
- All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
- With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
- To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
- Plant staking may be required.

Mulch Installation

- Only mulch that has been meeting Contech Engineered Solutions' mulch specifications can be used in the Filterra system.
- Mulch must be applied to a depth of 3" evenly over the surface of the media.

Irrigation Requirements

- Each Filterra system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore if dry periods exceed 3 weeks, irrigation may be required. It is also important to recognize that plants which are exposed to windy areas and reflected heat from paved surfaces may need more frequent irrigation. Long term care should develop a history which is more site specific.

** Five gallons per square yard approximates 1 inch of water Therefore for a 6' by 6' Filterra approximately 20-60 gallons of water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five gallon bucket to estimate the applied water flow rate then calculate the time needed to irrigate the Filterra. For example, if the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6' by 6' filter.

Notes

filterra®
Bioretention Systems

CONTECH®
ENGINEERED SOLUTIONS

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STORMWATER SOLUTIONS

PUMP SYSTEMS INSPECTION & MAINTENANCE MANUAL

10244 Freeman Avenue | Santa Fe Springs, CA 90670 | 562-777-9724
sfwsystems.com

PUMP SYSTEM - INSPECTION & MAINTENANCE

Inspection and maintenance of the pump system is vital for the performance and life cycle of the stormwater management system. All local, state, and federal permits and regulations must be followed for system compliance. Manway access locations are provided on each system for ease of ingress and egress for routine inspection and maintenance activities. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed and providing protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site-specific conditions. Inspection after the first significant rainfall event and at quarterly intervals is typical. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance, a BMP can exceed its storage capacity, become blocked, or damaged, which can negatively affect its continued performance. Pump systems should be inspected at the same time as other components of the stormwater management system.

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the underground pump system:

- Santa Fe Water Systems Inspection and Maintenance Report Form
- Flashlight
- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The key to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the pump system are quick and easy. As mentioned above, the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long term inspection and maintenance interval requirements.

The pump system can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
- Observe the upstream drainage area and look for sources of pollution, sediment, trash and debris.
- Observe the inside of the system through the access manholes. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all of its modules.
- Look for any out of the ordinary obstructions in the inflow pipe(s). Check pipes for movement or leakage. Write down any observations on the inspection form.
- Observe vault walls for signs of deterioration.
- Through observation and/or digital photographs, estimate the amount of floatable debris accumulated in the system. Record this information on the inspection form. Next, utilizing a tape measure or measuring stick, estimate the amount of sediment accumulated in the system. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

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

- Damaged inlet and outlet pipes.
- Obstructions in the system or its inlet(s).
- Excessive accumulation of floatables.
- Excessive accumulation of sediment of more than 6” in depth.
- Damaged joint sealant.

Maintenance Equipment

While maintenance can be done fully by hand, it is recommended that a vacuum truck be utilized to minimize time required to maintain the underground detention, retention, or infiltration system:

- Santa Fe Water Systems Inspection and Maintenance Report Form
- Flashlight

- Manhole hook or appropriate tools to access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- Vacuum truck
- Trash can
- Note: Entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system. Entry into the system will be required if maintenance is required. Some pump systems are sized such that entry is not possible and maintenance will be performed from the surface only.

Maintenance Procedures

It is recommended that maintenance occurs at least three days after the most recent rain event to allow for drain down of the system and any upstream detention systems designed to drain down or pump out over an extended period of time. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Once all safety measures have been set up cleaning of the system can proceed as follows:

- Remove pump(s) and piping components. This may require a hoist or portable crane system depending on pump weight.
- Using an extension on a boom on the vacuum truck, position the hose over the opened manway and lower into the system. Remove all floating debris, standing water (as needed) and sediment from the system. A power washer can be used to assist if sediments have become hardened and stuck to the walls and columns.

If maintenance requires entry into the vault:

- Following rules for confined space entry use a gas meter to detect the presence of any hazardous gases. If hazardous gases are present do not enter the vault. Follow appropriate confined space procedures, such as utilizing venting system, to address the hazard. Once it is determined to be safe, enter utilizing appropriate entry equipment such as a ladder and tripod with harness.
- The last step is to close up and replace all manhole covers and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.

For Pump Maintenance, see provided O&M manual specific to the pump manufacturer.

For Maintenance Services please contact Santa Fe Water Systems at 562-777-9724 for assistance in finding an authorized service provider.

Santa Fe Water Systems

Inspection and Maintenance Report
Pump Systems

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

Project Name ______________________________

Project Address ______________ [Street Number, Street Name (or Cross-Streets), City, Zip Code] ______________

Owner / Management Company ______________________________

Contact ______________________ Phone ( ) –

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

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

Weather Condition ______________________ Additional Notes ______________________

Site Map #	GPS Coordinates	Model #	Inspection of Inlet and Outlet Pipes, Joints, and Connections Between Modules	Trash or Sediment Accumulation (lbs) & Depth (inches)	Structural Notes	Operational Per Manufacturer's Specifications (If not, why?)
	Lat: Long:					
	Lat: Long:					
	Lat: Long:					
Comments:						

ATTACHMENT 4 – COPY OF PLAN SHEETS

Showing Permanent Storm Water BMPs, Source Control, and Site Design

This is the cover sheet for Attachment 4.

Use this checklist to ensure the required information has been included on the plans. Include checklist in submittal and check all boxes that are applicable. Provide justification for items not included.

The plans must identify:

☒ Structural BMP(s) with ID numbers matching Step 5 Summary of PDP Structural BMPs
☒ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
☒ Details and specifications for construction of structural BMP(s)
☒ Signage indicating the location and boundary of structural BMP(s) as required by City staff
☒ How to access the structural BMP(s) to inspect and perform maintenance
☒ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☒ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☒ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☒ Recommended equipment to perform maintenance
☒ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
☒ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
☒ All BMPs must be fully dimensioned on the plans
☒ When proprietary BMPs are used, site-specific cross section with outflow, inflow, and model number must be provided. Photocopies of general brochures are not acceptable.
☒ Include all source control and site design measures described in Steps 3 and 4 of the SWQMP. Can be included as a separate exhibit as necessary.

TENTATIVE TRACT MAP 22-0001/ DEVELOPMENT REVIEW 22-0003/ SP 22-0001/ ZC 22-0001/ GPA 22-0001

HARMON RANCH

CITY OF POWAY, CALIFORNIA

LAND USE

LOT AREA SUMMARY	SF	AC	LOT COVERAGE	TOTAL GROUND FLOOR SF	MAX SF ALLOWED AT 0.55	MAX SF ALLOWABLE ADDITION
LOT 1- PLAN 1, SB w/CA	3,858	0.09	0.47	1,818	2121.9	304
LOT 2- PLAN 2, M	3,864	0.09	0.49	1,878	2125.2	247
LOT 3- PLAN 2, R	3,864	0.09	0.50	1,929	2125.2	196
LOT 4- PLAN 1, FH w/CA	3,881	0.09	0.48	1,872	2134.6	263
LOT 5- PLAN 1, SB w/CA	4,673	0.11	0.39	1,818	2570.2	752
LOT 6- PLAN 3, SB	4,229	0.10	0.44	1,876	2326.0	450
LOT 7- PLAN 1, FH w/CA	4,104	0.09	0.46	1,872	2257.2	385
LOT 8- PLAN 2, M	4,024	0.09	0.47	1,878	2213.2	335
LOT 9- PLAN 3, FH	3,935	0.09	0.49	1,933	2164.3	231
LOT 10- PLAN 1, M	3,824	0.09	0.43	1,639	2103.2	464
LOT 11- PLAN 1, SB	3,982	0.09	0.41	1,638	2190.1	552
LOT 12- PLAN 2, R	3,864	0.09	0.50	1,929	2125.2	196
LOT 13- PLAN 3, FH	3,864	0.09	0.50	1,933	2125.2	192
LOT 14- PLAN 2, SB	3,864	0.09	0.50	1,929	2125.2	196
LOT 15- PLAN 3, FH	3,864	0.09	0.50	1,933	2125.2	192
LOT 16- PLAN 2, R	3,864	0.09	0.50	1,929	2125.2	196
LOT 17- PLAN 3, SB	3,986	0.09	0.47	1,876	2192.3	316
LOT 18- PLAN 2, R w/CA	5,113	0.12	0.42	2,124	2812.2	688
LOT 19- PLAN 1, M w/CA	4,051	0.09	0.45	1,819	2228.1	409
LOT 20- PLAN 3, SB w/CA	4,136	0.09	0.49	2,036	2274.8	239
LOT 21- PLAN 1, FHR w/CA	4,262	0.10	0.44	1,872	2344.1	472
LOT 22- PLAN 2, R w/CA	3,962	0.09	0.54	2,124	2179.1	55
LOT 23- PLAN 1, M w/CA	3,570	0.08	0.51	1,819	1963.5	145
LOT 24- PLAN 1, SB w/CA	3,570	0.08	0.51	1,818	1963.5	146
LOT 25- PLAN 1, FH w/CA	3,774	0.09	0.50	1,872	2075.7	204
LOT 26- PLAN 3, SB w/CA	3,945	0.09	0.52	2,036	2169.8	134
LOT 27- PLAN 2, R w/CA	3,939	0.09	0.54	2,124	2166.5	42
LOT 28- PLAN 3, FH w/CA	3,934	0.09	0.53	2,093	2163.7	71
LOT 29- PLAN 2, SB w/CA	3,928	0.09	0.54	2,124	2160.4	36
LOT 30- PLAN 1, M w/CA	3,729	0.09	0.49	1,819	2051.0	232
LOT 31- PLAN 1, FH w/CA	3,847	0.09	0.49	1,872	2115.9	244
LOT 32- PLAN 3, R w/CA	3,864	0.09	0.54	2,091	2125.2	34
LOT 33- PLAN 1, FH w/CA	3,939	0.09	0.48	1,872	2166.5	294
LOT 34- PLAN 3, R w/CA	3,881	0.09	0.54	2,091	2134.6	44
LOT 35- PLAN 2, M w/CA	3,912	0.09	0.53	2,073	2151.6	79
LOT 36- PLAN 3, SB w/CA	4,855	0.11	0.42	2,036	2670.3	634
LOT 37- PLAN 1, M w/CA	4,220	0.10	0.43	1,819	2321.0	502
LOT 38- PLAN 3, FH w/CA	3,864	0.09	0.54	2,093	2125.2	32
LOT 39- PLAN 2, M w/CA	3,864	0.09	0.54	2,073	2125.2	52
LOT 40- PLAN 1, SB w/CA	3,864	0.09	0.47	1,818	2125.2	307
LOT 41- PLAN 2, R w/CA	3,864	0.09	0.55	2,124	2125.2	1
LOT 42- PLAN 1, M w/CA	3,864	0.09	0.47	1,819	2125.2	306
LOT 43- PLAN 2, SB w/CA	3,865	0.09	0.55	2,124	2125.8	2
LOT 44- PLAN 1, FH w/CA	3,798	0.09	0.49	1,872	2088.9	217
LOT 45- PLAN 2, R w/CA	3,864	0.09	0.55	2,124	2125.2	1
LOT 46- PLAN 3, SB w/CA	3,864	0.09	0.53	2,036	2125.2	89
LOT 47- PLAN 2, M w/CA	3,864	0.09	0.54	2,073	2125.2	52
LOT 48- PLAN 3, R w/CA	3,863	0.09	0.54	2,091	2124.7	34
LOT 49- PLAN 1, FH w/CA	4,577	0.11	0.41	1,872	2517.4	645
LOT 50- PLAN 1, FH w/CA	3,612	0.08	0.52	1,872	1986.6	115
LOT 51- PLAN 1, SB w/CA	3,738	0.09	0.49	1,818	2055.9	238
LOT 52- PLAN 3, R w/CA	3,864	0.09	0.54	2,091	2125.2	34
LOT 53- PLAN 2, M w/CA	3,864	0.09	0.54	2,073	2125.2	52
LOT 54- PLAN 3, FH w/CA	3,864	0.09	0.54	2,093	2125.2	32
LOT 55- PLAN 2, R w/CA	3,864	0.09	0.55	2,124	2125.2	1
LOT 56- PLAN 3, SB w/CA	3,864	0.09	0.53	2,036	2125.2	89
LOT 57- PLAN 2, M w/CA	3,864	0.09	0.54	2,073	2125.2	52
LOT 58- PLAN 3, SB w/CA	3,864	0.09	0.53	2,036	2125.2	89
LOT 59- PLAN 2, R w/CA	3,864	0.09	0.55	2,124	2125.2	1
LOT 60- PLAN 1, FH w/CA	3,648	0.08	0.51	1,872	2006.4	134
LOT 61- PLAN 1, M w/CA	3,739	0.09	0.49	1,819	2056.5	237
LOT 62- PLAN 3, SB w/CA	3,978	0.09	0.51	2,036	2187.9	152
LOT 63- PLAN 1, SB w/CA	3,923	0.09	0.46	1,818	2157.7	340
SUBTOTAL	248,540	5.71				
LOT 64- HISTORIC HOME	10,948	0.25				
SUBTOTAL	10,948	0.25				
OS-1	56,343	1.29				
OS-2	25,666	0.59				
OS-3	1,430	0.03				
OS-4	12,168	0.28				
SUBTOTAL	95,607	2.19				
OSR-1	5,620	0.13				
OSR-2	11,026	0.25				
OSR-3	3,824	0.09				
OSR-4	1,692	0.04				
OSR-5	1,157	0.03				
OSR-6	18,236	0.42				
OSR-7	1,234	0.03				
SUBTOTAL	42,789	0.99				
PRIVATE STREET 'A'	36,322	0.83				
PRIVATE STREET 'B'	28,544	0.66				
PRIVATE STREET 'C'	6,366	0.15				
PRIVATE STREET 'D'	5,663	0.13				
PRIVATE STREET 'E'	2,161	0.05				
ROCA GRANDE (EXISTING)	3,159	0.07				
SUBTOTAL	82,215	1.89				
PUBLIC STREET (OAK KNOLL)	21,273	0.49				
SUBTOTAL	21,273	0.49				
PROJECT TOTAL	501,372	11.51				

LAND USE SUMMARY

Land Use	ACRES
Single Family	5.71
Historic Home	0.25
Open Space OS-3&4	0.31
Open Space Rec	0.99
Subtotal Net Project Area	7.26
Private Streets	1.88
Public Street (Oak Knoll)	0.49
Open Space Floodway OS-1&2	1.88
Project Total	11.51

GROUND FLOOR AREA PER UNIT

	GROUND FLOOR SF	
	W/O CA ROOM	WITH CA ROOM
PLAN 1		
SB	1,638	1,818
FH	1,692	1,872
M	1,639	1,819
PLAN 2		
SB	1,929	2,124
R	1,929	2,124
M	1,878	2,073
PLAN 3		
SB	1,876	2,036
R	1,931	2,091
FH	1,933	2,093

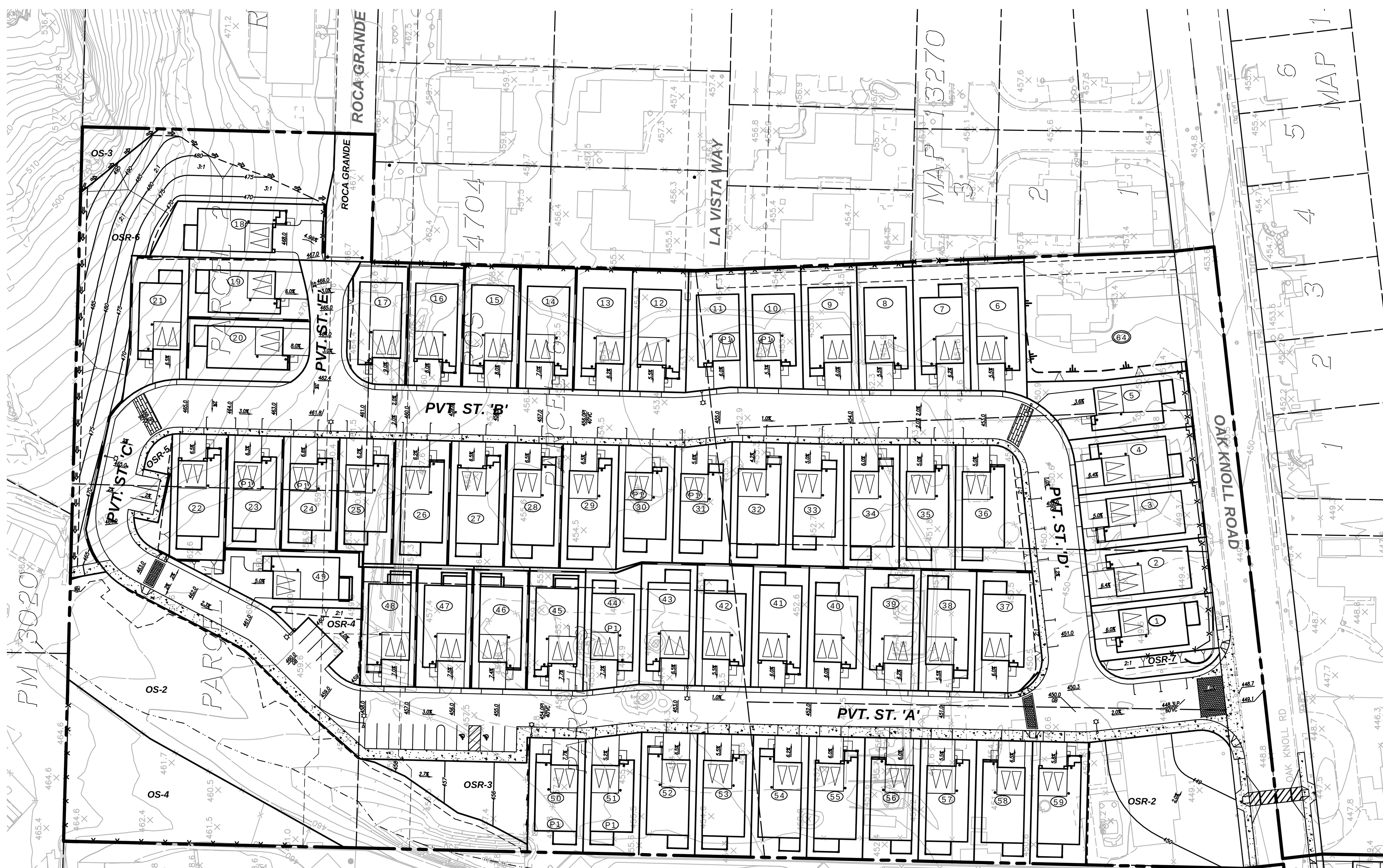
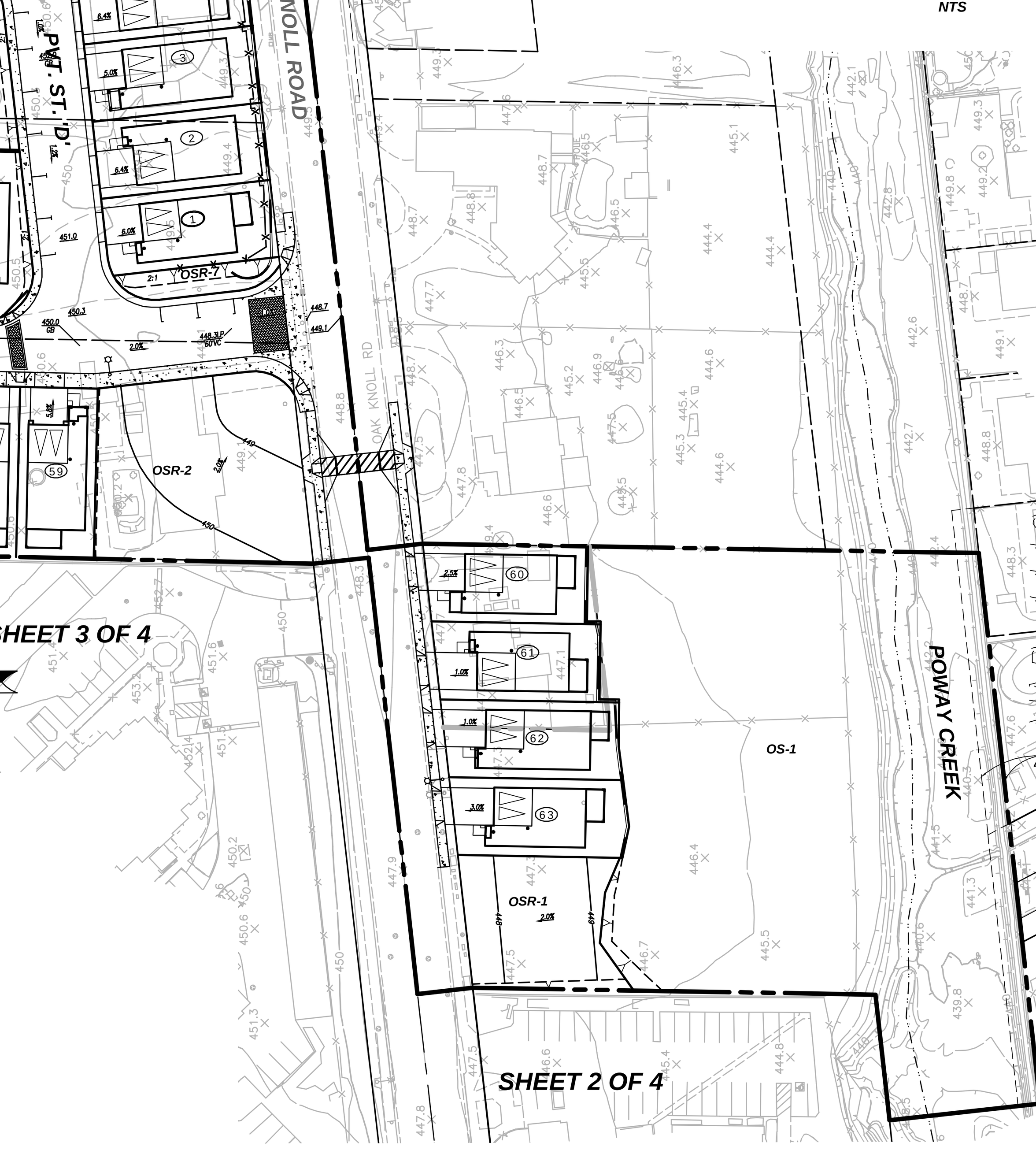
PARKING SUMMARY

PARKING REQUIRED

NO. OF UNITS	SPACES REQUIRED PER LOT (PER 17.08.160 RS-7)	TOTAL
63	2 CAR GARAGE GUEST-NO STATED REQUIREMENT	126
TOTAL REQUIRED		126

PARKING PROVIDED

GARAGE		126
GUEST		
DRIVEWAY	126	
PARALLEL	22	
PERPENDICULAR	18	
SUBTOTAL GUEST		166
TOTAL PROVIDED		292

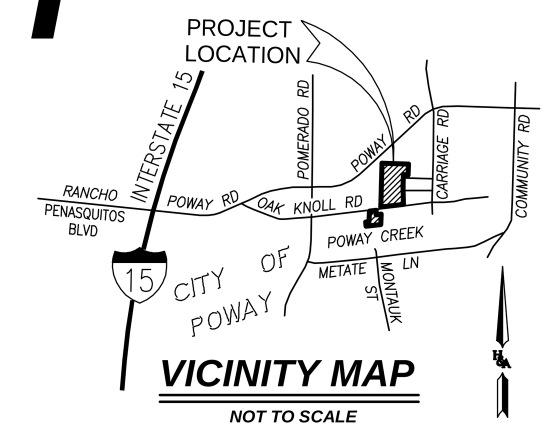



LEGEND

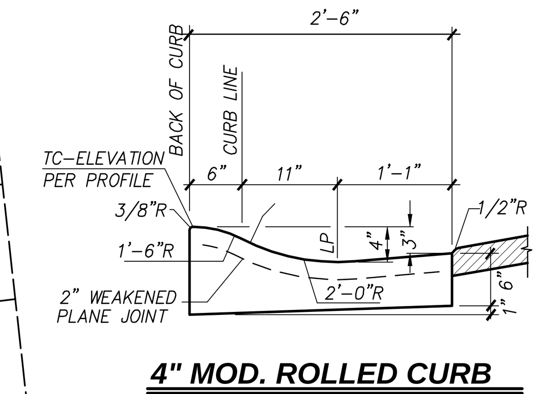
SUBDIVISION BOUNDARY
EASEMENT LINE
EASEMENT NUMBER
SLOPE (2:1 MAX)
% OF GRADE
LOT NUMBER
PAD ELEVATION — P=601.2
OPEN SPACE LOT — OS-1
OPEN SPACE RESERVE LOT — OSR-1
SEWER (*8" PVC)
WATER (*8" PVC)
STORM DRAIN (*18") *UNLESS SHOWN OTHERWISE — FILTERRA INLET, RIP-RAP, CLEANOUT, HEADWALL
EXISTING SEWER
EXISTING WATER
EXISTING STORM DRAIN
BROW DITCH
FIRE HYDRANT
EXISTING FIRE HYDRANT
STREET LIGHT
RETAINING WALL RSD C-4* *UNLESS SHOWN OTHERWISE
TOP/BOTTOM OF WALL ELEVATION — TW/BW
FINISHED SURFACE ELEVATION — FS
DIRECTION OF FLOW/EARTH SWALE
DRIVEWAY CUT PER SDRSD G-14b
10' CROSSWALK-COLOR STAMPED CONC.
CONCRETE SIDEWALK OR TRAIL
POTENTIALLY JURISDICTIONAL WATERS
PLAN TYPE & ELEVATION — 15B
ADA PATH OF TRAVEL
DECORATIVE PAVEMENT FOR TRAFFIC CALMING
CROSS GUTTER

PLAN TYPE SUMMARY

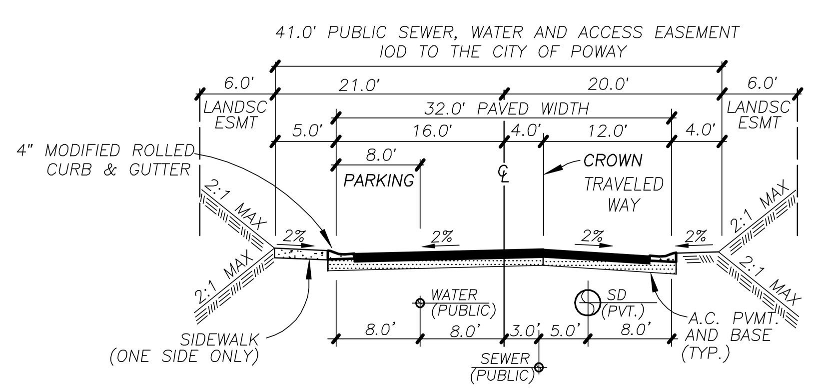
	Plan 1	Plan 2	Plan 3	Total Elev.
Monterey	7	7	-	14
Santa Barbara	7	3	9	19
Farm House	10	-	6	16
Ranch	-	9	5	14
Total Units	24	19	20	63



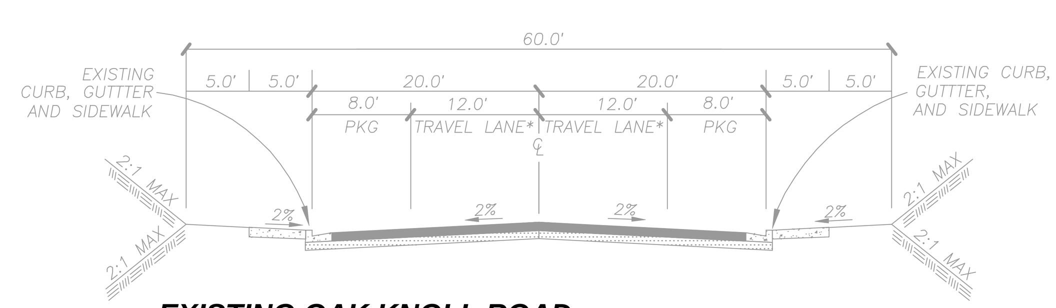
VICINITY MAP
NOT TO SCALE



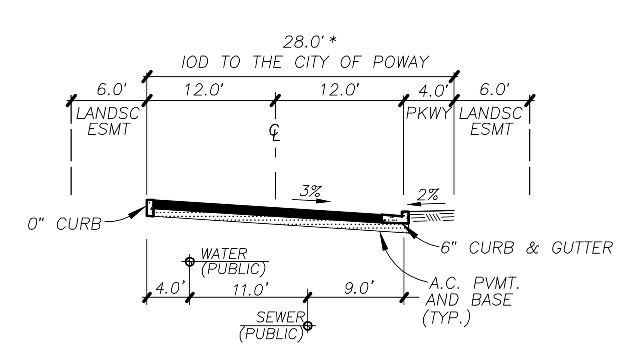
4" MOD. ROLLED CURB
NTS



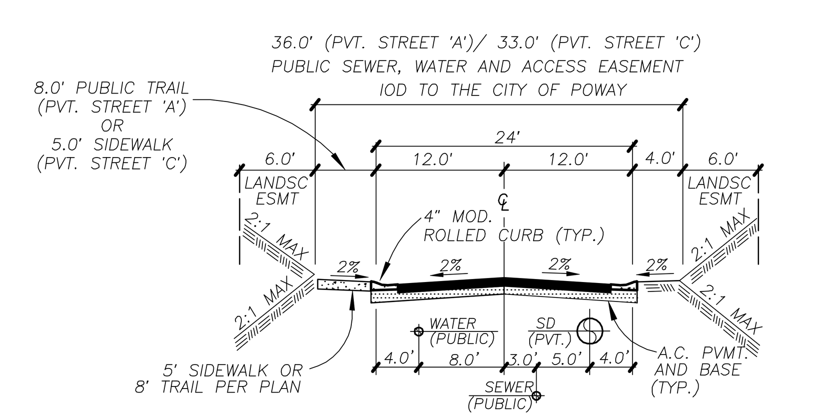
32' PAVED PRIVATE STREET
STREETS 'B' & 'D', AND PORTION OF 'A'
PARKING PERMITTED ON ONE SIDE OF ROAD — PRIVATE ROAD — NTS
20 MPH DESIGN SPEED



EXISTING OAK KNOLL ROAD
LOCAL COLLECTOR, 30 MPH (PUBLIC) — NTS
* SHARED USE BIKE LANE



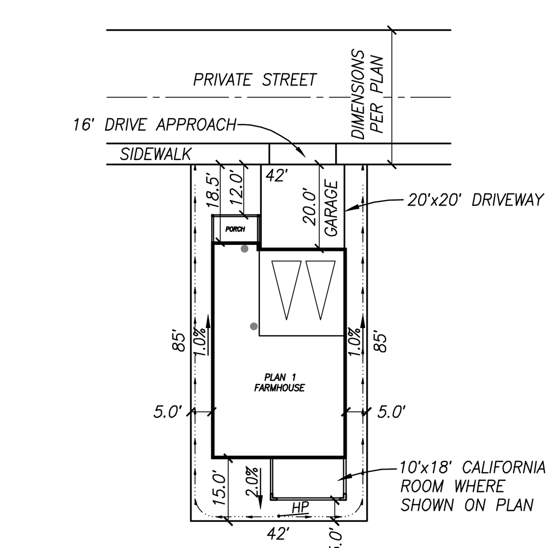
24' PAVED PRIVATE STREET
STREET 'E'
20 MPH DESIGN SPEED — PRIVATE ROAD — NTS
* DIMENSION VARIES AT EVA CONNECTION



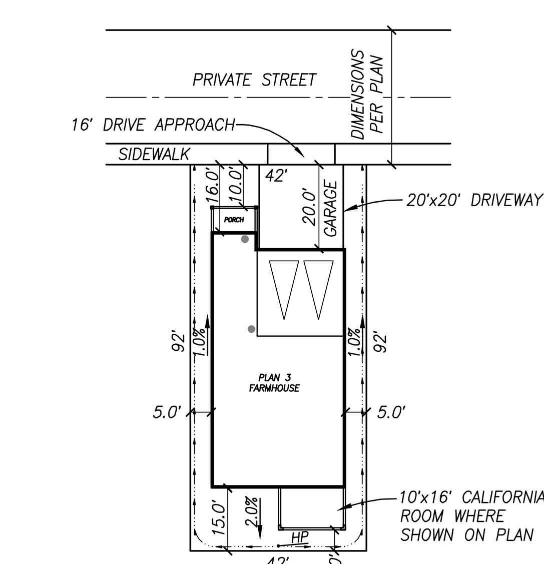
24' PAVED PRIVATE STREETS
STREETS 'A' & 'C'
20 MPH DESIGN SPEED — PRIVATE ROAD — NTS

SHEET INDEX

SHEET 1 — TITLE SHEET
SHEET 2 — TENTATIVE MAP/ PRELIMINARY DEMOLITION PLAN
SHEET 3 — TENTATIVE MAP
SHEET 4 — RECORD BOUNDARY & ENCUMBRANCES, WALL/ FENCE DETAILS



TYPICAL LOT & DRAINAGE DETAIL
PLAN 1 — NTS



TYPICAL LOT & DRAINAGE DETAIL
PLANS 2 & 3 — NTS

GENERAL NOTES

1. TOTAL SITE AREA: 11.51 AC
2. TOTAL SPECIFIC PLAN BOUNDARY: 11.51 AC
3. TOTAL NO. RES UNITS: 64
4. TOTAL NO. LOTS: 81 (63 RESIDENTIAL LOTS, 1 HISTORIC HOME LOT, 4 OPEN SPACE LOTS, 7 OPEN SPACE/REC LOTS, 6 PRIVATE STREET LOTS)
5. ASSESSOR'S PARCEL NUMBER: SEE SHEET 4 OF 4
6. EXIST. GENERAL PLAN DESIGNATION: RS-7
7. PROPOSED GENERAL PLAN DESIGNATION: PD
8. EXISTING ZONING: RS-7
   PROPOSED ZONING: PD (SPECIFIC PLAN)
9. PROPOSED DENSITY: 64 (TOTAL RESIDENTIAL LOTS)/ 7.26 ACRES (NET PROJECT AREA)= 8.8 DU/AC
10. LOT AREAS AND COVERAGE ARE SUBJECT TO CHANGE IN FINAL MAPPING.

GENERAL DESIGN NOTES

1. ALL STREET DESIGNS, STREET LIGHTS, AND FIRE HYDRANTS TO CONFORM TO CITY OF POWAY DESIGN STANDARDS AND AS REQUIRED BY THE CITY ENGINEER.
2. EASEMENTS AS REQUIRED BY THE CITY ENGINEER, PUBLIC UTILITIES AND DISTRICTS.
3. ALL PROPOSED UTILITIES TO BE UNDERGROUND. EXISTING UTILITY POLES LESS THAN 69Kv TO BE UNDERGROUNDED WITHIN THE PROJECT BOUNDARY.
4. CONTOUR INTERVAL: 2 FEET
5. FINISHED GRADES AND DIMENSIONS SHOWN HEREON ARE PRELIMINARY ONLY AND SUBJECT TO CHANGE IN FINAL DESIGN.
6. SOILS INFORMATION WAS OBTAINED FROM SOILS REPORTS BY: GEOCON, INC. DATED 06/15/2022.
7. CUT AND FILL SLOPES NOT TO EXCEED 2:1.
8. THIS PROJECT IS A MULTIPLE "UNIT" SUBDIVISION. IT IS THE INTENT THAT MULTIPLE FINAL MAPS BE FILED PURSUANT TO SECTION 66456.1 OF THE SUBDIVISION MAP ACT. THE FINAL MAP MAY CONSIST OF ONE OR MORE MULTIPLE LOTS AS SHOWN ON THIS TENTATIVE MAP.
9. ALL STREETS SHALL BE CONSTRUCTED IN CONFORMANCE WITH POWAY MUNICIPAL CODE 12.20.070. STREETS WITH GRADES OVER 10 PERCENT MAY BE REQUIRED TO BE CONSTRUCTED OF PORTLAND CEMENT CONCRETE TO THE SATISFACTION OF THE DIRECTOR OF DEVELOPMENT SERVICES (MIN. THICKNESS SHALL BE SIX INCHES) WHEN NECESSITATED BY SPECIFIC FIELD CONDITIONS.
10. SEE SHEET 4 FOR EXISTING EASEMENTS. ANY EASEMENT NOT SHOWN ON SITE PLAN SHEETS TO BE VACATED AND/OR RELOCATED AS SHOWN ON SHEET 4.
11. RETAINING WALLS SHALL COMPLY WITH POWAY MUNICIPAL CODE 17.08.240 OR AS OTHERWISE SHOWN IN THE SPECIFIC PLAN
12. FIRE NOTES SHOWN ON SHEET 2
13. RESIDENTIAL DRIVEWAYS SHALL BE 20' WIDE BY 20' DEEP MINIMUM, WITH 16' WIDE APPROACHES.
14. OFF STREET PARKING SHALL COMPLY WITH PMC CHAPTER 17.42
15. HOMESITES WITHIN THE PROJECT THAT ARE LOCATED WITHIN THE FLOOD PLAIN (AE ZONE) WILL HAVE A MINIMUM FINISH FLOOR ELEVATION OF 2' ABOVE THE BASE FLOOD ELEVATION. FIRM PANEL #1358G DATED 05/16/2012
16. PRIVATE STREETS SHALL HAVE AN IOD TO CITY OF POWAY ON THE FINAL MAP
17. SEE WALL/ FENCE DETAILS ON SHEET 4.

EARTHWORK/GRADING QUANTITIES

CUT: 19,250 C.Y.
FILL: 19,250 C.Y.

MAX. DEPTH OF CUT=18', MAX DEPTH OF FILL=3'.
GRADING QUANTITIES SHOWN ARE RAW QUANTITIES ONLY AND DO NOT INCLUDE THE EFFECT OF REMEDIAL GRADING SHOWN IN THE PRELIMINARY SOILS REPORT.

EXISTING EASEMENTS & ENCUMBRANCES

SEE SHEET 4 of 4 FOR PROPOSED DISPOSITION. ONLY EASEMENTS TO REMAIN ARE PLOTTED ON TM SHEETS 2 & 3.

LEGAL DESCRIPTION

SEE SHEET 4 of 4

TOPOGRAPHIC DATA

TOPO FLOWN BY R.J. LUNG ON 11/29/21 @ 1' CONTOUR INTERVAL

BENCHMARK: CITY OF POWAY BENCHMARK NUMBER A-35
2" DIAMETER BRASS DISK STAMPED "POWAY A-35," IN THE TOP OF CURB ON THE SOUTHERLY SIDE OF POWAY ROAD +32 FEET WESTERLY FROM THE APPROXIMATE CENTERLINE OF RIDGEDALE DRIVE AND ADJACENT TO A STREET LIGHT.

DATUM: NGVD29
PROJECT TO BE ADJUSTED TO DATUM NAVD88 DURING FINAL ENGINEERING. PROPOSED ELEVATIONS SHOWN HEREON TO BE ADJUSTED +2.1 FEET TO BE IN SUBSTANTIAL CONFORMANCE.

PUBLIC UTILITIES AND DISTRICTS

GAS AND ELECTRIC	SAN DIEGO GAS AND ELECTRIC	STORM DRAIN	CITY OF POWAY
TELEPHONE	PACIFIC BELL TELEPHONE	FIRE	CITY OF POWAY
WATER	POWAY MUNICIPAL WATER DIST.	POLICE	SAN DIEGO COUNTY SHERIFF
WATER TRANSMISSION	SAN DIEGO COUNTY WATER AUTHORITY	SCHOOLS	POWAY UNIFIED SCHOOL DIST.
SEWER	POWAY MUNICIPAL WATER DIST.		

OWNERS

HARMON FAMILY TRUST — DATE

SUBDIVIDER/ APPLICANT

LENNAR — DATE

ENGINEER OF WORK

REGISTERED PROFESSIONAL ENGINEER — ALISA S. VIALPANDO — C 47945 — CIVIL — STATE OF CALIFORNIA

ALISA S. VIALPANDO — R.C.E. 47945 — DATE
MY REGISTRATION EXPIRES ON 12/31/23

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC

PLANNING — 9707 Waples ST.
ENGINEERING — San Diego, Ca 92121
SURVEYING — PH(858)558-4500 · FX(858)558-1414

NO.	REVISIONS	DATE	BY
1	FIRST SUBMITTAL	07-25-22	H&A
2	SECOND SUBMITTAL	12-09-22	H&A
3	THIRD SUBMITTAL	04-05-23	H&A
4	FINAL SUBMITTAL	09-05-23	H&A
5			
6			
7			
8			
9			
10			

TENTATIVE TRACT MAP/SP/ZC/ GPA 22-0001 & DEVELOPMENT REVIEW 22-0003

HARMON RANCH

CITY OF POWAY, CALIFORNIA

W.O. 2167-0225

R:\1713\&Pln\Tentative Map\Harmon Ranch TM Sheet 01.dwg[]Sep-05-2023:09:02

SEE SHEET 2 FOR CONTINUATION

NOTES:

1) PADS SHOWN WITH * HAVE ONE 7.5" STEP FROM GARAGE.

2) SIDE YARD SETBACKS ARE 5.0' UNLESS OTHERWISE SHOWN.

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC.

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TENTATIVE TRACT MAP/SP/ZC/ GPA 22-0001 & DEVELOPMENT REVIEW 22-0003

HARMON RANCH

CITY OF POWAY, CALIFORNIA

W.O. 2167-0225

ATTACHMENT 5 – COPY OF PROJECT'S DRAINAGE REPORT

This is the cover sheet for Attachment 5.

If hardcopy or CD is not attached, the following information should be provided:

Title: Drainage Study for Harmon Oaks
Prepared By: Hunsaker & Associates San Diego, Inc
Date: September 2023

PRELIMINARY DRAINAGE STUDY
For
HARMON OAKS

APN'S 317-501-01-00, 317-500-02, 03,09,10,11,12,13,14

Preparation/Revision Date:

June 17, 2022/ November 30, 2022/ September 01, 2023

Prepared for:

Lennar Homes of California, Inc.

16465 Via Esprillo, Ste. 150

San Diego, CA 92127

(858) 618-4942

Declaration of Responsible Charge

I hereby declare that I am the engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by City of Poway is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

Engineer of Work
Hunsaker & Associates San Diego, Inc.
9707 Waples Street
San Diego, CA 92121
Phone: (858)558-4500
Fax: (858)558-1414
Web: www.HunsakerSD.com

09/01/2023

Alisa S. Vialpando, R.C.E. 47945 Date
President

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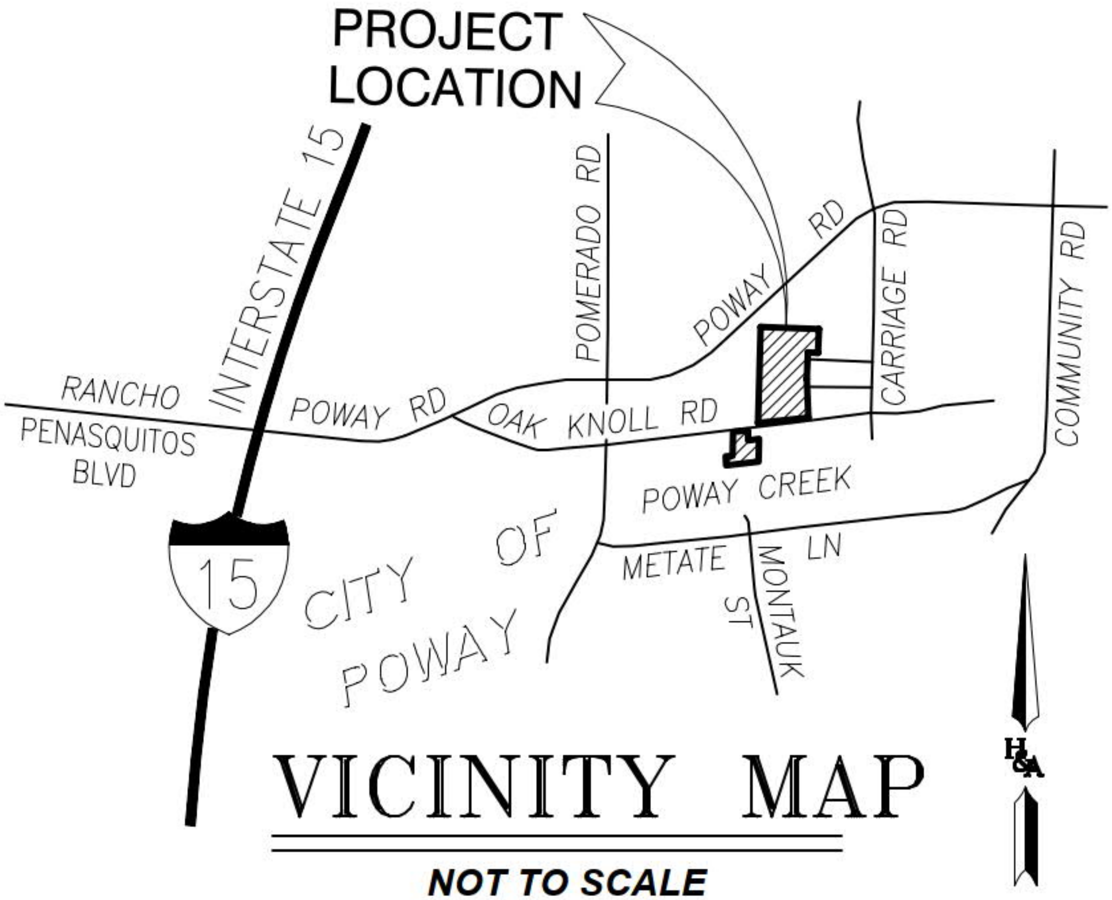
CHAPTER 1 EXECUTIVE SUMMARY

1.1 Introduction

The Harmon Oaks project is located in the City of Poway and is split by Oak Knoll Road, with a portion north of Oak Knoll Road and a smaller portion south of Oak Knoll Road. See below for vicinity map. The development proposes a single-family community with 63 residential lots within 10.77 acres. The site will also include detention underground vault, sidewalks, and parking stalls. The lots are connected by private drives which are accessible via Oak Knoll Road and Roca Grande Drive.



Scope

The scope of this report is to analyze both the existing and proposed hydrologic conditions relative to development of the site and prepare storm drain facilities based on the 100 year flow. Proposed stormwater facilities include storm drain, curb inlets, catch basins, proprietary biofiltration BMPs (curb type Filterra Units or equivalent), underground vault, outlet structure, a pump to pump the hydromodification low flows to the existing storm drain system under Oak Knoll Road, brow ditches, and energy dissipation devices and will be calculated upon Final Engineering. The proposed proprietary biofiltration units for the site will address the water quality requirements, while the underground vault will address the 100 year peak flows, and flow control hydromodification concerns. A separate report has been prepared which details the proposed treatment and flow control features for the project. Refer to the *Stormwater Quality Management Plan (SWQMP) for Harmon Oaks* prepared by Hunsaker & Associates San Diego, Inc. (June 2022).

Summary of Existing Conditions

The existing condition hydrology map (Exhibit 1) is located in Chapter 5. A portion of the project site is currently occupied by single family building structures, driveways, construction equipment yard, and vacant area north of Oak Knoll Road. There is a vegetated channel runs in a north-south direction along the northwestern border of the site. The remainder of the project site, found south of Oak Knoll Road, is a vacant area in its northern portion, except for a building structure northeast of the southern lot, and densely vegetated area in its southern portion. The total analyzed drainage area (on-site and off-site) is 13.79 acres. The elevation-range of the studied water-shed is between 540 feet down to 438 feet. The average slope across the site from the northeast corner to the southwest corner is approximately 5.3%. The imperviousness of the analyzed watershed in its existing condition is approximately 19% (20% for the onsite and offsite area drains to the northern portion of Oak Knoll Road (Node 1 to Node 5), 63% for the offsite area southeast of the northern portion (Node 3 to Node 5), 24% for onsite area and northwest portion of Oak Knoll Road (Node 6 to Node 8), 90% for Oak Knoll Road paved area (Node 9 to Node 11), 0% for the western slopes to Node 14, 8% for the southern portion at Node 16). Please refer to AES Input Data Table in Chapter 3.

Runoff from the northern portion of the project site with the run-on from the eastern offsite development is conveyed via overland flow towards Oak Knoll Road existing inlet (Node 1 to Node 5), where it is captured and comingled with the offsite flows from the southwestern existing development and northeastern half of Oak Knoll Road (Node 3 to Node 5). Total runoff from Node 5 is routed westerly via existing 36” RCP storm drain system to Node 8 per 801-05-1076. Runoff from the southwestern sub-watershed of northern portion of the project site is conveyed via overland flow towards Oak Knoll Road existing inlet, where it is captured and comingled with the offsite flows from the northwestern half of Oak Knoll Road (Node 6 to Node 8). Existing 36” RCP storm drain system carries the total runoff from Node 8 to Node 11, where it comingles with the captured flow from the southern portion of Oak Knoll Road before continues westerly to Node 15. Run-on from the offsite northern slope is conveyed with the runoff from the northwestern portion of the site via overland flow to enters the existing 8’ X 5’ RCP box culvert through the existing headwall per 801-04-150 sheet 5 (Node 12 to Node 14). The existing 8’X5’ RCP box culvert routes the captured flows southwesterly to Node 15, where it comingles with the discharge from (Node 11) the 36” existing storm drain, and then continues southerly to discharge into Poway Creek at Node 16.

Runoff from southern portion of the site with the adjacent eastern offsite area is also conveyed via overland flow to discharge directly into Poway Creek to Node 16.

Table 1 below summarizes the 100-year existing condition peak flow at the downstream project boundary. A runoff coefficient was calculated for each subarea within the watershed based on soil type and impervious percentage using the following formula in accordance with Section 3.1.2 of San Diego County Hydrology Manual June 2003.

C= 0.90 x (% Impervious) + Cp x (1 - % Impervious)

Cp = Pervious Coefficient Runoff value (Cp=0.35 for Soil D and 0.20 for Soil A per Table 3.1)

Runoff Coefficients

C Factor	Description
0.35 Soil D 0.20 Soil A	Cp= Pervious area per SDC Section 3.1.2 and table 3.1
0.90	Impervious areas (proposed and existing)

The calculations for each weighted run-off coefficient for each sub-area as determined in accordance with Section 3.2.1 are shown in Chapter 3. AES input data tables. Supporting calculations for the data presented in Table 1 is located in Chapter 3 of this report. The corresponding hydrology map (Exhibit 1) is located in Chapter 5.

TABLE 1 - Summary of Existing Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	100-Year Peak Flow (cfs)
1	16	SW of site	13.79	26.85

Summary of Developed Conditions

PROJECT DESCRIPTION

The proposed Harmon Ranch Specific Plan and Tentative Map project site (“Project Site”) is located within the southern area of City of Poway, south of Poway Road and east of Pomerado Road. This Project Site is 11.5 acres and is currently designated Residential Single Family 7 (RS-7) in the Poway Comprehensive Plan: General Plan which permits single-family homes on a minimum of 4,500 square foot lots and a maximum density of eight dwelling units per acre. Surrounding land uses include mixed use retail land uses and the Kumeyaay Interpretive Center to the north, Oak Knoll Road, Poway Creek and existing single-family homes to the south and east which are also designated RS-7 and an apartment community to the west.

The current property owner is Harmon Family Trust. The majority of the site has been cleared for several years and was previously used as a construction staging yard for an SDG&E gas line project. The site includes four existing single-family residences. One of the existing homes is a locally designated historic building located at 12702 Oak Knoll Road (APN 317-500-14-00). The historic building was built in 1933 and is constructed of cobblestones. The building is presently designated as City of Poway Historical Site 113 and is documented and known as the “Harmon House.” The historic home will be retained in place within a 0.25-acre site as part of the project. The historic home site will be designated Residential – Historic Home within the Specific Plan.

Lennar Homes of California, LLC (“Applicant”), is proposing a residential neighborhood on a 11.5-acre Project Site. The Project site is comprised of approximately 5.7 acres designated for residential development, a 0.25-acre historic home site, 3.2 acres of open space areas, 1.9 acres for private streets and 0.5 acres of public right-of-way (Oak Knoll Road). The Proposed Project would include 64 single family detached homes. The Proposed Project density (8.8 units/acre) is slightly higher than the 8.0 units/acre permitted in the existing RS-7 designation. Primary access to the Project Site is planned via existing Oak Knoll Road. Fifty-nine of the new homes are proposed to front newly constructed private streets, while four homes and an open space/overlook area front existing Oak Knoll Road. The existing historic home has direct access via Oak Knoll Road.

Land Use Summary

Use/Land Use	Approx. Net Acres (AC)	% of Planning Area (%)	Max. Dwelling Units (DU)	Density (DU/AC)[1]
Non-Residential Land Uses				
Open Space (OS-1 & 2) (Floodway)	1.88	16.3%		
Open Space (OS-3 & 4)	0.31	2.7%		
Open Space Recreation (OSR-1 to 7)	0.99	8.6%		
Subtotal Open Space	3.18	27.6%		
Private Internal Residential Streets	1.88	16.3%		
Oak Knoll Road ROW (existing)	0.49	4.3%		
Subtotal Streets	2.37	20.6%		
Subtotal Non-Residential	5.55	48.2%		
Residential (R) Land Use				
Residential Single Family (R-SF) (Lots 1 to 64)	5.96	51.8%	64	
Subtotal Residential	5.96	51.8%	64	
TOTAL Specific Plan Area	11.51	100%	64	8.8

1- Statistics are based upon preliminary design and may vary slightly from Development Plan, Tentative Map, and/or Final Map. Refer to Chapter 7 regarding substantial conformance.
2- Pursuant to State Law, local governments cannot preclude an Accessory Dwelling Unit (ADU) or Junior Accessory Dwelling Units (JADU). An ADU and JADU is an accessory use for the purposes of counting allowable density under general plan and zoning and is therefore not counted as an additional unit. An ADU and JADU shall be permissible in accordance with the PMC or, if the locally adopted ordinance is void, the State Government Code. See Section 3.2.2.G for information regarding ADUs.
3- Open Space areas within the floodway (OS-1 and OS-2) and public street (Oak Knoll Road) and internal private streets are excluded from the density calculation. The following calculation was utilized to determine the net residential density for the project: Residential (5.96 ac) + Open Space Recreation Lots 1-7 (0.99 ac) + Open Space Lots 3 and 4 (0.31 ac) = 7.26 ac. 64 / 7.26 = 8.8.

The Applicant is proposing a Specific Plan and Tentative Map to facilitate development of a 64 single family homes. The Harmon Ranch Specific Plan will establish three land use districts within the Project Site: Residential Single Family (R-SF); Open Space (OS); and Open Space Recreation (OS-R). The Specific Plan will also provide development regulations and permitted uses for each land use district.

The Proposed project is comprised of 64 single-family homes on lots 42-feet wide and 85- to 90-feet deep, with standard two-car garages, 20-foot-deep by 20-foot-wide driveways to accommodate an additional two off-street parking spaces within the private lots and private fenced rear yards. The Proposed Project also includes 40 guest parking spaces along the private streets, approximately 1.0 acres of Open Space Recreation areas, approximately 2.2 acres of natural Open Space areas and a segment of the General Plan Community trail (approximately 1,000 feet) within the Project Site. A potential off-site trail connection to the adjacent retail area located to the north may occur in the future, subject to property owner cooperation but is not part of the proposed project. The "Overlook" area located in the south portion of the Project Site is planned to provide public access and will be privately maintained.

Discretionary actions which require Poway City Council consideration include the following:

- Environmental Impact Report (EIR)
- General Plan Amendment/Zone Change (GPA/ZC) from Residential Single-Family 7 (RS-7) to Planned Community (PC)
- Tentative Map (TM)
- Development Review (DR) Permit
- Final Map

The post-developed condition of the site will include improvements consisting of a single-family residential development including building structures, driveways, access roads, sidewalks, and landscaped areas. The site also proposes proprietary biofiltration facilities to address water quality requirements (Filterra units or alternative), underground vault, storm drains, inlets, and brow ditches sized to collect and convey site runoff through the project area.

The proposed vault will attenuate the 100 year peak flows as well as address flow control hydromodification and pollutant control for water quality. For additional discussion on the proposed water quality and hydromod features of the site, refer to the *Stormwater Quality Management Plan (SWQMP) for Harmon Oaks* (June 2022) prepared by Hunsaker & Associates San Diego, Inc.

Runoff from the northern portion of the proposed development will be routed via street gutters to the proposed on site inlets and proprietary biofiltration units to address water quality requirements, and then travels via private proposed storm drain system southwesterly to the proposed underground vault (Node 50 to Node 74). Discharge from the vault will be controlled by an outlet structure equipped with orifices and weir with varying dimensions and invert elevations to meet current hydromodification requirements and attenuate the proposed 100-year peak flows to be equal or less than existing conditions 100-year peak flow. Due to existing storm drain flow elevation, the low flow orifice can't be routed directly to the downstream storm drain. Therefore, discharge from the low flow orifice will be pumped to the proposed cleanout\ manhole downstream of the vault, where the discharge from the rest of the orifices and weir (Vault outlet structure) will be routed to before discharging into the existing 36" RCP at Oak Knoll Road (Node 8). The proposed vault within northern portion of the project has been sized to provide additional hydromodification and 100-year peak flow control and mitigate impact from this area when measured at the analyzed discharge point (Node 16-POC1).

Runoff from northeastern offsite development -that drains through the site in existing conditions- will be conveyed via proposed ditch to a proposed catch basin west of La Vista Way and then routed vis proposed storm drain to the existing 36" storm drain at Oak Knoll Road (Node 3 to Node 5). Runoff from offsite area southeast of the northern portion of the project will drain similarly to existing conditions via overland flow towards Oak Knoll Road existing inlet (Node 4 to Node 5), where it will be captured and routed via existing 36" RCP storm drain system to Node 8, where it comingles with the discharge from the proposed development and runoff from the northwestern half of Oak Knoll Road (Node 5 to Node 8). Total runoff from Node 8 will be routed westerly via existing 36” RCP storm drain system to Node 11. Existing 36” RCP storm drain system carries the total runoff from Node 8 to Node 11. Runoff from northern area of southern portion of the project will drain towards Oak Knoll Road gutter and routed westerly to proposed proprietary biofiltration unit (filterra unit or equivalent). The proposed proprietary biofiltration unit will provide water quality pollutant control prior to discharging into the existing storm drain system at Oak Knoll Road Node 11. Total runoff from southern portion of Oak Knoll Road and northern developed area of southern portion of the project will comingle with the total captured flow at Node 11, berfore continues westerly to Node 15.

Runoff from the offsite northern slope will be captured via a brow ditch and conveyed with the runoff from the proposed graded slope northwest of the northern portion of the site via overland flow to enters the existing 8’ X 5’ RCP box culvert through the existing headwall per 801-04-150 sheet 5 (Node 12 to Node 14). The existing 8’X5’ RCP box culvert routes the captured flows southwesterly to Node 15, where it comingles with the discharge from (Node 11) the 36” existing storm drain, and then continues southerly to discharge into Poway Creek at Node 16.

Runoff from southern area of southern portion of the site with the adjacent eastern offsite area will also conveyed via overland flow similarly to existing conditions to discharge directly into Poway Creek to Node 16.

Table 2 below summarizes the 100-year proposed condition peak flow at the downstream project boundary. A runoff coefficient was calculated for each subarea within the watershed based on soil type and impervious percentage using the following formula in accordance with Section 3.1.2 of San Diego County Hydrology Manual June 2003.

C= 0.90 x (% Impervious) + Cp x (1 - % Impervious)

The calculations for each weighted run-off coefficient for each sub-area as determined in accordance with Section 3.2.1 are shown in Chapter 3. AES input data tables. Supporting calculations for the data presented in Table 2 is located in Chapter 3 of this report. The corresponding hydrology map (Exhibit 2) is located in Chapter 5.

TABLE 2 - Summary of Proposed Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	100-Year Peak Flow (cfs) ^	100-Year Peak Flow (cfs)*
1	16	SW of site	13.79	46.65	14.21

^runoff rates before flood attenuation
*runoff rates after flood attenuation

A portion of the site, at the south western corner of the northern portion of the project and northern developed area of the southern portion of the project, is located within Zone AE (within the flood plain for Poway Creek), per the FEMA Firmette found in Chapter 6 and will require a Floodplain Development Permit.

The Proposed Drainage Map in Chapter 5 shows the developed site with its subareas and flow paths. There is only one outfall location from the proposed site, as the proposed and existing storm drain conveys the flows towards Poway Creek, similarly to existing conditions. Due to the increase in impervious area compared with the existing condition, the peak flows generated from the site will be reduced through the proposed vault. Design calculations for the vault attenuation can be found in Chapter 4.

<u>Summary of Results</u>

Development of *Harmon Oaks* site required a storm drain system to capture and convey the Q100 peak flows safely to the existing storm drain system at Oak Knoll Road. See Chapters 3 hydrologic models. The corresponding hydrology maps are located in Chapter 5.

Ten proprietary biofiltraton units (Filterra units or equivalent) are proposed to address water quality requirements, and one underground vault for hydromodification, and peak flow attenuation. Flows from the site are attenuated to be less than the existing flows when measured at the point of compliance southwest of the project (POC-1) to Poway Creek.

Since the proposed vault onsite will mitigate the 100 year flow to below existing conditions, there will be no negative impacts to downstream drainage developments and facilities.

Inlet calculations, brow ditches and storm drain hydraulic will be provided in final engineering.

Table 3 below summarizes the comparison between existing and proposed flow rates from the site.

TABLE 3 – Existing Condition vs. Proposed Condition

Discharge Location	Existing Node	Proposed Node	Existing Condition Area (ac)	Proposed Condition Area (ac)	Existing: 100-Year Peak Flow (cfs)	Proposed: 100-Year Peak Flow (cfs)	Q100 Flow Difference (cfs)
SW of site	16	16	13.79	13.79	26.85	14.21	-12.64

Conclusions

Development of Harmon Oaks site will not alter the drainage patterns, and the proposed improvements will decrease the flows to below existing conditions. Therefore no adverse impacts are expected.

References

San Diego County Hydrology Manual, County of San Diego Department of Public Works Flood Control Division, June 2003.

San Diego County Hydraulic Design Manual, County of San Diego Department of Public Works Flood Control Division, September 2014

Stormwater Quality Management Plan (SWQMP) for Harmon Oaks, Hunsaker & Associates San Diego, Inc., June 2022

CHAPTER 2 METHODOLOGY

Modified Rational Method Hydrologic Analysis

Computer Software Package – AES-2015

Design Storm - 100- year return interval

Land Use – Single-family Residential

Soil Type – Per the NRCS Web Soil Survey, the existing soil consists of Soil Type D for majority of the site and A for a small portion of the southern area. Group D soils have very slow rates. Consisting chiefly of clay soils with a high swelling potential, soils with a high permanent water table, soils with clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials, Group D soils have a very slow rate of water transmission. Group A. Soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Runoff Coefficient - In accordance with the County of San Diego standards, runoff coefficients were based on land use and soil type San Diego County Hydrology Manual. Runoff coefficient was calculated for each subarea within the watershed based on soil type and impervious percentage using the following formula in accordance with Section 3.1.2 of San Diego County Hydrology Manual June 2003.
C= 0.90 x (% Impervious) + Cp x (1 - % Impervious)

Cp = Pervious Coefficient Runoff value (Cp=0.35 for Soil D and 0.20 for Soil A per Table 3.1)

Runoff Coefficients

	C Factor	Description
Rainfall	0.35 Soil D 0.20 Soil A	Cp= Pervious area per SDC Section 3.1.2 and table 3.1
	0.90	Impervious areas (proposed and existing)

Intensity- The rainfall intensity is determined per the San Diego County Hydrology Manual based on 6-hour precipitation amounts and calculated time of concentrations. Six-hour precipitations are taken from the San Diego County Hydrology Manual isopluvials.

Method of Analysis – The Rational Method is the most widely used hydrologic model for estimating peak runoff rates. Applied to small urban and semi-urban areas with drainage areas less than 0.5 square miles, the Rational Method relates storm rainfall intensity, a runoff coefficient, and drainage area to peak runoff rate. This relationship is expressed by the equation:

Q = CIA, where:

- Q = The peak runoff rate in cubic feet per second at the point of analysis.
- C = A runoff coefficient representing the area - averaged ratio of runoff to rainfall intensity.
- I = The time-averaged rainfall intensity in inches per hour corresponding to the time of concentration.
- A = The drainage basin area in acres.

To perform a node-link study, the total watershed area is divided into subareas which discharge at designated nodes.

The procedure for the subarea summation model is as follows:

(1) Subdivide the watershed into subareas with the initial subarea being less than 10 acres in size (generally 1 lot will do), and subsequent subareas gradually increasing in size. Assign upstream and downstream nodal numbers to each subarea to correlate calculations to the watershed map.

(2) Estimate an initial T_c by using the appropriate nomograph or overland flow velocity estimation.

(3) Using the initial T_c, determine the corresponding values of I. Then Q = CIA.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to the particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES-2003 computer subarea menu is as follows:

SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipe flow travel time (computer estimated).
4. Pipe flow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through subarea.
7. User - specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$Q_p = Q_a + Q_b$; $T_p = T_a = T_b$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.

$Q_p = Q_a + Q_b\ (I_a/I_b)$; $T_p = T_a$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

$Q_p = Q_b + Q_a\ (T_b/T_a)$; $T_p = T_b$

Underground storm drains are analyzed in a similar way. Flow data obtained from the surface model for inlets and collection points are input into the nodes representing those structures. Design grades and lengths are used to compute the capacity of the storm drains and to model the downstream travel times.

Detention

In order to provide adequate peak flow attenuation, increases in peak flow rates at the outfall location for this site has been mitigated using the design of the proposed vault. Mitigation within the vault has been modeled using SWMM 5.01.

RickRatHydro has been used to generate inflow hydrograph for the vault, based on area, time of concentration, P6 value, runoff coefficient, and peak flow rate for the drainage area (from hydrology analysis).

The inflow hydrograph was then imported into SWMM model as an inflow to the storage unit (representing the vault volume) and was connected to the outfall point by using an outlet link (represent the outlet structure). The vault Stage-Storage curve and Stage-Discharge curve were generated by Excel. Generating Stage-Storage curve is relatively simple for the vertical-sided vault, where volume increases linearly with the stage value. For the Stage-Discharge curve, both weir equation (for partially submerged condition) and orifice flow equation (for fully submerged condition) were adopted to evaluate the riser discharge based on the water depth in front of the orifice and emergency weir. These generated curves were modeled as tabular curves for the storage unit and the outlet link in SWMM to calculate the water surface elevation and outfall flow rate.

ATTACHMENT 6 – COPY OF PROJECT'S GEOTECHNICAL REPORT

This is the cover sheet for Attachment 6.

If hardcopy or CD is not attached, the following information should be provided:

Title: Geotechnical Investigation **OAK KNOLL, POWAY, CA**
Prepared By: Geocon
Date: June 15, 2022

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

GEOTECHNICAL INVESTIGATION

OAK KNOLL
POWAY, CALIFORNIA

PREPARED FOR

LENNAR
SAN DIEGO, CALIFORNIA

JUNE 15, 2022
PROJECT NO. G2746-32-02

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. G2746-32-02
June 15, 2022

Lennar
16465 Via Esprillo, Suite 150
San Diego, California 92127

Attention: Mr. David Shepherd

Subject: GEOTECHNICAL INVESTIGATION
OAK KNOLL
POWAY, CALIFORNIA

Dear Mr. Shepherd:

In accordance with your request, we have performed a geotechnical investigation for the Oak Knoll project located in Poway, California. The accompanying report presents the findings of our study, and conclusions and recommendations pertaining to the geotechnical aspects of developing the project as presently proposed. Based on the results of this study, it is our opinion that the subject property can be developed as planned provided that the recommendations of this report are followed.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

David B. Evans
CEG 1860

TEM:DBE:am

(e-mail) Addressee

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GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed Oak Knoll project located in Poway, California (see Vicinity Map, Figure 1). The purpose of our study was to evaluate the soil and geologic conditions on the site and provide geotechnical recommendations pertaining to development of the property as proposed.

The scope of this investigation included a review of the Tentative Map for Oak Knoll, City of Poway, California, Sheets 1 through 3 of 3, prepared by Hunsaker and Associates San Diego, Inc, undated. We also performed a field investigation, conducted laboratory testing to characterize the physical properties of the soils encountered, performed engineering analyses and prepared this report.

We performed an initial field investigation on May 28, 2021, which consisted of drilling 10 hydraulic rotary air percussion borings (generically referenced herein as air-track borings) to evaluate rock rippability in the northeastern portion of the site. On May 18, 2022, we excavated 11 exploratory trenches to evaluate the thickness and condition of surficial deposits requiring remedial grading. We also performed one infiltration test in the area of the proposed stormwater vault to assess the saturated hydraulic conductivity of the underlying soil. Logs of the exploratory trenches, air-track borings, and other details of the field investigation are presented in Appendix A. The locations of the exploratory trenches and borings are presented on the Geologic Map, Figure 2 (map pocket). The infiltration test results are presented in Appendix C.

We performed laboratory testing on selected soil samples obtained during the field investigation to evaluate pertinent physical properties of the soil types encountered. The laboratory information was used in engineering analyses to develop recommendations for geotechnical aspects of site development. Details of the laboratory tests and a summary of the test results are presented in Appendix B.

The recommendations presented herein are based on analysis of the data and observations obtained during field investigations, and our experience with similar soil and geologic conditions. Additional references reviewed to prepare this report are provided in the *List of References*.

2. SITE AND PROJECT DESCRIPTION

The overall site consists of two properties located on either side of Oak Knoll Road, south of Poway Road, east of Pomerado Road, and west of Carriage Road. The northern portion of the site (north of Oak Noll Road) consists of approximately 10-acres of essentially undeveloped land, except for a single-family residence and several associated structures along the southwestern property boundary. The southern portion (south of the Oak Knoll Road) consists of two parcels of land. The western parcel is undeveloped, and the eastern parcel is occupied by a single-family residence.

Topographically, the southern property is relatively flat with an elevation of approximately 446 feet Mean Sea Level (MSL) to 448 feet MSL and the northern property is level to moderately sloping with elevations ranging from approximately 449 feet MSL to 495 feet MSL. Poway Creek is located along the southern boundary of the southern parcels. A flood elevation of 447 feet MSL is shown on the Tentative Map. A tributary to Poway Creek exists along the northwest property boundary of the northern parcel. The tributary has been channelized and outlets into a storm drain system beneath Oak Knoll Road, constructed as part of the existing residential development to the west. Surface drainage across the northern property is primarily to the south and southwest towards Oak Knoll Road. The southern property drains to the south and southwest into Poway Creek.

Vegetation within the development footprint consists of natural low-lying grasses and some isolated small trees. A large portion of the northern property has been cleared, fenced, and covered with gravel to support an equipment storage yard for a San Diego Gas and Electric subcontractor. Heavy vegetation consisting of large trees and shrubs exist along the southern margin of the south parcels.

Based on review of the Tentative Map, the properties will be developed to create 64 single-family residences, including 60-lots on the northern property and 4-lots on the southern property. The northern development includes a loop road off of Oak Knoll Road that also connects to Roca Grande Drive to the northeast. Associated storm water BMP's, underground utilities, and retaining walls are also planned.

Grading will consist of maximum cut and fill depths of approximately 16 feet and 4 feet, respectively, not considering remedial grading. Cut and fill slopes with maximum heights of approximately 30 feet and 4 feet, respectively, are planned and designed at an inclination of 2:1 (horizontal:vertical) or flatter. Several retaining walls are shown on both properties that range from approximately 1-foot to 6-feet in height. A rear-yard retaining wall is shown along the south development boundary of the southern property to raise building pad elevations above the flood elevation of 447 feet (MSL).

The locations and descriptions of the site and proposed development above are based on our recent and previous field study and review of the project Tentative Map. If development plans differ significantly from those described herein, Geocon Incorporated should be contacted for review and possible revisions to this report.

3. SOIL AND GEOLOGIC CONDITIONS

Four surficial soil types and two geologic formations were encountered during the field investigation. The surficial deposits consist of undocumented fill, alluvium, colluvium, and terrace deposits. The formational units includes the Eocene-age Friars Formation and Cretaceous-age granodiorite (granitic rock). Each of the surficial soils and geologic units encountered are described in order of increasing age. The approximate extent of the surficial deposits and formational materials are shown on the Geologic Map, Figure 2.

3.1 Undocumented Fill (Qudf)

Undocumented fill embankments cover the majority of both properties. The fill is approximately 6-feet thick along the southern boundary of Lots 61 through 64 (adjacent to Poway Creek). However, within the development footprint, these materials generally range from 1 to 2-feet-thick with the exception of the west margin of the northern parcel where the fill may be up to 5-feet-thick. The undocumented fill is unsuitable for support of additional fill or structural loading in its present condition and will require complete removal and compaction within areas of planned development.

3.2 Alluvium (Qal)

Alluvial deposits were encountered in Trench T-1 beneath the undocumented fill. Alluvium may also extend into the proposed roadway area northwest of Lots 23, 49 and 50. These deposits generally consist of very loose, wet, sandy gravel with silt and clay. The alluvium is compressible and will require removal and compaction if encountered in areas of planned development.

3.3 Colluvium (Qc)

Colluvial deposits were encountered in Trenches T-10 and T-11 overlying the granitic rock or terrace deposits. These deposits were up to 10-feet-thick and consist of dry to damp silty/clayey sand with pinhole porosity. The colluvium is considered hydro-compressible and will require removal and compaction.

3.4 Terrace Deposits (Qt)

Terrace deposits were encountered across the majority of both properties as encountered in Trenches T-2 through T-10. These deposits overly granitic rock and Friars Formation and where encountered, were up to 12-feet-thick. The terrace deposits generally consist of damp to moist, medium stiff to very stiff sandy clay and moist to wet, medium dense clayey gravel with cobble. In general, the terrace deposits are currently considered unsuitable for additional fill or structural loading and will require removal and compaction. However, it is possible that a portion of these deposits can be left in-place upon further testing.

3.5 Friars Formation (Tf)

The Eocene-age Friars Formation was encountered beneath the surficial soils across both properties and overlies the granitic rock. This formation typically consists of dense sandstones, hard claystones, and siltstones. The Friars Formation is suitable for support of additional fill or structural loads.

3.6 Granodiorite (Kgd)

Cretaceous-age Granodiorite (granitic rock) underlies the sedimentary deposits and is exposed in the north and northeast portion of the northern property. Based on observations made during the field exploration, site reconnaissance, and rock rippability study, the granitic rock exhibits a variable weathering pattern ranging from highly weathered, decomposed rock to outcrops of slightly weathered, extremely strong rock that will require blasting to excavate. The granitic unit generally exhibits adequate bearing and slope stability characteristics. Cut slopes excavated within the granitic rock should be stable to the proposed heights if free of adversely oriented joints or fractures.

The soils derived from excavations within the decomposed granitic rock are anticipated to consist of low-expansive, silty, medium- to coarse-grained sands and should provide suitable foundation support in either a natural or properly compacted condition. Excavations within the granitic rock may generate boulders and oversize materials (rocks ≥12 inches in nominal dimension) that will require special handling and placement as recommended hereinafter.

4. RIPPABILITY AND ROCK CONSIDERATIONS

We performed a rock rippability evaluation consisting of drilling 10 air-track borings in proposed cut areas. We performed the study with an Ingersoll-Rand ECM 490 equipped with a 4-inch-diameter bit. Drill penetration rates were used to evaluate rock rippability and to estimate the depth at which difficult excavation will occur. Rock rippability is a function of natural weathering processes that can vary vertically and horizontally over short distances depending on jointing, fracturing, and/or mineralogic discontinuities within the bedrock.

A frequently used guideline to equate rock rippability to drill penetration rate is that a penetration rate of approximately 0 to 20 seconds per foot (spf) generally indicates rippable material, 20 to 30 spf indicates marginally to non-rippable material, and greater than 30 spf indicates non-rippable rock. These general guidelines are typically based on drill rates using a rotary percussion drill rig similar to an Ingersoll Rand ECM 360 with a 3½-inch drill bit. The penetration rates (recorded in seconds per foot) for the air track boring are presented in Appendix A, Figures A-12 through A-21.

The rippability designations discussed above are based on the use of a D9 or equivalent bulldozer equipped with a single shank ripper. Rippable materials can be excavated with moderate to heavy effort. Marginally rippable includes very heavy ripping and isolated zones of probable blasting. Non-rippable materials will require blasting to excavate the rock.

The estimated thickness of rippable material for each air track boring is presented on Figure 2 (map pocket). Perspective contractors should use their own judgment to identify the penetration rate boundary between productive and non-productive ripping and, rippable and non-rippable rock. We used a threshold of 20 spf to indicate the thickness of rippable material next to each boring on the geologic map.

Based on an air track penetration rate of 20 spf, it is expected that the rippability characteristics will vary. The air-track borings indicate that, where fresh rock is not exposed near the surface (e.g., boulders), the granitic rock is characterized by a rippable weathered mantle varying from approximately 4 to 20-feet-thick. Excavations greater than these depths will encounter difficult ripping conditions and may requiring blasting techniques and can be expected to generate oversized rock (rocks ≥12 inches in dimension), which will necessitate typical hard rock handling, sizing, and placement procedures during grading operations. Proposed cuts in the weathered mantle may also generate oversized fragments.

Estimates of the anticipated volume of hard rock materials generated from proposed excavations should be evaluated based on the information from each boring and drill penetration rate criteria acceptable to the contractor. Roadway/utility corridors and lot undercutting criteria should also be considered when calculating the volume of hard rock. In addition, a volumetric evaluation should be performed to determine if there are available fill placement areas considering the rock hold down criteria.

Earthwork construction should be carefully planned to efficiently utilize available rock placement areas. Oversize materials should be placed in accordance with rock placement procedures presented in Appendix D of this report and governing jurisdictions.

5. GROUNDWATER/SEEPAGE

Groundwater/seepage was encountered in the exploratory trenches (T-1 through T-3, T-5 through T-8, and T-11) adjacent to Poway Creek and other areas of the site at depths ranging between 6 feet and 11 feet below the ground surface. It appears that the groundwater is perched above the alluvium/colluvium/terrace deposit contact with the underlying Friars Formation or granitic rock. We encountered seepage in exploratory trenches T-9 and T-10 at depths ranging from 8 feet to 11 feet below the ground surface. We performed the field investigation in May 2022 during a regional drought. The seepage encountered in the trenches was likely associated with previous rain and irrigation.

Groundwater levels in drainage areas can be expected to fluctuate seasonally and may affect grading. In this regard, grading may encounter wet to saturated soils conditions causing excavation and compaction difficulty, particularly if construction is planned during the rainy season. Remedial grading of surficial deposits near the tributary (Trench T-11) or Poway Creek, if any, will encounter shallow groundwater and wet to saturated soils requiring specialized excavation equipment, possible dewatering and drying of the material to facilitate proper compaction.

6. GEOLOGIC HAZARDS

6.1 Ground Rupture

USGS (2016) shows that there are no mapped Quaternary faults crossing or trending toward the property. In addition, the site is not located within a currently established Alquist-Priolo Earthquake Fault Zone.

The nearest known active faults are the Newport-Inglewood/Rose Canyon Fault Zone, located approximately 15 miles west of the subject site. Based on this study, it is our opinion that the risk associated with ground rupture hazard is considered low.

6.2 Seismicity

The San Diego County and Southern California region is seismically active. Considerations important in seismic design include the frequency and duration of motion and the soil conditions underlying the site. Seismic design of structures should be performed in accordance with the California Building Code (CBC) guidelines currently adopted by the local agency. The risk associated with strong ground shaking due to earthquakes at the site is no greater than that for the region.

6.3 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil densities are less than about 70 percent of the maximum dry densities. If all four criteria are met, a seismic event could result in a rapid increase in pore water pressure from the earthquake-generated ground accelerations. The potential for liquefaction at the site is considered to be negligible due to the dense formational material encountered and remedial grading.

6.4 Tsunamis and Seiches

The risk associated with tsunamis and seiches hazard at the project is low due to the site elevation and the absence of an upstream body of water.

6.5 Landslides

We did not encountered landslides within the site or mapped any landslides within the immediate areas influencing the project. In our opinion, the risk associated with landslide hazard is low.

6.6 Flooding

The County of San Diego Multi-Jurisdictional Hazard Mitigation Plan, dated October 2017, indicates that the southern property (Lots 61 through 64) is located within a 500-year floodplain.

A review of the Tentative Map indicates that proposed grades for the southern property will be raised above the 500-year floodplain elevation. Therefore, the risk associated with inundation by flooding is considered low due to the proposed grading.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 No soil or geologic conditions were encountered during this study that would preclude development of the property as presently proposed provided the recommendations of this report are followed.

7.1.2 Undocumented fill, alluvium, colluvium, and terrace deposits are not suitable for the support of fill or structural loading in their present condition and will require removal and compaction in areas of planned development. The suitability of portions of the terrace deposits to be left in place may be evaluated during grading.

7.1.3 Remedial grading along Oak Knoll Road and the existing subdivisions east and west of the northern property will likely be impacted by the proximity of proposed development to existing improvements. These areas will require evaluation on a case-by-case basis and additional recommendations may be necessary where the limits of remedial grading are constrained. Slot cutting may be necessary along the west boundary and oak knoll road where remedial grading will be performed adjacent to the existing wall and roadway.

7.1.4 Hard rock is present within proposed cut area along the northeast property boundary and will require special consideration during site development. Excavations within the granitic rock that extend below the weathered mantle or where fresh core stones are exposed at grade will likely require blasting to facilitate the excavations. We anticipate that excavations performed during grading operations will generate oversize materials (rock fragments >12 inches) that will require special handling and fill placement procedures. Oversize materials should be placed in accordance with grading recommendations presented in Appendix D.

7.1.5 We encountered groundwater/seepage and perched water conditions during the field investigation. Dependent upon seasonal conditions at the time of grading, remedial grading of surficial deposits along the natural drainages may encounter wet to saturated materials and groundwater resulting in possible excavation and fill placement difficulties. Saturated soil conditions and shallow groundwater should be anticipated. Dewatering and/or use of specialized equipment may be required to excavate the surficial deposits. Overly wet soils may require spreading and drying and/or mixing with drier materials to reduce the moisture content so that compaction can be achieved.

7.1.6 An earthwork analysis should be performed to determine if there is an adequate volume of fill area available to accommodate the anticipated volume of blasted/oversize materials. This study should consider the proposed grading, rippability information contained in this report, rock placement requirements and include proposed undercutting (pads and streets). Rock crushing may be necessary if the amount of oversize rock generated exceeds the available fill volume based on the project rock placement specifications.

7.1.7 An engineering geologist should observe cut slopes during grading to check that the soil and geologic conditions do not differ significantly from those anticipated. Scaling of loose rocks to remain in-place above planned cut slopes may be necessary.

7.1.8 Grading along the western limits of the north property (Lots 51 through 60) is planned next to an existing retaining wall. If during remedial grading the drainage measures for this wall are found to consist of weepholes along the base of the wall, a subdrain system should be constructed in front of the weepholes to maintain wall drainage. This condition may necessitate an easement. The subdrain, if needed, should outlet into the storm drain system to the south. The subdrain should consist of a 4-inch diameter perforated Schedule 40 PVC pipe surrounded by at least 1 cubic foot of ¾-inch crushed rock and wrapped in filter fabric (Mirafi 140N, or equivalent).

7.1.9 Subsurface conditions observed may be extrapolated to reflect general soil/geologic conditions; however, some variations in subsurface conditions between trench locations should be anticipated.

7.2 Excavation and Soil Characteristics

7.2.1 The soils encountered in the field investigation are considered to be both “non-expansive (expansion index [EI] less than 20) and “expansive” (expansion index [EI] of 20 or more) as defined by 2019 California Building Code (CBC) Section 1803.5.3. Table 7.2 presents soil classifications based on the expansion index. The soil materials observed on site are anticipated to have a “very low” to “low” expansion potential (expansion index of 50 or less).

TABLE 7.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

<table>
<tr><th>Expansion Index (EI)</th><th>ASTM 4829
Expansion Classification</th><th>2019 CBC
Expansion Classification</th></tr>
<tr><td>0 – 20</td><td>Very Low</td><td>Non-Expansive</td></tr>
<tr><td>21 – 50</td><td>Low</td><td rowspan="4">Expansive</td></tr>
<tr><td>51 – 90</td><td>Medium</td></tr>
<tr><td>91 – 130</td><td>High</td></tr>
<tr><td>Greater Than 130</td><td>Very High</td></tr>
</table>

7.2.2 Excavation of the surficial deposits should be possible with light to moderate effort using conventional heavy-duty equipment. Excavating within the granitic rock will generally vary in difficulty with the depth of excavation depending on the degree of weathering. It is anticipated that the majority of the proposed excavations will encounter moderate to heavy ripping with conventional heavy-duty equipment. Blasting will be required where excavations extend beyond the weathered granitic rock mantle and where unweathered boulders or “core” stones are encountered in proposed granitic rock cut areas. Oversize rock (material >12 inches) should be placed in accordance with *Recommended Grading Specifications* (Appendix D) and the requirements of the governing agency. Oversize rock may require breakage to acceptable sizes or exportation from the property. Placement of oversize rock within the area of proposed underground utilities should not be permitted.

7.3 Corrosion

7.3.1 The laboratory test results indicate that the near-surface on-site materials at the locations tested possess *Not Applicable* sulfate severity and *S0* exposure to concrete structures as defined by 2019 CBC Section 1904 and ACI 318-14 Chapter 19. Table 7.3 presents a summary of concrete requirements set forth by 2019 CBC Section 1904 and ACI 318. ACI guidelines should be followed when determining the type of concrete to be used. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 7.3
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Exposure Class		Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
S0		$SO_4<0.10$	No Type Restriction	n/a	2,500
S1		$0.10 \leq SO_4 < 0.20$	II	0.50	4,000
S2		$0.20 \leq SO_4 \leq 2.00$	V	0.45	4,500
S3	Option 1	$SO_4>2.00$	V+Pozzolan or Slag	0.45	4,500
	Option 2		V	0.40	5,000

[1] Maximum water to cement ratio limits do not apply to lightweight concrete

7.3.2 Geocon Incorporated does not practice in the field of corrosion engineering; therefore, further evaluation by a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of underground pipes and buried metal in direct contact with the soils.

7.4 Slope Stability - General

7.4.1 A slope stability analysis for the proposed 30-foot high cut slope was performed utilizing average drained direct shear strength parameters from the laboratory test results and our experience with similar materials. These analyses indicate that the proposed 2:1 cut slopes, constructed of on-site materials, should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions to heights of at least 30 feet. Generalized slope stability calculations for both deep-seated and surficial slope stability are presented on Figures 3 and 4.

7.4.2 Although rare, the most common mode of instability for rock slopes are shallow wedge failures from intersecting fault planes or clay filled joints/fractures dipping out of slope. In this regard, the structural measurements obtained during our studies did not reveal such conditions. It is recommended, however, that all slope excavations proposed on the site be observed during grading by an engineering geologist to confirm that geologic conditions do not differ significantly from those anticipated. In the event that adverse conditions are observed, stabilization recommendations can be provided.

7.4.3 Fill slopes should be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill soils are uniformly compacted to at least 90 percent relative compaction to the face of the finished sloped. Alternatively, the fill slope may be over-built at least 3 feet and cut back to yield a properly compacted slope face.

7.4.4 Where fill slopes and fill-over-cut slopes are planned, a 15-foot-wide, 2-foot-deep, undrained keyway should be constructed prior to placing compacted fill. The keyway should be constructed with a minimum 5 percent inclination away from the toe of slope.

7.4.5 All slopes should be landscaped with drought-tolerant vegetation, having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion.

7.5 Grading

7.5.1 All grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix D. Where the recommendations of Appendix D conflict with this report, the recommendations of this report should take precedence.

7.5.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and the grading plans can be discussed at that time.

7.5.3 Grading should be performed in conjunction with the observation and compaction testing services of Geocon Incorporated.

7.5.4 Site preparation should begin with the removal of existing structures, improvements, deleterious material and vegetation in areas of planned development. The depth of removal should be such that material exposed in cut areas or soils to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.

7.5.5 All potentially compressible surficial soils (undocumented fill, alluvium, colluvium, and terrace deposits) within areas of planned grading should be removed to formational materials and properly compacted prior to placing additional fill and/or structural loads. The suitability of leaving portions of the terrace deposits in-place should be evaluated during grading.

7.5.6 Where not restricted by property boundaries, protected open space or exiting improvements, removal of compressible surficial soils should extend beyond structural areas a horizontal distance equal to the depth of the removal (see Figure 5 for general information). This condition occurs at the south of Lots 61 through 64. The actual extent of unsuitable soil removals will be determined in the field during grading by the geotechnical engineer and/or engineering geologist.

7.5.7 We expect groundwater/perched water conditions will be encountered in removal areas performed at or near Poway Creek and the other areas noted on the trench logs. Wet to saturated soil and perched water may also be encountered in the surficial deposits located near the natural drainages, especially, if grading is performed during the rainy season. Remedial grading of surficial deposits in these areas will likely result in possible excavation and fill placement difficulties. Dewatering and/or use of specialized equipment may be required to excavate the alluvium, colluvium, and terrace deposits. Overly wet materials will require spreading and drying and/or mixing with drier materials to reduce the moisture content so that compaction can be achieved.

7.5.8 If complete removal of compressible material cannot be performed at or near the creek or other areas of the site due to groundwater conditions, alternative measures such as surcharge loading with settlement monitoring may be required. Geocon Incorporated will provide alternate recommendations, if needed, based on conditions encountered during grading.

7.5.9 After removal of unsuitable material as recommended above, the base of excavations to receive fill (where practical) should be scarified approximately 12 inches, moisture conditioned, and compacted.

7.5.10 Grading should be conducted so that high expansive soils (EI >90) are placed in the deeper fill areas at least three feet below proposed finish grade elevations and at least 15 feet from the face of fill slopes. Where practical, the upper three feet of graded areas (cut or fill) should consist of properly compacted very low to low (EI $\leq$50) expansive granular soils. Medium expansive soils (EI $\leq$90) may also be used to achieve design grades.

7.5.11 Capping material refers to select material placed within three feet from building pad grade and parkway/roadway grade. This material should consist of soil fill with an approximate maximum particle dimension of 6 inches with a minimum of 40 percent soil passing the ¾-inch sieve and should have at least 20 percent of the soil passing the No. 4 screen. Based on subsurface information presented in Appendix A, most capping material generally can be obtained from the granitic rock and colluvium. Soils with an expansion potential (EI) of greater than 90 are not suitable for capping and should be placed in the deeper fill areas or at least three feet below design grade across the site and 15 feet from face of slopes. The grading contractor should take necessary steps to manage the available soils to cap the project.

7.5.12 Consideration may also be given to over-excavate (mine) the weathered portions of the granitic rock to generate additional capping material and to provide additional areas for disposal of oversize rock material, if needed.

7.5.13 The site should be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for re-use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill, including backfill and scarified ground surfaces, should be compacted to at least 90 percent of laboratory maximum dry density at or above optimum moisture content, as determined in accordance with ASTM D1557. Fill materials below optimum moisture content will require additional moisture conditioning prior to placing additional fill.

7.5.14 Recommendations for the handling and disposal of oversized rock in fill areas are presented on Figure 6. In general, structural fill placed and compacted at the site should consist of material that can be classified into four zones:

Zone A: Material placed within 3 feet from building pad grade and, parkways and street grade should consist of soil fill with an approximate maximum particle dimension of 6 inches with a minimum of 40 percent of the soil passing the ¾-inch sieve and should have at least 20 percent of the soil passing the No. 4 sieve.

Zone B: Soil fill with rock up to 1 foot in maximum dimension. See Figure 6 for minimum thickness of zone.

Zone C: Rock fill or soil-rock fill generally consisting of 2 foot minus rock material with occasional rock up to 4 foot in maximum dimension. Alternatively, rock 2 to 4 feet in maximum dimension can be placed in window rows spaced a minimum of 12 feet. The voids around and beneath the rock should be filled with soil possessing a sand equivalent of at least 30. Zone C should terminate at least 2 feet below lowest utility.

Zone D: Soil fill with rock up to 1 foot in maximum dimension. See Figure 6 for minimum thickness of zone.

7.5.15 Blasting of rock material should be performed to maximize breakage to 2-foot minus material. Although not anticipated "rock fill" placement should generally be limited to 2-foot-thick horizontal layers and compacted using rock trucks and bulldozers. Significant volumes of water will be required during rock fill placement.

7.5.16 Based on the Tentative Map, grading will result in fill to formation transitions across several building pads. A transition condition is defined where formation is located within three feet of finish pad grade. To reduce the potential for differential settlement, the formation portion of the transition should be over-excavated (undercut) at least three feet below proposed finish grade and replaced with properly compacted very low to low expansive fill soil. As a minimum, the building pads should be provided with medium expansive soil (EI $\leq$90). Overexcavations should be cut at a gradient toward the deepest fill area or streets to provide drainage for moisture migration along the contact between the formation and compacted fill.

7.5.17 Cut pads exposing granitic rock should be undercut at least three feet and replaced with properly compacted very low to low expansive soil to facilitate excavation of foundations and shallow utilities. As a minimum, fill should consist of medium expansive soil (EI $\leq$90).

7.5.18 Where the streets are located in cut areas composed of granitic rock, roadways should be undercut to a depth of at least 2 feet below the lowest utility.

7.5.19 In order to maintain safety and the stability of adjacent improvements, it is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with the applicable OSHA rules and regulations.

7.5.20 Imported materials (if required), should consist of granular very low to low expansive soils (EI $\leq$50) and, should be free of oversize rock (greater than 6 inches) and construction debris Prior to importing the material, samples from proposed borrow areas should be obtained and subjected to laboratory testing to determine if the material conforms to the recommended criteria. The grading contractor should allow at least four days for completion of the laboratory testing and schedule grading accordingly.

7.6 Seismic Design Criteria

7.6.1 Table 7.6.1 summarizes site-specific design criteria obtained from the 2019 California Building Code (CBC; Based on the 2018 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. We used the computer program *U.S. Seismic Design Maps*, provided by the Structural Engineers Association (SEA) to calculate the seismic design parameters. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2019 CBC and Table 20.3-1 of ASCE 7-16. The values presented herein are for the risk-targeted maximum considered earthquake (MCE_R). Sites designated as Site Class D, E and F may require additional analyses if requested by the project structural engineer and client.

TABLE 7.6.1
2019 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2019 CBC Reference
Site Class	C	Section 1613.2.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.798g	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.295g	Figure 1613.2.1(2)
Site Coefficient, F_A	1.2	Table 1613.2.3(1)
Site Coefficient, F_V	1.5*	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.958g	Section 1613.2.3 (Eqn 16-36)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0.442g*	Section 1613.2.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.639g	Section 1613.2.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.295g*	Section 1613.2.4 (Eqn 16-39)

***** Using the code-based values presented in this table, in lieu of a performing a ground motion hazard analysis, requires the exceptions outlined in ASCE 7-16 Section 11.4.8 be followed by the project structural engineer. Per Section 11.4.8 of ASCE/SEI 7-16, a ground motion hazard analysis should be performed for projects for Site Class "E" sites with Ss greater than or equal to 1.0g and for Site Class "D" and "E" sites with S1 greater than 0.2g. Section 11.4.8 also provides exceptions which indicates that the ground motion hazard analysis may be waived provided the exceptions are followed.

7.6.2 Table 7.6.2 presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

TABLE 7.6.2
ASCE 7-16 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.342g	Figure 22-7
Site Coefficient, F_{PGA}	1.2	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.41g	Section 11.8.3 (Eqn 11.8-1)

7.6.3 Conformance to the criteria in Tables 7.6.1 and 7.6.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in the event of a large earthquake. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

7.6.4 The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and resulting in a Seismic Design Category D. Table 7.6.3 presents a summary of the risk categories in accordance with ASCE 7-16.

TABLE 7.6.3
ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk to Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

7.7 Foundation and Concrete Slabs-On-Grade Recommendations

7.7.1 The foundation recommendations herein are for proposed one- to three-story residential structures. The foundation recommendations have been separated into three categories based on either the maximum and differential fill thickness or Expansion Index. The foundation category criteria are presented in Table 7.7.1.

TABLE 7.7.1
FOUNDATION CATEGORY CRITERIA

Foundation Category	Maximum Fill Thickness, T (Feet)	Differential Fill Thickness, D (Feet)	Expansion Index (EI)
I	$T<20$	--	$EI\leq 50$
II	$20\leq T<50$	$10\leq D<20$	$50<EI\leq 90$
III	$T\geq 50$	$D\geq 20$	$90<EI\leq 130$

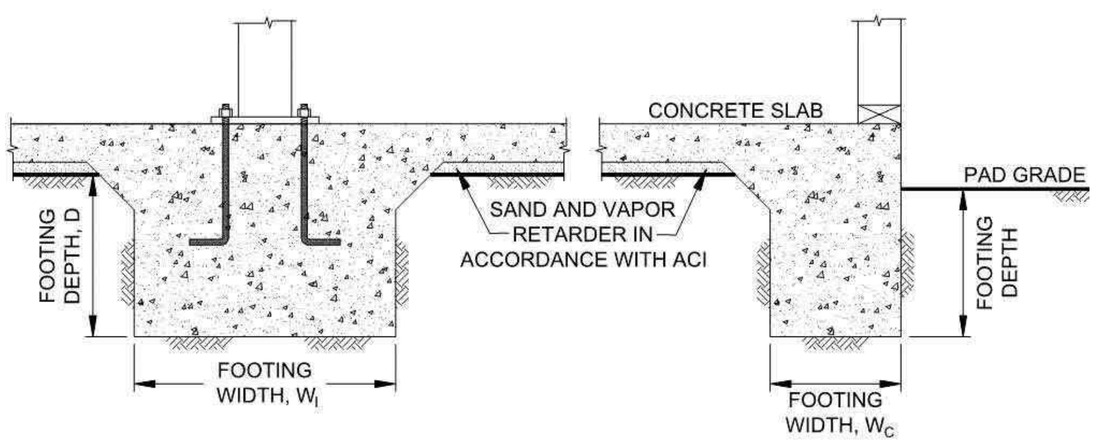
7.7.2 We will provide final foundation categories for each building or lot after finish pad grades have been achieved, the underlying fill-bedrock geometry is evaluated and we perform laboratory testing of the subgrade soil.

7.7.3 Table 7.7.2 presents minimum foundation and interior concrete slab design criteria for conventional foundation systems.

TABLE 7.7.2
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Footing Embedment Depth, D (inches)	Minimum Continuous Footing Reinforcement	Minimum Footing Width (Inches)
I	12	Two No. 4 bars, one top and one bottom	12 – Continuous, W_C 24 – Isolated, W_I
II	18	Four No. 4 bars, two top and two bottom	
III	24	Four No. 5 bars, two top and two bottom	

7.7.4 The foundations should be embedded in accordance with the recommendations herein and the Wall/Column Footing Dimension Detail. The embedment depths should be measured from the lowest adjacent pad grade for both interior and exterior footings. Footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope (unless designed with a post-tensioned foundation system as discussed herein).



Wall/Column Footing Dimension Detail

7.7.5 The proposed structures can be supported on a shallow foundation system founded in the compacted fill/formational materials. Table 7.7.3 provides a summary of the foundation design recommendations.

TABLE 7.7.3
SUMMARY OF FOUNDATION RECOMMENDATIONS

Parameter	Value
Allowable Bearing Capacity	2,000 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Allowable Bearing Capacity	4,000 psf
Estimated Total Static Settlement*	1 Inch
Estimated Differential Static Settlement*	½ Inch in 40 Feet

7.7.6 The bearing capacity values presented herein are for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

7.7.7 The concrete slab-on-grades should be a designed in accordance with Table 7.7.4.

TABLE 7.7.4
CONVENTIONAL SLAB-ON-GRADE RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Concrete Slab Thickness (inches)	Interior Slab Reinforcement	Typical Slab Underlayment
I	4	6 x 6 - 10/10 welded wire mesh at slab mid-point	3 to 4 Inches of Sand/Gravel/Base
II	4	No. 3 bars at 24 inches on center, both directions	
III	5	No. 3 bars at 18 inches on center, both directions	

7.7.8 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

7.7.9 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. It is common to see 3 inches and 4 inches of sand below the concrete slab-on-grade for 5-inch and 4-inch thick slabs, respectively, in the southern California area. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

7.7.10 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems (foundation dimensions and embedment depths, slab thickness and steel placement) should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC 10.5-12 *Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils* or *WRI/CRSI Design of Slab-on-Ground Foundations*, as required by the 2019 California Building Code (CBC Section 1808.6.2). Although this procedure was developed for expansive soil conditions, it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented in Table 7.7.5 for the particular Foundation Category designated. The parameters presented in Table 7.7.5 are based on the guidelines presented in the PTI DC 10.5 design manual.

TABLE 7.7.5
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI) DC10.5 Design Parameters	Foundation Category		
	I	II	III
Thornthwaite Index	-20	-20	-20
Equilibrium Suction	3.9	3.9	3.9
Edge Lift Moisture Variation Distance, e_M (Feet)	5.3	5.1	4.9
Edge Lift, y_M (Inches)	0.61	1.10	1.58
Center Lift Moisture Variation Distance, e_M (Feet)	9.0	9.0	9.0
Center Lift, y_M (Inches)	0.30	0.47	0.66

7.7.11 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

7.7.12 If the structural engineer proposes a post-tensioned foundation design method other than PTI, DC 10.5:

- The deflection criteria presented in Table 7.7.5 are still applicable.
- Interior stiffener beams should be used for Foundation Categories II and III.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 12 inches, 18 inches and 24 inches for foundation categories I, II, and III, respectively. The embedment depths should be measured from the lowest adjacent pad grade.

7.7.13 Foundation systems for the lots that possess a foundation Category I and a "very low" expansion potential (expansion index of 20 or less) can be designed using the method described in Section 1808 of the 2019 CBC. If post-tensioned foundations are planned, an alternative, commonly accepted design method (other than PTI) can be used. However, the post-tensioned foundation system should be designed with a total and differential deflection of 1 inch. Geocon Incorporated should be contacted to review the plans and provide additional information, if necessary.

7.7.14 If an alternate design method is contemplated, Geocon Incorporated should be contacted to evaluate if additional expansion index testing should be performed to identify the lots that possess a "very low" expansion potential (expansion index of 20 or less).

7.7.15 Our experience indicates post-tensioned slabs may be susceptible to excessive edge lift from tensioning, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

7.7.16 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless designed by the structural engineer.

7.7.17 Isolated footings outside of the slab area, if present, should have the minimum embedment depth and width recommended for conventional foundations for a particular Foundation Category. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended for Category III. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams in both directions. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.

7.7.18 Interior stiffening beams should be incorporated into the design of the foundation system in accordance with the PTI design procedures.

7.7.19 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

7.7.20 Where buildings or other improvements are planned near the top of a slope 3:1 (horizontal:vertical) or steeper, special foundation and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high or cut slopes regardless of height, footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

- When located next to a descending 3:1 (horizontal:vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to H/3 (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. A post-tensioned slab and foundation system or mat foundation system can be used to reduce the potential for distress in the structures associated with strain softening and lateral fill extension. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.

- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.

- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height, and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.

- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures which would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

7.7.21 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present), differential settlement of fill soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.7.22 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute when establishing crack-control spacing. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

7.7.23 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

7.7.24 We should observe the foundation excavations prior to the placement of reinforcing steel to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. If unexpected soil conditions are encountered, foundation modifications may be required.

7.8 Concrete Flatwork

7.8.1 The following recommendations apply to exterior flatwork where near surface soils are low to medium expansive (EI less than 90). Exterior slabs not subjected to vehicular traffic should be a minimum of 4 inches thick and reinforced with 6 x 6-6/6 welded wire mesh. The mesh should be placed in the middle of the slab. Proper mesh positioning is critical to future performance of the slabs. The contractor should take extra measures to provide proper mesh placement. Prior to construction of slabs, the upper 12 inches of subgrade soils should be moisture conditioned at or slightly above optimum moisture content and compacted to at least 90 percent of the laboratory maximum dry density per ASTM 1557.

7.8.2 Where highly expansive soils (EI greater than 90) are present near finish grade, the following recommendations apply. Exterior slabs should be at least 5 inches thick and reinforced with No. 3 steel bars spaced 18 inches on center each direction positioned at the slab midpoint. Driveways should be constructed with a 6-inch deep slab edge (measured from the bottom of the slab). Slabs should be doweled to the building foundation where they abut the stem wall. Sidewalks should be doweled to the curbs. Prior to construction of slabs, the upper 12 inches of subgrade soils should scarified and moisture conditioned to **a minimum of 3% above optimum moisture content** just prior to placing the concrete. Moisture conditioning should be observed and checked by a representative of Geocon Incorporated.

7.8.3 Consideration should be given to adding concrete cut-off walls beneath exterior flatwork supported by highly expansive soils (EI greater than 90). The cut-off walls are recommended where any water (e.g. landscape) may migrate laterally beneath the flatwork and cause adverse soil movement. The cut-off walls should be located along the perimeter of the concrete slab adjacent to landscaping areas and extend at least 6-inches into the soil subgrade.

7.8.4 Concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. A 4-inch-thick slab should have a maximum joint spacing of 10 feet. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented above prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be checked prior to placing concrete.

7.8.5 Even with the incorporation of the recommendations within this report, the exterior concrete flatwork has a likelihood of experiencing some settlement due to potentially compressible and liquefiable soil beneath grade; therefore, the welded wire mesh should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.

7.8.6 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. Periotic maintenance such as slab replacement and/or grinding of elevated slab margins may be necessary due to the highly expansive soils. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.9 Conventional Retaining Walls

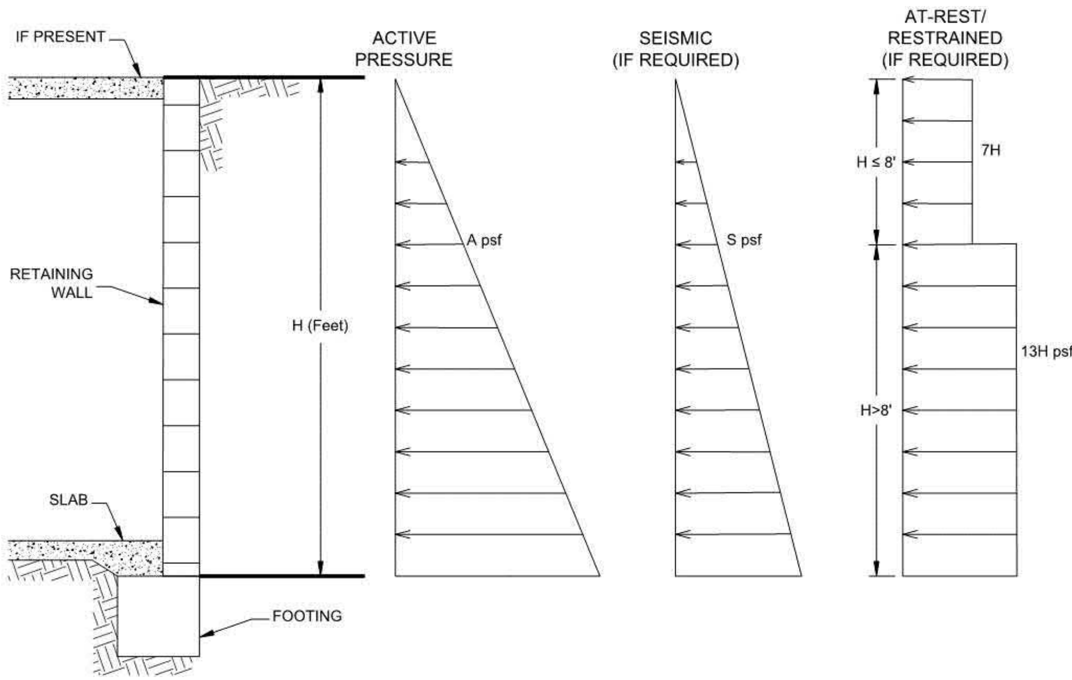
7.9.1 Retaining walls should be designed using the values presented in Table 7.9.1. Soil with an expansion index (EI) of greater than 50 should not be used as backfill material behind retaining walls.

TABLE 7.9.1
RETAINING WALL DESIGN RECOMMENDATIONS

Parameter	ValueP
Active Soil Pressure, A (Fluid Density, Level Backfill)	35 pcf
Active Soil Pressure, A (Fluid Density, 2:1 Sloping Backfill)	50 pcf
Seismic Pressure, S	18H psf
At-Rest/Restrained Walls Additional Uniform Pressure (0 to 8 Feet High)	8H psf
At-Rest/Restrained Walls Additional Uniform Pressure (8+ Feet High)	12H psf
Expected Expansion Index for the Subject Property	EI≤50

H equals the height of the retaining portion of the wall

7.9.2 The project retaining walls should be designed as shown in the Retaining Wall Loading Diagram.



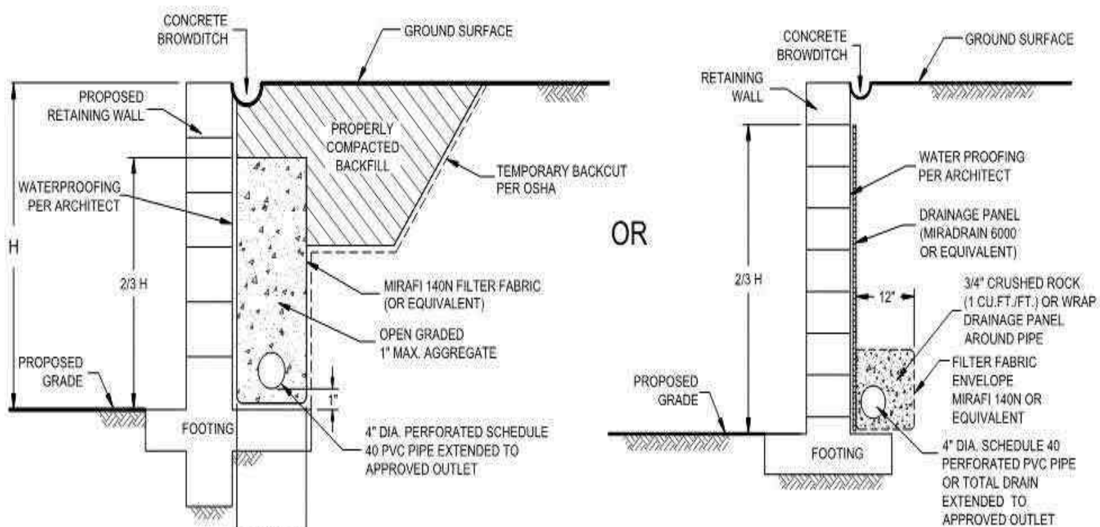
Retaining Wall Loading Diagram

7.9.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall. Where walls are restrained from movement at the top (at-rest condition), an additional uniform pressure should be applied to the wall. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added.

7.9.4 The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613.3.5 of the 2019 CBC or Section 11.6 of ASCE 7-16. For structures assigned to Seismic Design Category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2019 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall.

7.9.5 Retaining walls should be designed to ensure stability against overturning sliding, and excessive foundation pressure. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, it is not necessary to consider active pressure on the keyway.

7.9.6 Drainage openings through the base of the wall (weep holes) should not be used where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted granular (EI of 90 or less) free-draining backfill material with no hydrostatic forces or imposed surcharge load. The retaining wall should be properly drained as shown in the Typical Retaining Wall Drainage Detail. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.



Typical Retaining Wall Drainage Detail

7.9.7 The retaining walls may be designed using either the active and restrained (at-rest) loading condition or the active and seismic loading condition as suggested by the structural engineer. Typically, it appears the design of the restrained condition for retaining wall loading may be adequate for the seismic design of the retaining walls. However, the active earth pressure combined with the seismic design load should be reviewed and also considered in the design of the retaining walls.

7.9.8 In general, wall foundations should be designed in accordance with Table 7.9.2. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, retaining wall foundations should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

TABLE 7.9.2
SUMMARY OF RETAINING WALL FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Retaining Wall Foundation Width	12 inches
Minimum Retaining Wall Foundation Depth	12 Inches
Minimum Steel Reinforcement	Per Structural Engineer
Allowable Bearing Capacity	2,000 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Allowable Bearing Capacity	4,000 psf
Estimated Total Static Settlement*	1 Inch
Estimated Differential Static Settlement*	½ Inch in 40 Feet

7.9.9 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls. In the event that other types of walls (such as mechanically stabilized earth [MSE] walls) are planned, Geocon Incorporated should be consulted for additional recommendations.

7.9.10 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

7.9.11 Soil contemplated for use as retaining wall backfill, including import materials, should be identified in the field prior to backfill. At that time, Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used.

7.10 Lateral Loading

7.10.1 Table 7.10 should be used to help design the proposed structures and improvements to resist lateral loads for the design of footings or shear keys. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

TABLE 7.10
SUMMARY OF LATERAL LOAD DESIGN RECOMMENDATIONS

Parameter	Value
Passive Pressure Fluid Density	300 pcf
Coefficient of Friction (Concrete and Soil)	0.35
Coefficient of Friction (Along Vapor Barrier)	0.2 to 0.25*

*Per manufacturer's recommendations.

7.10.2 The passive and frictional resistant loads can be combined for design purposes. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

7.11 Mechanically Stabilized Earth (MSE) Retaining Walls

7.11.1 Mechanized stabilized earth (MSE) retaining walls can be used on the property. MSE retaining walls are alternative walls that consist of modular block facing units with geogrid reinforced earth behind the block. The reinforcement grid attaches to the block units and is typically placed at specified vertical intervals and embedment lengths. The grid length and spacing will be determined by the wall designer.

7.11.2 The geotechnical parameters listed in Table 7.11 can be used for preliminary design of the MSE walls. Soil with an expansion index (EI) of greater than 50 should not be used as backfill material behind retaining walls. In addition, some wall designers request soil with a plasticity index greater than 20, a liquid limit greater than 40 and a fines content greater than 35 percent should not be used for soil within the reinforcing zone. This may require import of select materials for the wall backfilling operations or selectively stockpiling of granular soils. Once the backfill source has been determined, laboratory testing should be performed to check that the shear strength parameters used in the design of the MSE walls meet or exceed the required strength within the reinforced zone.

TABLE 7.11
GEOTECHNICAL PARAMETERS FOR MSE WALLS

Parameter	Reinforced Zone	Retained Zone	Foundation Zone
Angle of Internal Friction	30 degrees	30 degrees	30 degrees
Cohesion	0 psf	0 psf	0 psf
Wet Unit Density	125 pcf	125 pcf	125 pcf

7.11.3 The soil parameters presented in Table 7.17 are based on our experience with MSE wall contractors on previous projects. The wet unit density values presented in Table 7.17 can be used for design but actual in-place densities may range from approximately 110 to 135 pounds per cubic foot. Geocon has no way of knowing which materials will actually be used as backfill behind the wall during construction. It is up to the wall designers to use their judgment in selection of the design parameters. As such, once backfill materials have been selected and/or stockpiled, sufficient shear tests should be conducted on samples of the proposed backfill materials to check that they conform to actual design values. Results should be provided to the designer to re-evaluate stability of the walls. Dependent upon test results, the designer may require modifications to the original wall design (e.g., longer reinforcement embedment lengths and/or steel reinforcement).

7.11.4 The foundation zone is the area where the footing is embedded, the reinforced zone is the area of the backfill that possesses the reinforcing fabric, and the retained zone is the area behind the reinforced zone.

7.11.5 Wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,000 psf. The MSE walls should be designed for a total and differential static settlement of 1-inch and ½-inch in 40 feet, respectively.

7.11.6 Backfill materials within the reinforced zone should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content in accordance with ASTM D 1557. This is applicable to the entire embedment width of the reinforcement. Typically, wall designers specify no heavy compaction equipment within 3 feet of the face of the wall. However, smaller equipment (e.g., walk-behind, self-driven compactors or hand whackers) can be used to compact the materials without causing deformation of the wall. If the designer specifies no compactive effort for this zone, the materials are essentially not properly compacted and the reinforcement grid within the uncompacted zone should not be relied upon for reinforcement, and overall embedment lengths will have to be increased to account for the difference.

7.11.7 The wall should be provided with a drainage system sufficient to prevent excessive seepage through the wall and the base of the wall, thus preventing hydrostatic pressures behind the wall.

7.11.8 Geosynthetic reinforcement must elongate to develop full tensile resistance. This elongation generally results in movement at the top of the wall. The amount of movement is dependent upon the height of the wall (e.g., higher walls rotate more) and the type of reinforcing grid used. In addition, over time the reinforcement grid has been known to exhibit creep (sometimes as much as 5 percent) and can undergo additional movement. Given this condition, the owner should be aware that structures and pavement placed within the reinforced and retained zones of the wall may undergo movement.

7.11.9 The MSE wall contractor should provide the estimated deformation of wall and adjacent ground in associated with wall construction. The calculated horizontal and vertical deformations should be determined by the wall designer. The estimated movements should be provided to the project structural engineer to determine if the planned improvements can tolerate the expected movements.

7.11.10 The MSE wall designer/contractor should review this report, including the slope stability requirements, and incorporate our recommendations as presented herein. We should be provided the plans for the MSE walls to check if they are in conformance with our recommendations prior to issuance of a permit and construction.

7.12 Preliminary Pavement Recommendations

7.12.1 We calculated the preliminary flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) using estimated Traffic Indices (TI's) of 4.5, 5.0, 6.0 and 7.0 for the interior roadways. The project civil engineer and owner should review the pavement designations to determine appropriate locations for pavement thickness. We have assumed an R-Value of 10 and 78 for the subgrade soil and base materials, respectively, for the purposes of this preliminary analysis. The final pavement sections should be based on the R-Value of the subgrade soil encountered at final subgrade elevation once site grading and utility trench backfill is completed. Table 7.12.1 presents the preliminary flexible pavement sections.

TABLE 7.12.1
PRELIMINARY FLEXIBLE PAVEMENT SECTION

Location	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Parking Stalls	4.5	10	3	7
Interior Roadways (light-duty)	5.0	10	3	9
Interior Roadways (medium duty)	6.0	10	3.5	12.5
Interior Roadways (heavy duty)	7.0	10	4	14.5

7.12.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

7.12.3 Base materials should conform to Section 26-1.02B of the *Standard Specifications for The State of California Department of Transportation (Caltrans)* with a ¾-inch maximum size aggregate. The asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook).*

7.12.4 The base thickness can be reduced if a reinforcement geogrid is used during the installation of the pavement. Geocon should be contact for additional recommendations, if required.

7.12.5 A rigid Portland cement concrete (PCC) pavement section should be placed in driveway entrance aprons, cross-gutters and trash bin loading/storage areas. The concrete pad for trash truck areas should be large enough such that the truck wheels will be positioned on the concrete during loading. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R-08 *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 7.12.2.

TABLE 7.12.2
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	50 pci
Modulus of rupture for concrete, M_R	500 psi
Traffic Category, TC	A and B
Average daily truck traffic, ADTT	10 and 25

7.12.6 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 7.12.3.

TABLE 7.12.3
RIGID PAVEMENT RECOMMENDATIONS

Location	Portland Cement Concrete (inches)
Medium Duty Areas (TC=B)	6.0
Heavy Duty Areas (TC=C)	7.0

7.12.7 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch). Base materials will not be required beneath concrete improvements including cross-gutters, curb and gutters, and sidewalks.

7.12.8 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 7.5-inch-thick slab would have a 9.5-inch-thick edge). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

7.12.9 To control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab. Crack-control joints should not exceed 30 times the slab thickness with a maximum spacing of 15 feet for slabs 6 inches and thicker and should be sealed with an appropriate sealant to prevent the migration of water through the control joint to the subgrade materials. The depth of the crack-control joints should be determined by the referenced ACI report. The depth of the crack-control joints should be at least ¼ of the slab thickness when using a conventional saw, or at least 1 inch when using early-entry saws on slabs 9 inches or less in thickness, as determined by the referenced ACI report discussed in the pavement section herein. Cuts at least ¼ inch wide are required for sealed joints, and a ⅜ inch wide cut is commonly recommended. A narrow joint width of $^{1}/_{10}$ to $^{1}/_{8}$-inch wide is common for unsealed joints.

7.12.10 Concrete curb/gutter should be placed on soil subgrade compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Cross-gutters should be placed on subgrade soil compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Base materials should not be placed below the curb/gutter, cross-gutters, or sidewalk so water is not able to migrate from the adjacent parkways to the pavement sections.

7.12.11 The performance of pavement is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement and subgrade will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

7.13 Low Impact Development (Bioswales, Bio-retention systems)

7.13.1 At the completion of grading the site will be underlain by compacted fill over dense/hard formation materials. Based on soils encountered during the field investigation, we anticipate that the compacted fill will consist of sandy clay and clayey gravel, and mixtures of angular gravel and boulders generated from blasting operations in granitic rock. Infiltrating into compacted fill generally results in settlement of granular soils, heaving of expansive soils, and distress to improvements placed over the compacted fill; as well as slope instability. It is our opinion the compacted fill is unsuitable for infiltration of storm water runoff due to the potential for adverse settlement and potential for water to daylight. The formational materials (Friars Formation and granitic rock) are also sufficiently dense and impermeable that infiltration water would be expected to perch on the surface.

7.13.2 Bio-retention basins, bioswales and bio-remediation areas should be designed by the project civil engineer and reviewed by Geocon Incorporated. Typically, bioswales consist of a surface layer of vegetation underlain by clean sand. A subdrain should be provided beneath the sand layer. Prior to discharging into the storm drain pipe, a seepage cutoff wall should be constructed at the interface between the subdrain and storm drain pipe. The concrete cut-off wall should extend at least 6 inches beyond the perimeter of the gravel-packed subdrain system.

7.13.3 To minimize adverse impacts to existing or planned improvements, we recommend that proposed LID systems be provided with a waterproof liner, such as 30-mil HDPE, or equivalent, to prevent water infiltration and saturation of compacted fill soil and formational materials. This recommendation is intended to reduce potential negative impacts to public and private improvements due to water infiltration. Downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration. Saturating compacted fills typically results in induced hydraulic settlement of the fills potentially impacting adjacent surface improvements supported by the fill. Bioswale systems when located adjacent to pavements often enable water to migrate beneath pavements saturating subgrade soils and aggregate base, which can lead to premature pavement distress. Also, water may enter underground utility pipe zones and impact improvements down gradient from the site.

7.13.4 A storm water vault is shown on the Tentative Map. If this vault allows water to migrate into the subgrade soils, the design should include an impermeable liner, as discussed in Appendix C.

7.13.5 As plans progress and details for LID systems are available for our review, we can provide additional recommendations. Temporary detention basins in areas where improvements have not been constructed do not need to be lined.

7.13.6 Appendix C presents storm water management for the subject project in accordance with City of Poway Storm Water BMP Design Manual. Recommendations for the planned drainage management areas (DMA) are presented in Appendix C.

7.13.7 The landscape architect should be consulted to provide the appropriate plant recommendations for use with LID systems. If drought resistant plants are not used, irrigation may be required.

7.14 Site Drainage and Moisture Protection

7.14.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2019 CBC 1804.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

7.14.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.14.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material should be considered.

7.15 Slope Maintenance

7.15.1 Slopes that are steeper than 3:1 (horizontal:vertical) may, under conditions that are both difficult to prevent and predict, be susceptible to near-surface (surficial) slope instability. The instability is typically limited to the outer 3 feet of a portion of the slope and usually does not directly impact the improvements on the pad areas above or below the slope. The occurrence of surficial instability is more prevalent on fill slopes and is generally preceded by a period of heavy rainfall, excessive irrigation, or the migration of subsurface seepage. The disturbance and/or loosening of the surficial soils, as might result from root growth, soil expansion, or excavation for irrigation lines and slope planting, may also be a significant contributing factor to surficial instability. It is therefore recommended that, to the maximum extent practical: (a) disturbed/loosened surficial soils be either removed or properly recompacted, (b) irrigation systems be periodically inspected and maintained to eliminate leaks and excessive irrigation, and (c) surface drains on and adjacent to slopes be periodically maintained to preclude ponding or erosion. Although the incorporation of the above recommendations should reduce the potential for surficial slope instability, it will not eliminate the possibility and, therefore, it may be necessary to rebuild or repair a portion of the project's slopes in the future.

7.16 Grading and Foundation Plan Review

7.16.1 Geocon Incorporated should review the grading plans and foundation plans for the project prior to final design submittal to evaluate whether additional analyses and/or recommendations are required

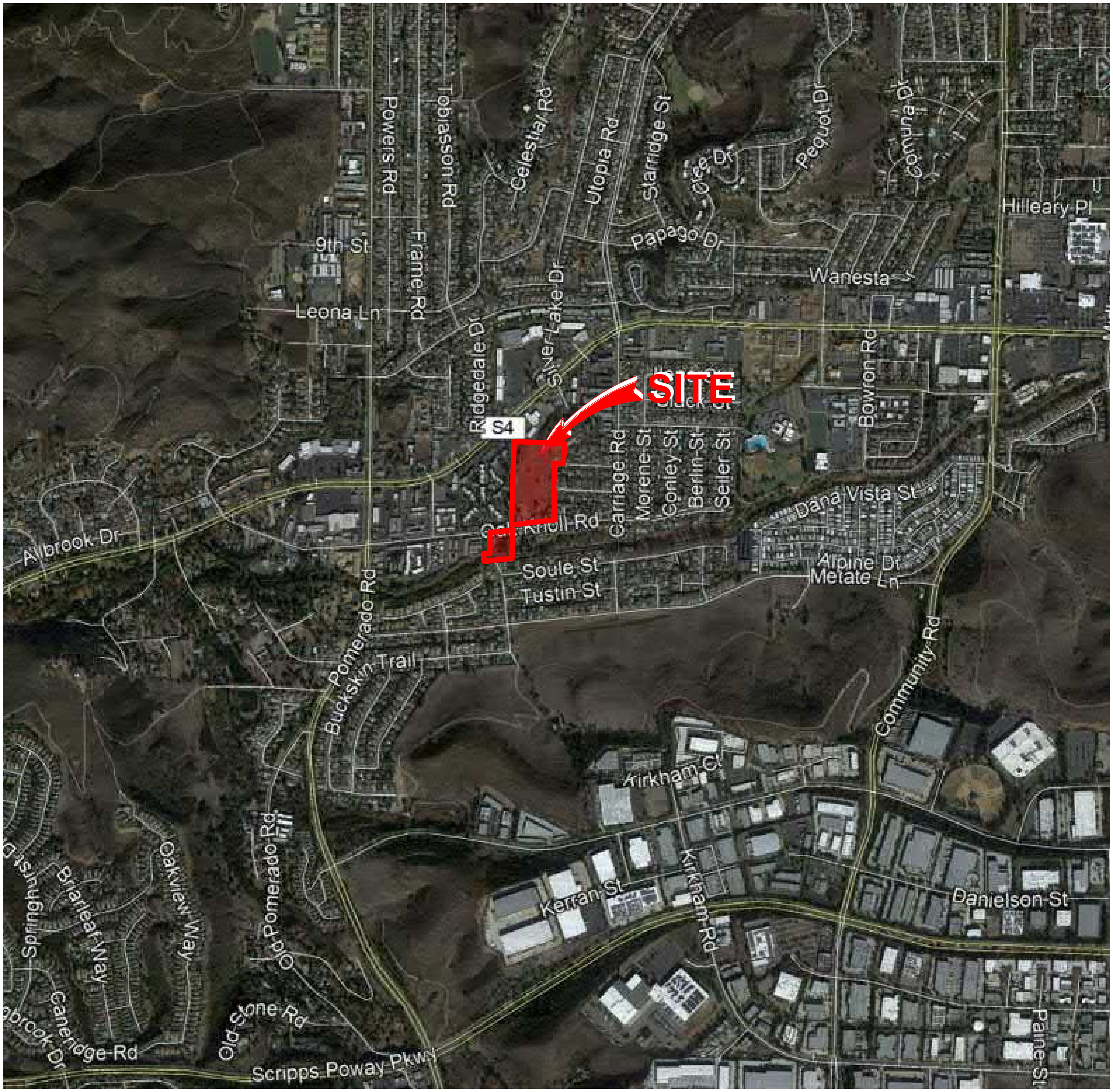
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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N

NO SCALE

VICINITY MAP

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OAK KNOLL
POWAY, CALIFORNIA

TM / RA		DSK/GTYPD	DATE 06 - 15 - 2022	PROJECT NO. G2746 - 32 - 02	FIG. 1

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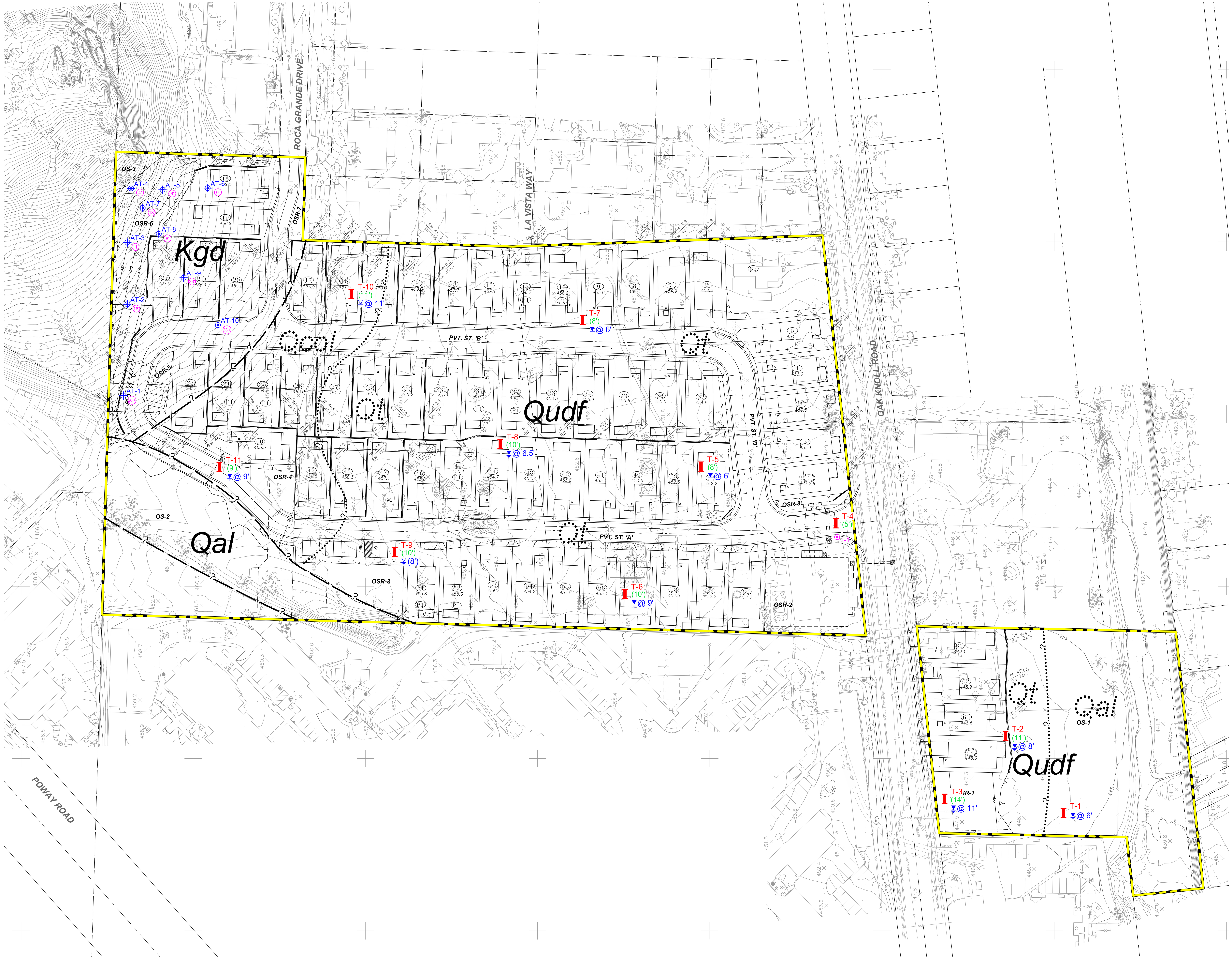

GRAPHIC SCALE
0' 25' 50' 75' 100' 150' 200'
SCALE 1"=50' (on 36x24)

GEOCON LEGEND

Qudf ........UNDOCUMENTED FILL
Qal ....ALLUVIUM (Dotted Where Buried)
Qt ....TERRACE DEPOSITS (Dotted Where Buried)
Qcol ....COLLUVIUM (Dotted Where Buried))
Kgd ........GRANODIORITE (Dotted Where Buried)
........APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
T-11 ....APPROX. LOCATION OF EXPLORATORY TRENCH
(9') ....APPROX. THICKNESS OF SURFICIAL SOIL REQUIRING REMEDIAL GRADING
@ 9' ....APPROX. DEPTH TO GROUNDWATER
@ 11' ....APPROX. DEPTH TO SEEPAGE
I-1 ....APPROX. LOCATION OF INFILTRATION TEST
AT-10 ....APPROX. LOCATION OF AIR-TRACK BORING
16 ....APPROX. THICKNESS (Ft) OF RIPPABLE MATERIAL BASED ON A LITERAL INTERPRETATION OF 20 SECONDS PER FOOT AS THE BOUNDARY BETWEEN RIPPABLE AND TO MARGINALLY TO NON-RIPPABLE ROCK
........PROPERTY BOUNDARY

GEOLOGIC MAP

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SCALE 1" = 50'	DATE 06 - 15 - 2022	
PROJECT NO. G2746 - 32 - 02		FIGURE 2
SHEET 1 OF 1		

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= Infinite
DEPTH OF SATURATION	Z	= 3 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
SLOPE ANGLE	i	= 26.6 degrees
UNIT WEIGHT OF WATER	γ_w	= 62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 35 degrees
APPARENT COHESION	C	= 250 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$\mathrm{FS} = \frac{C + (\gamma_t - \gamma_w)\ Z \cos^2 i \tan \phi}{\gamma_t\ Z \sin i \cos i} = 2.3$$

REFERENCES :

1......Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62

2......Skempton, A. W., and F.A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81

SURFICIAL SLOPE STABILITY ANALYSIS

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= 30 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 35 degrees
APPARENT COHESION	C	= 500 pounds per square foot
NO SEEPAGE FORCES		

ANALYSIS :

$$\lambda_{c\phi} = \frac{\gamma_t H \tan\phi}{C}$$ EQUATION (3-3), REFERENCE 1

$$FS = \frac{N_{cf} C}{\gamma_t H}$$ EQUATION (3-2), REFERENCE 1

$\lambda_{c\phi}$	=	5.5	CALCULATED USING EQ. (3-3)
Ncf	=	20	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	2.6	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1......Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2......Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - CUT SLOPES

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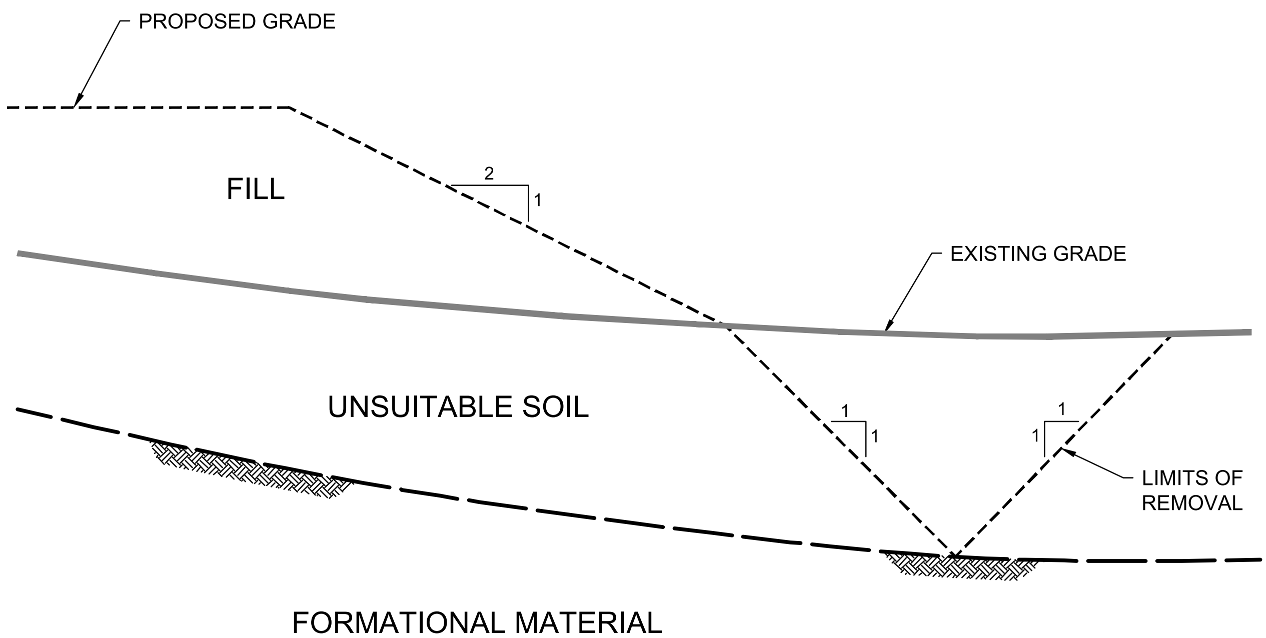

NOTE:

SLOPE OF BACKCUT MAY BE STEEPENED WITH THE APPROVAL OF THE SOILS ENGINEER WHERE BOUNDARY CONSTRAINTS LIMIT EXTENT OF REMOVALS

NO SCALE

CONSTRUCTION DETAIL FOR LATERAL EXTENT OF REMOVAL

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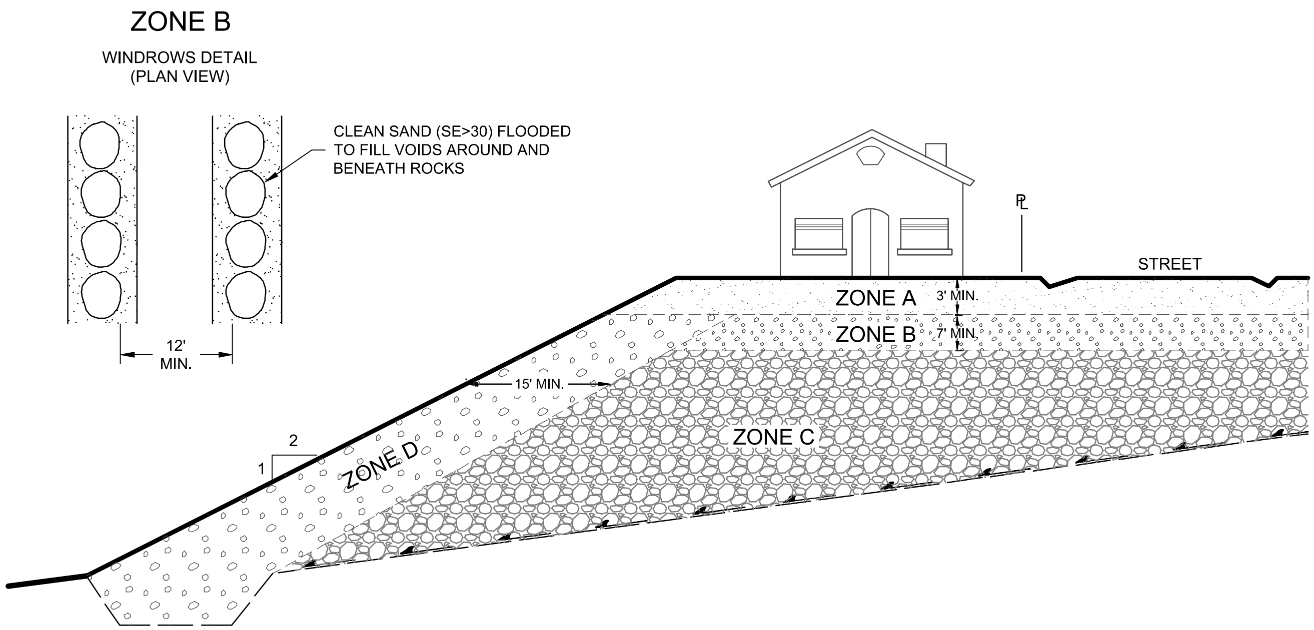

NO SCALE

LEGEND

ZONE A: COMPACTED SOIL FILL. NO ROCK FRAGMENTS OVER 6 INCHES IN DIMENSION.

ZONE B: ROCKS UP TO 1 FOOT IN MAXIMUM DIMENSION IN A MATRIX OF COMPACTED SOIL FILL.

ZONE C: ROCK OR SOIL-ROCK FILL GENERALLY CONSISTING OF 2 FOOT MINUS MATERIAL WITH OCCASIONAL INDIVIDUAL FRAGMENTS UP TO 4 FEET MAXIMUM DIMENSION. ZONE C SHOULD TERMINATE AT LEAST 2 FEET BELOW LOWES UTILITY. ALTERNATE: ROCKS 2 TO 4 FEET IN MAXIMUM DIMENSION CAN BE PLACED IN WINDROWS IN COMPACTED SOIL FILL AND BACKFILLED WITH SOIL POSSESSING A SAND EQUIVALENT OF AT LEAST 30.

ZONE D: ROCKS UP TO 12 INCHES IN MAXIMUM DIMENSION IN A MATRIX OF COMPACTED SOIL FILL.

NOTES

1. COMPACTED SOIL FILL IN UPPER 3 FEET SHALL CONTAIN AT LEAST 40 PERCENT SOIL PASSING THE 3/4 - INCH SIEVE (BY WEIGHT) AND AT LEAST 20% SOIL PASSING THE NO. 4 SIEVE (BY WEIGHT)

2. CONTINUOUS OBSERVATION REQUIRED BY GEOCON DURING ROCK PLACEMENT.

ROCK PLACEMENT DETAIL

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APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The initial field investigation was performed on May 28, 2021, and consisted of a visual site reconnaissance and drilling 10 air-track borings in anticipated cut areas. On May 18, 2022, eleven exploratory trenches were excavated to evaluate the thickness and condition of surficial soils requiring remedial grading. The approximate locations of the exploratory trenches and air-track borings are shown on the Geologic Map, Figure 2.

The exploratory trenches were performed using a John Deere 310L rubber tire backhoe equipped with a 24-inch-wide bucket. We collected bulk soil samples for laboratory testing. The air-track borings were advanced using an Ingersoll-Rand ECM 490 drill rig with 4-inch diameter bit.

The soil conditions encountered in the excavations were visually classified and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual Manual Procedure D 2844) and, where applicable, in general conformance with current Caltrans Soil and Rock Logging, Classification and Presentation Manual. Logs of the backhoe trenches depicting the soil and geologic conditions encountered and the depth at which samples were obtained are presented on Figures A-1 through A-11. Air-track boring logs are presented as Figures A-12 through A-21.

PROJECT NO. G2746-32-02

TRENCH T 1

ELEV. (MSL.) **446'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T1-1			GC	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, moist to damp, brown, Clayey to Silty GRAVEL with cobble; some granodiorite boulders, abundant debris			
2								
4					-Layer of asphalt concrete (deteriorated)			
			▽		-Groundwater at 6 feet			
6	T1-2			GP	**ALLUVIUM (Qal)** Very loose, wet, dark brown to gray, fine- to coarse-grained Sandy GRAVEL with cobble; some silt and clay			
8					PRACTICAL REFUSAL AT 8 FEET DUE TO CAVING Groundwater encountered at 6 feet Backfilled with spoils			

Figure A-1,
Log of Trench T 1, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▽ ... WATER TABLE OR ▽ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2746-32-02

TRENCH T 2

ELEV. (MSL.) **447'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, damp, brown, fine- to coarse-grained Clayey SAND			
	T2-1			CL	**TERRACE DEPOSITS (Qt)** Medium stiff, moist, dark brown to reddish brown, fine- to coarse-grained Sandy CLAY; trace gravel			
2								
	T2-2			GC	Medium dense, moist, reddish brown, fine- to coarse-grained Clayey GRAVEL with cobble; oxidized, clasts of stadium conglomerate			
4								
6								
8			∇		-Groundwater at 8 feet			
10					-wet; more cobble and boulders			
				CL	**FRIARS FORMATION (Tf)** Stiff to very stiff, moist, greenish gray, fine grained Silty CLAYSTONE; moderately cemented/indurated			
12								

TRENCH TERMINATED AT 12.5 FEET
Groundwater encountered at 8 feet
Backfilled with spoils

Figure A-2,
Log of Trench T 2, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	∇ ... WATER TABLE OR ∇ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2746-32-02

TRENCH T 3

ELEV. (MSL.) **447'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, damp, brown, fine- to coarse-grained Clayey SAND with gravel; some debris			
2				CL	**TERRACE DEPOSITS (Qt)** Medium stiff to stiff, moist, dark reddish brown, fine- to coarse-grained Sandy CLAY; trace gravel			
4				GC	Medium dense, moist, reddish brown, fine- to coarse-grained Clayey GRAVEL with cobble; consist of predominantly stadium conglomerate; oxidized			
6								
8					-Zone of mottling/heavier oxidation			
10								
11			∇		-Groundwater at 11 feet			
12					-wet; more cobble and boulders			
14				CL	**FRIARS FORMATION (Tf)** Stiff to hard, wet, greenish gray, fine grained Silty CLAYSTONE			

TRENCH TERMINATED AT 15 FEET
Groundwater encountered at 11 feet
Backfilled with spoils

Figure A-3,
Log of Trench T 3, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ∇ ... WATER TABLE OR ∇ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 4

ELEV. (MSL.) 449' DATE COMPLETED 05-18-2022

EQUIPMENT 310L RUBBER TIRE BACKHOE BY: DJM

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, moist, brown, fine to coarse Clayey SAND; trace gravel			
2				CL	**TERRACE DEPOSITS (Qt)** Stiff, moist, reddish brown, fine to coarse Sandy CLAY; trace gravel; precipitates and oxidation			
4								
6				CL	**FRIARS FORMATION (Tf)** Very stiff to hard, moist, greenish gray, fine grained Silty CLAYSTONE; manganese staining, moderately indurated/cemented			
8					TRENCH TERMINATED AT 8 FEET Groundwater not encountered Backfilled with spoils			

Figure A-4,
Log of Trench T 4, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 5

ELEV. (MSL.) **451'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, moist, brown, fine to coarse Clayey SAND			
1	T5-1			CL	**TERRACE DEPOSITS (Qt)** Stiff, damp to moist, dark brown to reddish brown, fine- to coarse-grained Sandy CLAY			
2								
4								
5	T5-2			GC	Medium dense, moist, reddish brown, fine- to coarse-grained Clayey GRAVEL; oxidized, some cobble -Groundwater at 6 feet			
6			∇					
8				CL	**FRIARS FORMATION (Tf)** Very stiff to stiff, moist, greenish gray, fine grained Silty CLAYSTONE; manganese staining, moderately cemented/indurated			
10					TRENCH TERMINATED AT 10 FEET Groundwater encountered at 6 feet Backfilled with spoils			

Figure A-5,
Log of Trench T 5, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	∇ ... WATER TABLE OR ∇ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2746-32-02

TRENCH T 6

ELEV. (MSL.) **452'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Medium dense, damp, brown, fine- to coarse-grained Clayey SAND; debris			
2				CL	**TERRACE DEPOSITS (Qt)** Stiff, moist, reddish brown, fine- to coarse-grained Sandy CLAY			
4				GC	Medium dense, moist, reddish brown, fine- to coarse-grained Clayey GRAVEL; oxidized			
6								
8			▽		-Groundwater at 9 feet			
10				CL	**FRIARS FORMATION (Tf)** Very stiff to hard, moist, greenish gray, fine grained Silty CLAYSTONE; moderately cemented/indurated, manganese staining			

TRENCH TERMINATED AT 11 FEET
Groundwater encountered at 9 feet
Backfilled with spoils

Figure A-6,
Log of Trench T 6, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
▽ ... WATER TABLE OR ▽ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 7

ELEV. (MSL.) **453'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**UNDOCUMENTED FILL (Qudf)** Stiff, dry, dark gray, fine- to coarse-grained Sandy CLAY			
2				CL	**TERRACE DEPOSITS (Qt)** Stiff, moist, mottled light gray to gray, fine grained Sandy CLAY			
4								
					-Becomes medium stiff -Groundwater at 6 feet			
6			▽	GC	Medium dense, wet, reddish brown, fine- to coarse-grained Clayey GRAVEL			
8				CL	**FRIARS FORMATION (Tf)** Very stiff to hard, moist, greenish gray, fine grained Silty CLAYSTONE; manganese staining, moderately cemented/indurated			
10					TRENCH TERMINATED AT 10 FEET Groundwater encountered at 6 feet Backfilled with spoils			

Figure A-7,
Log of Trench T 7, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▽ ... WATER TABLE OR ▽ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2746-32-02

TRENCH T 8

ELEV. (MSL.) **453'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				GC	**UNDOCUMENTED FILL (Qudf)** Medium dense, moist, brown, fine- to coarse-grained Clayey SAND with gravel			
2	T8-1			SC	**TERRACE DEPOSITS (Qt)** Very stiff, , moist, gray, fine- to coarse-grained Sandy CLAY; precipitates			
4				GC	Medium dense, moist, reddish brown, fine- to coarse-grained Clayey GRAVEL with cobble			
6					-Groundwater at 6.5 feet			
8					-More cobbles			
10				CL	**FRIARS FORMATION (Tf)** Very stiff to hard, moist, greenish gray, fine grained CLAYSTONE; manganese staining			

TRENCH TERMINATED AT 11.5 FEET
Groundwater encountered at 6.5 feet
Backfilled with spoils

Figure A-8,
Log of Trench T 8, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G2746-32-02

TRENCH T 9

ELEV. (MSL.) **457'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				GC	**UNDOCUMENTED FILL (Qudf)** Medium dense, moist, dark brown, fine- to coarse-grained Clayey GRAVEL			
2				GC	**TERRACE DEPOSITS (Qt)** Medium dense, moist, light brown to reddish brown, fine- to coarse-grained Clayey GRAVEL; oxidized			
4								
6								
8			▽		-Seepage at 8 feet -Becomes wet -More cobble			
10				CL	**FRIARS FORMATION (Tf)** Very stiff to hard, moist, yellowish gray, fine-to coarse-grained Sandy Silty CLAYSTONE; moderately cemented/indurated, oxidized/mottled			
12					TRENCH TERMINATED AT 12 FEET Seepage encountered at 8 feet Backfilled with spoils			

Figure A-9,
Log of Trench T 9, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▽ ... WATER TABLE OR ▽ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 10

ELEV. (MSL.) 459' DATE COMPLETED 05-18-2022

EQUIPMENT 310L RUBBER TIRE BACKHOE BY: DJM

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Medium dense, dry, light brown, fine- to coarse-grained Clayey SAND			
	T10-1			SC	**COLLUVIUM (Qcol)** Medium dense, moist to damp, reddish brown, fine- to coarse-grained Clayey SAND; manganese staining, oxidized, moderately cemented, pinhole porosity			
2								
4								
6								
8								
10			∇		-Seepage at 11 feet			
				GC	**TERRACE DEPOSITS (Qt)** Dense, wet, gray to reddish brown, fine- to coarse-grained Clayey GRAVEL with cobble			
12								
					REFUSAL AT 13 FEET DUE TO GRAVEL AND DIORITE Seepage encountered at 11 feet Backfilled with spoils			

Figure A-10,
Log of Trench T 10, Page 1 of 1

G2746-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	∇ ... WATER TABLE OR ∇ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2746-32-02

TRENCH T 11

ELEV. (MSL.) **461'** DATE COMPLETED **05-18-2022**

EQUIPMENT **310L RUBBER TIRE BACKHOE** BY: **DJM**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (Qudf)** Medium dense, damp, dark brown, Clayey SAND with gravel; some debris			
2	T11-1			SM	**COLLUVIUM (Qcol)** Medium dense, dry, brown to light brown, fine- to coarse-grained Silty SAND; some gravel, pinhole porosity			
4								
6								
8			▽		-Groundwater at 9 feet -More gravel and cobble			
10	T11-2				**GRANODIORITE (Kgd)** Highly weathered, strong, gray to yellowish brown, GRANODIORITE; moderately decomposed			

TRENCH TERMINATED AT 10.5 FEET
Groundwater encountered at 9 feet
Backfilled with spoils

Figure A-11,
Log of Trench T 11, Page 1 of 1

G2746-32-02.GPJ

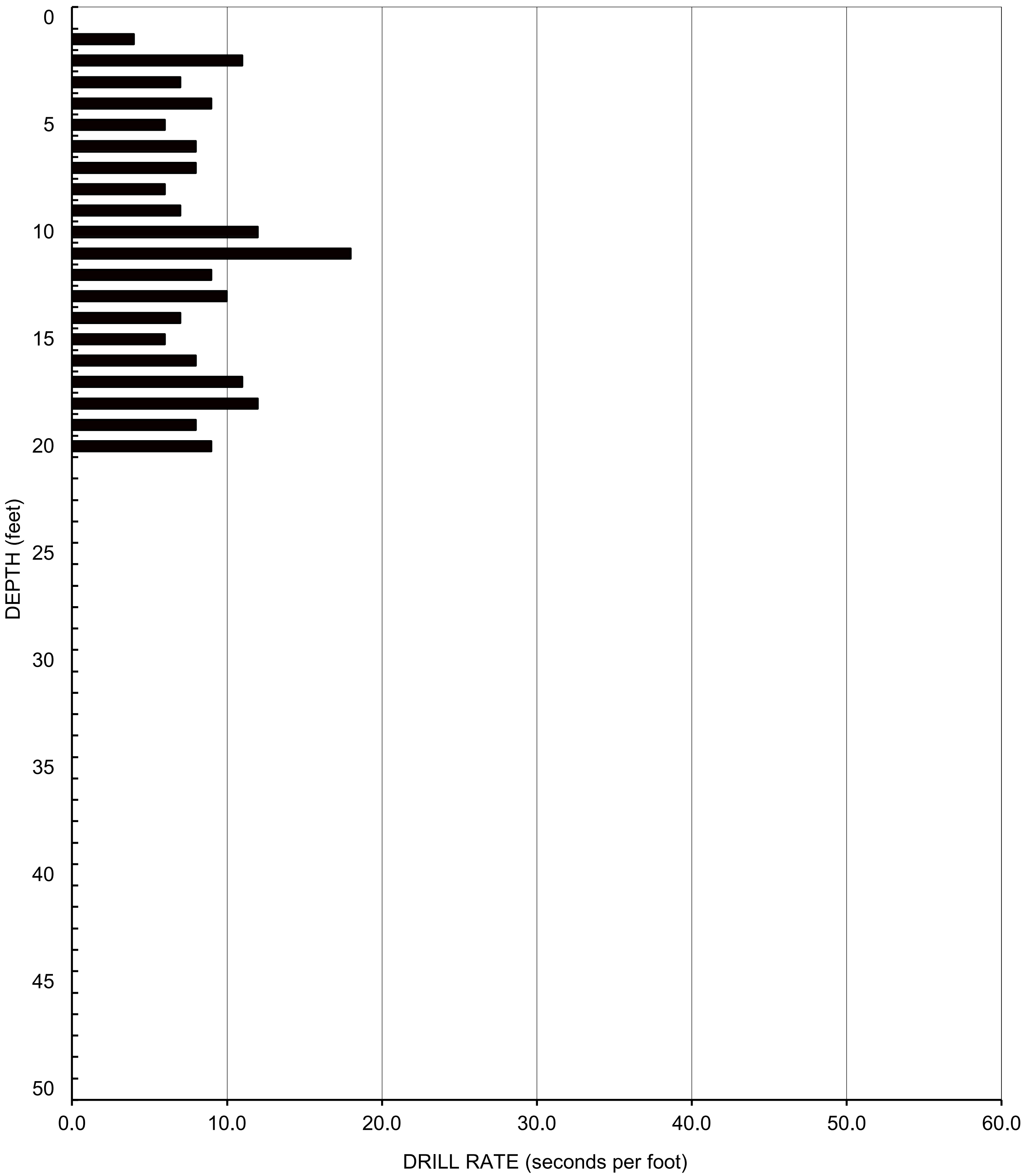
SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▽ ... WATER TABLE OR ▽ ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

AIR TRACK BORING AT-1
Elevation - 475 Feet (MSL)
Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

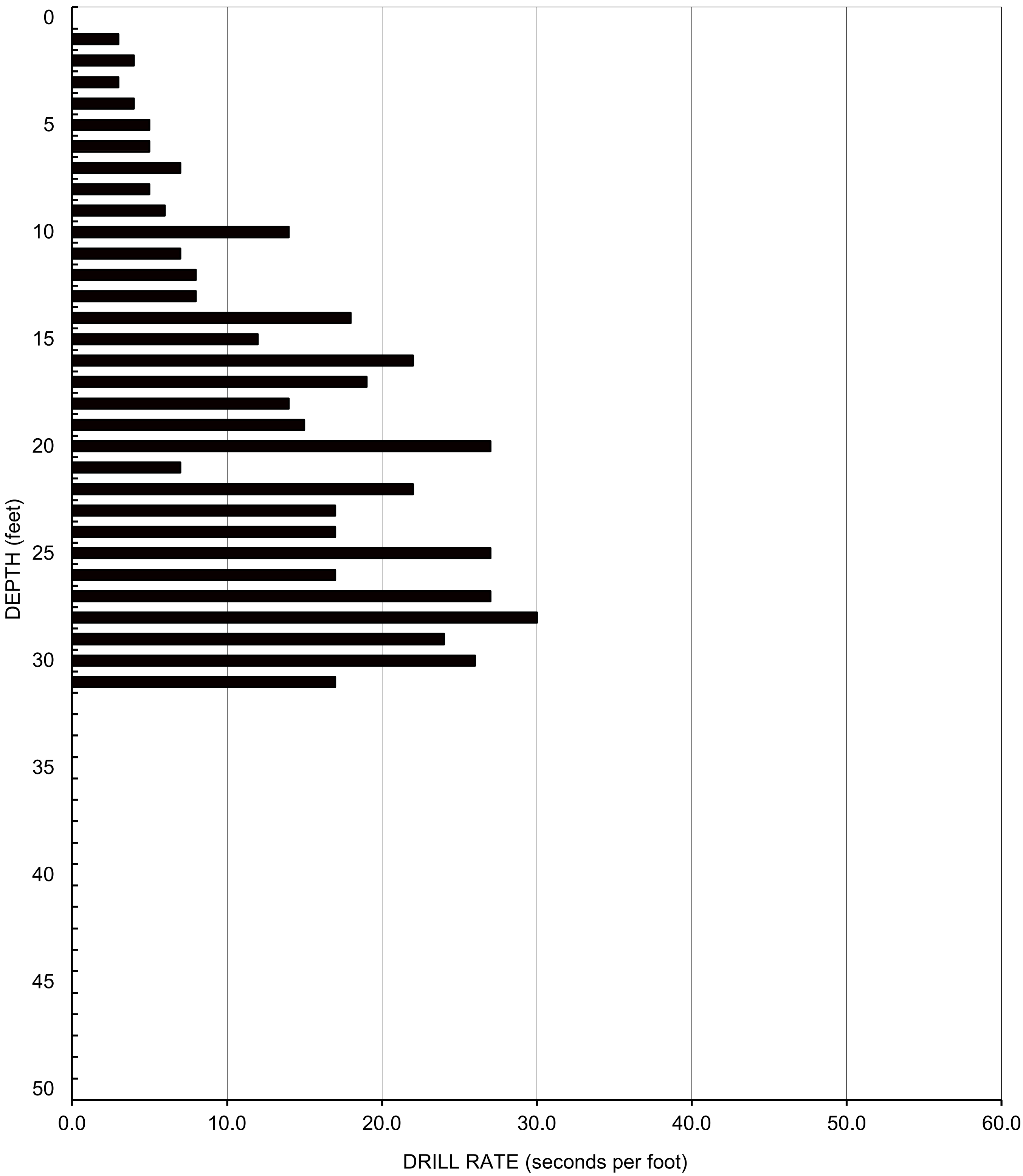
GEOCON INCORPORATED



OAK KNOLL - POWAY

AIR TRACK BORING AT-2
Elevation - 485 Feet (MSL)
Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

GEOCON INCORPORATED



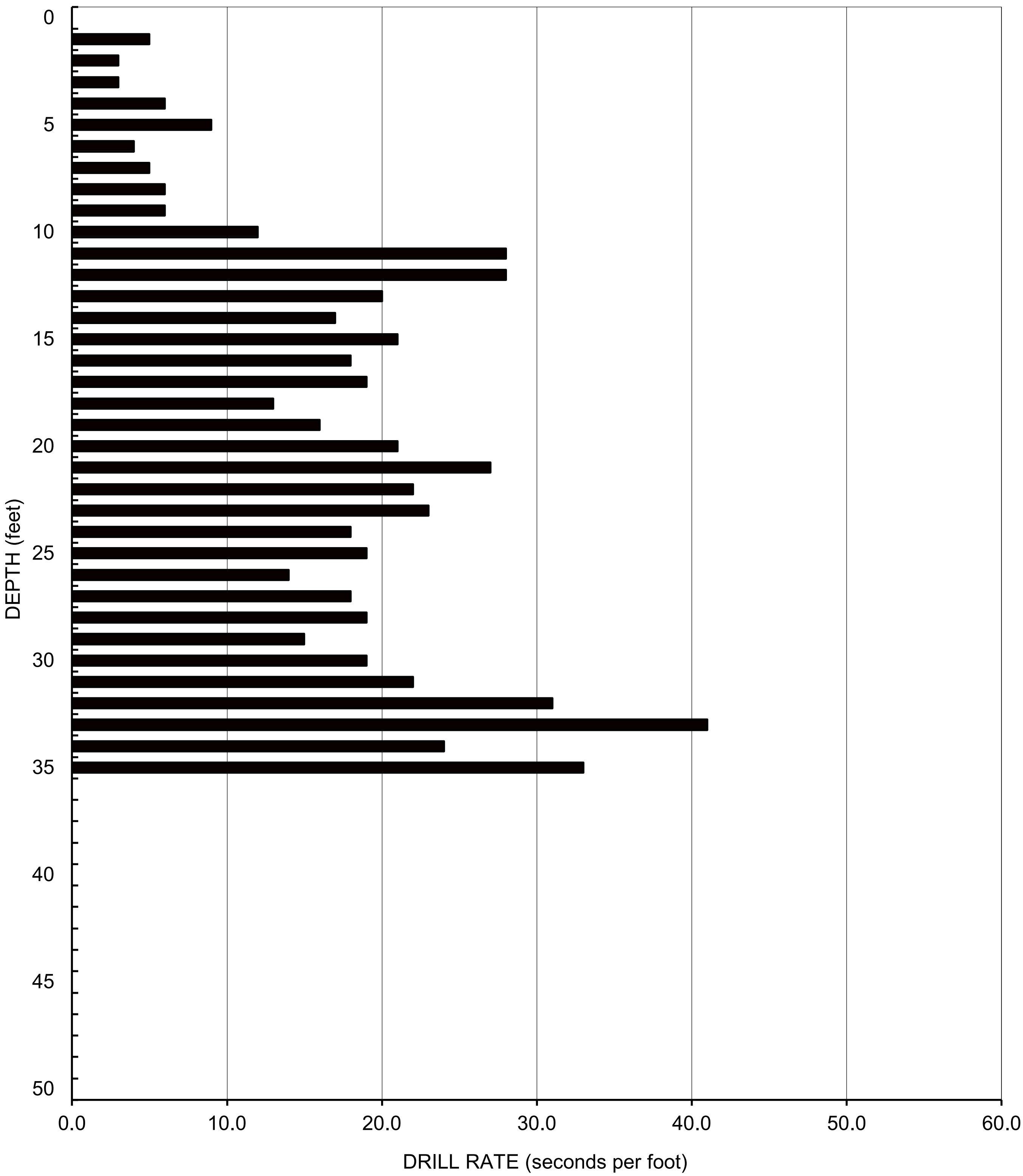
AT02.xls

AIR TRACK BORING AT-3

Elevation - 492 Feet (MSL)

Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

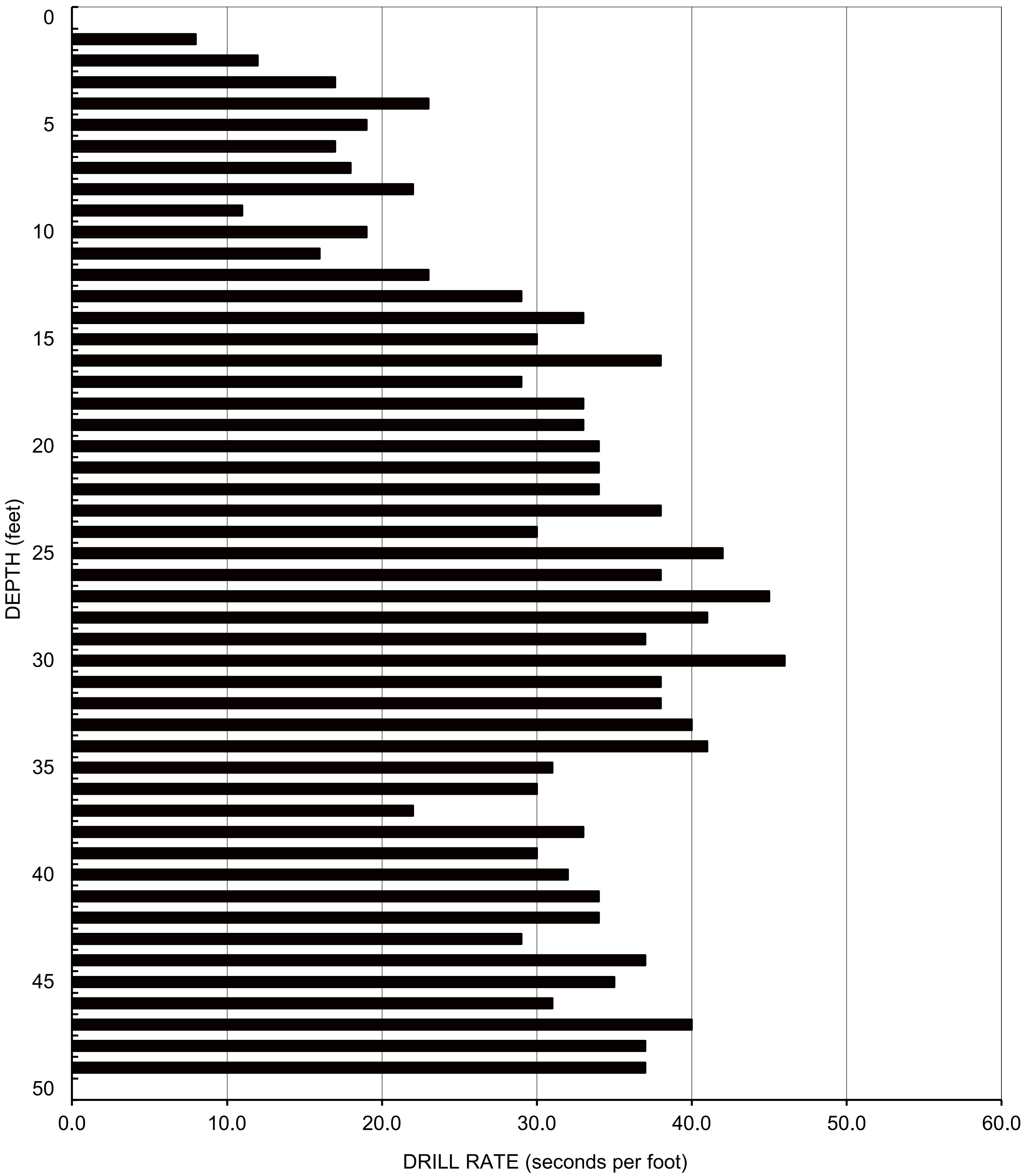
GEOCON INCORPORATED



OAK KNOLL - POWAY

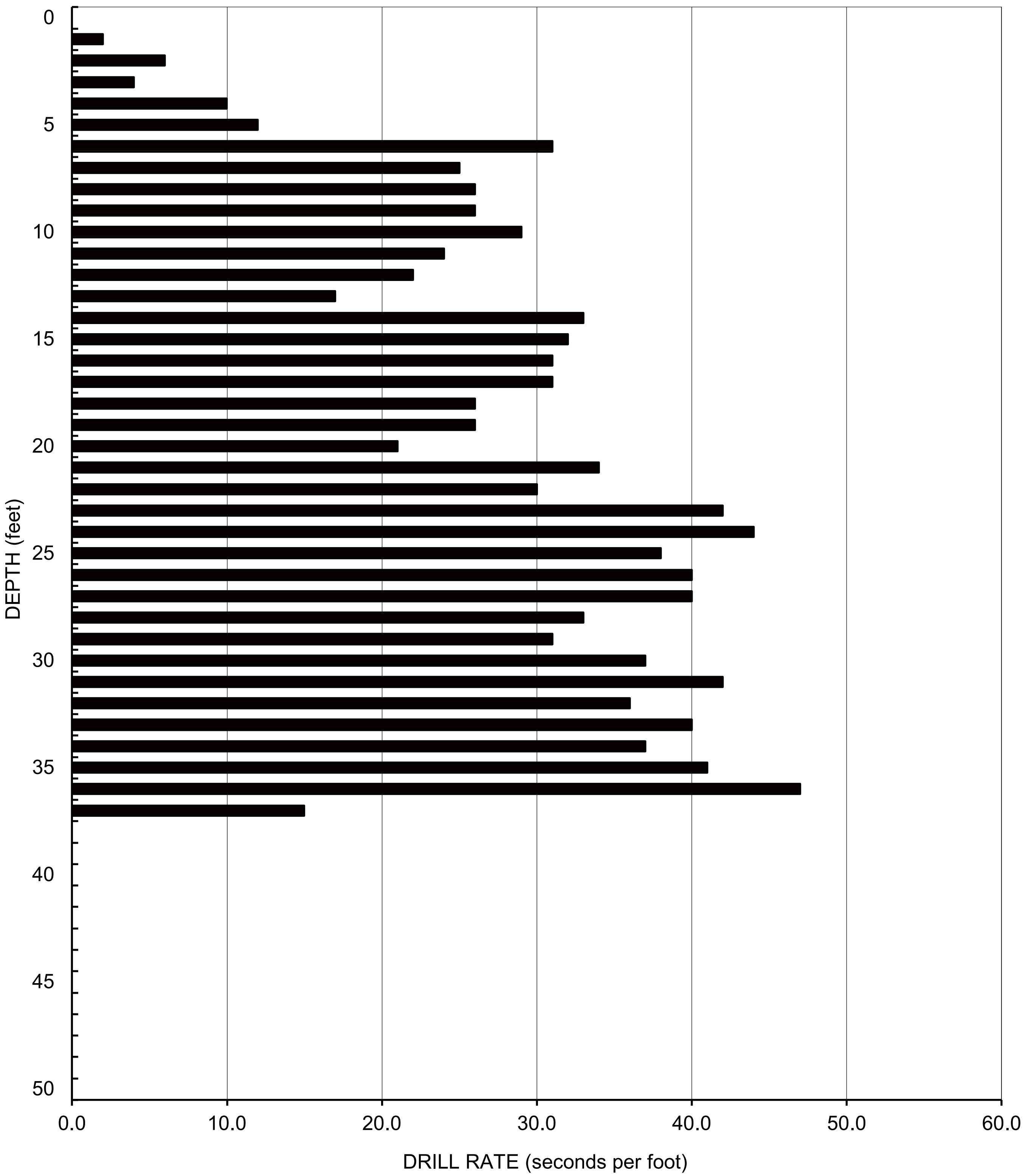
AIR TRACK BORING AT-4
Elevation - 499 Feet (MSL)
Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

GEOCON INCORPORATED



AIR TRACK BORING AT-5
Elevation - 490 Feet (MSL)
Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

GEOCON INCORPORATED



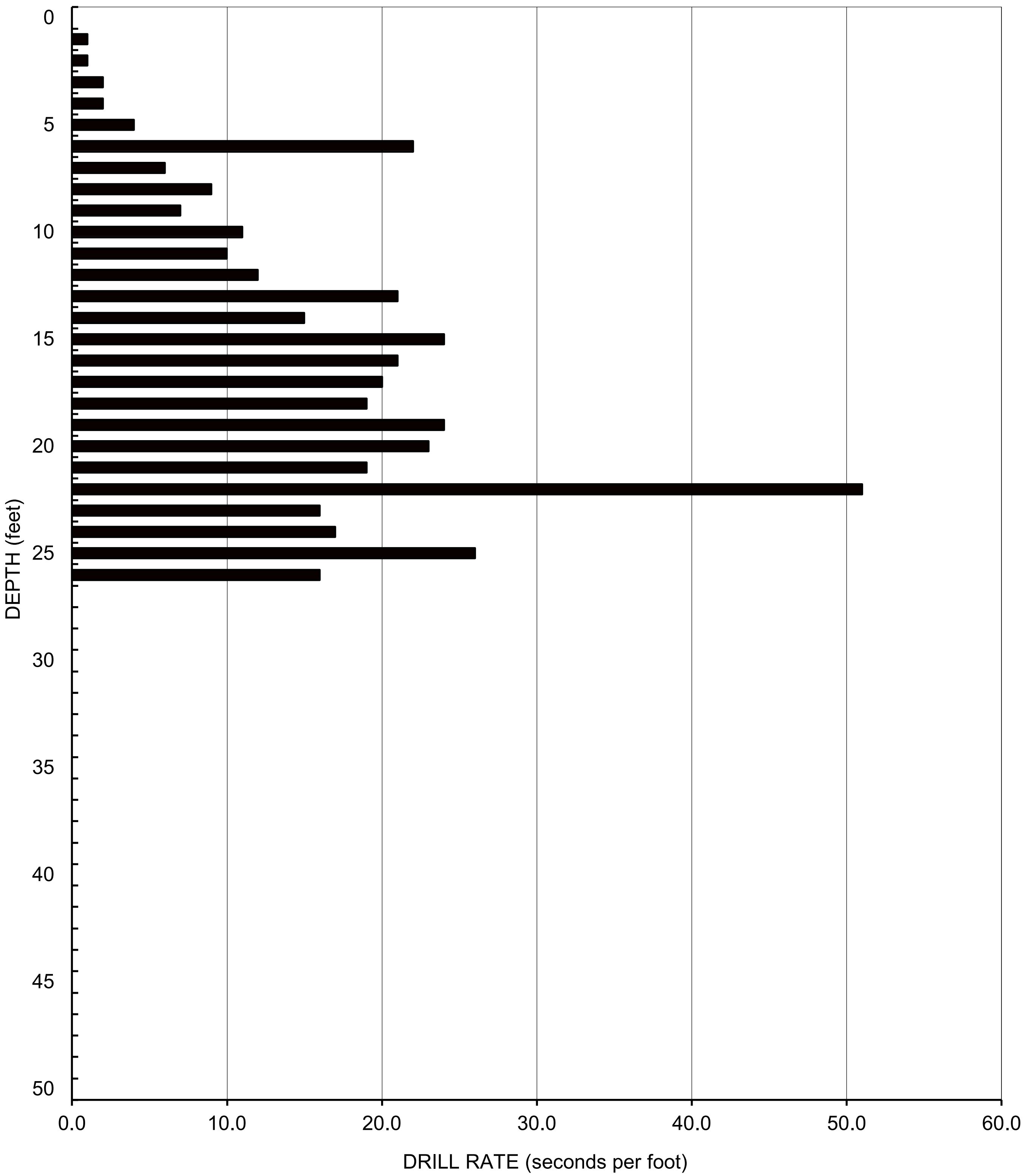
OAK KNOLL - POWAY

AIR TRACK BORING AT-6

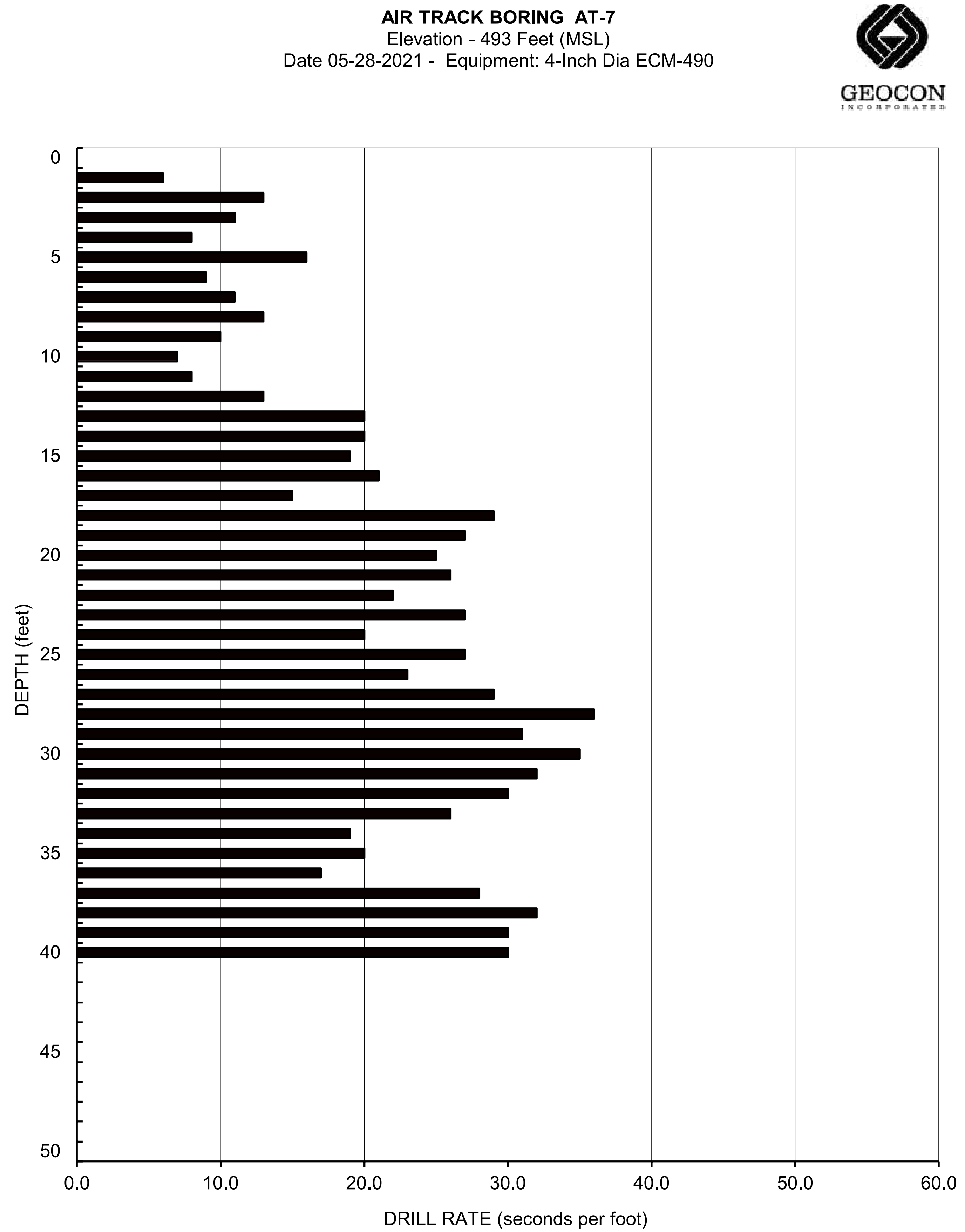
Elevation - 482 Feet (MSL)

Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

GEOCON INCORPORATED



OAK KNOLL - POWAY

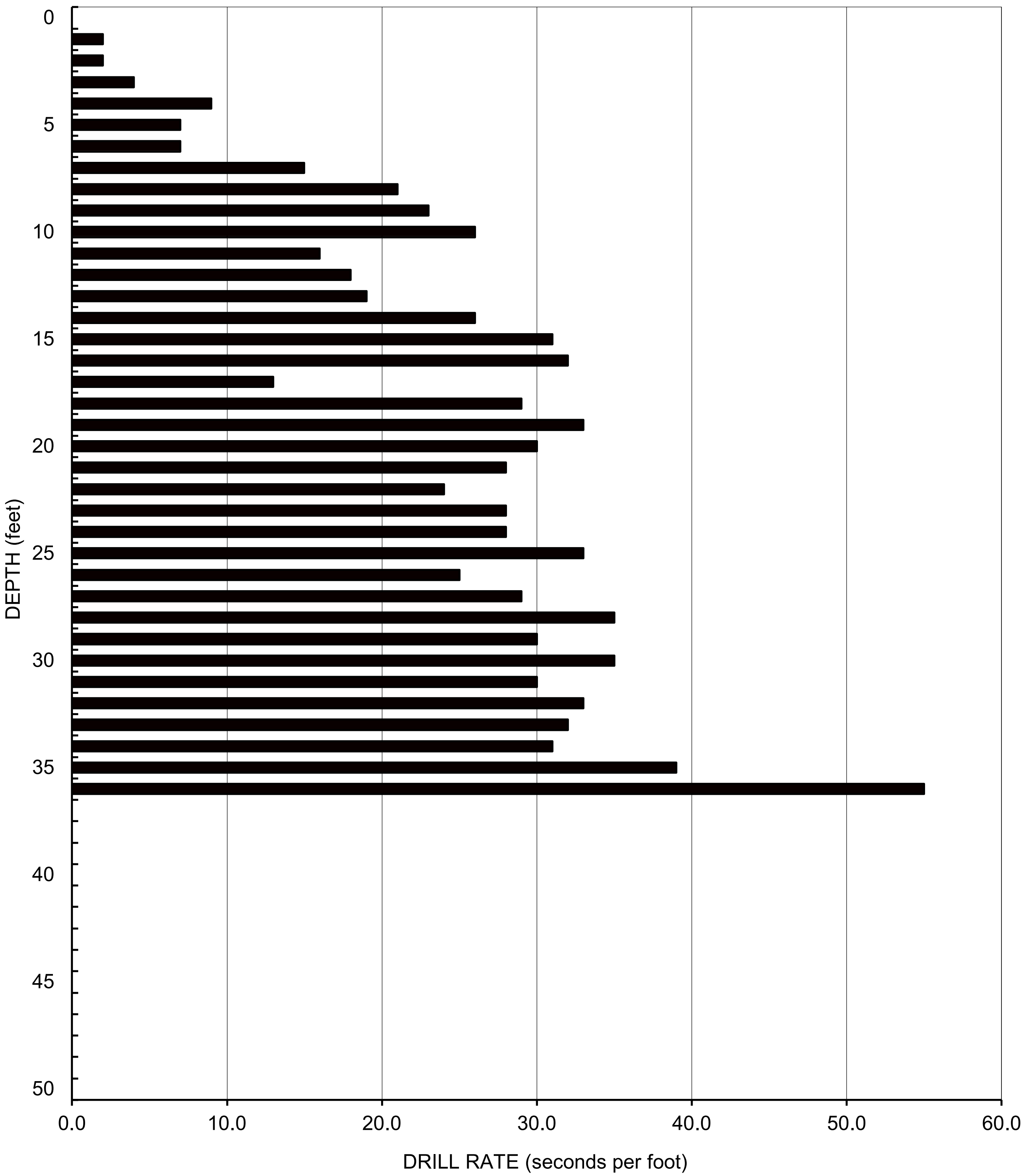


AIR TRACK BORING AT-8

Elevation - 488 Feet (MSL)

Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

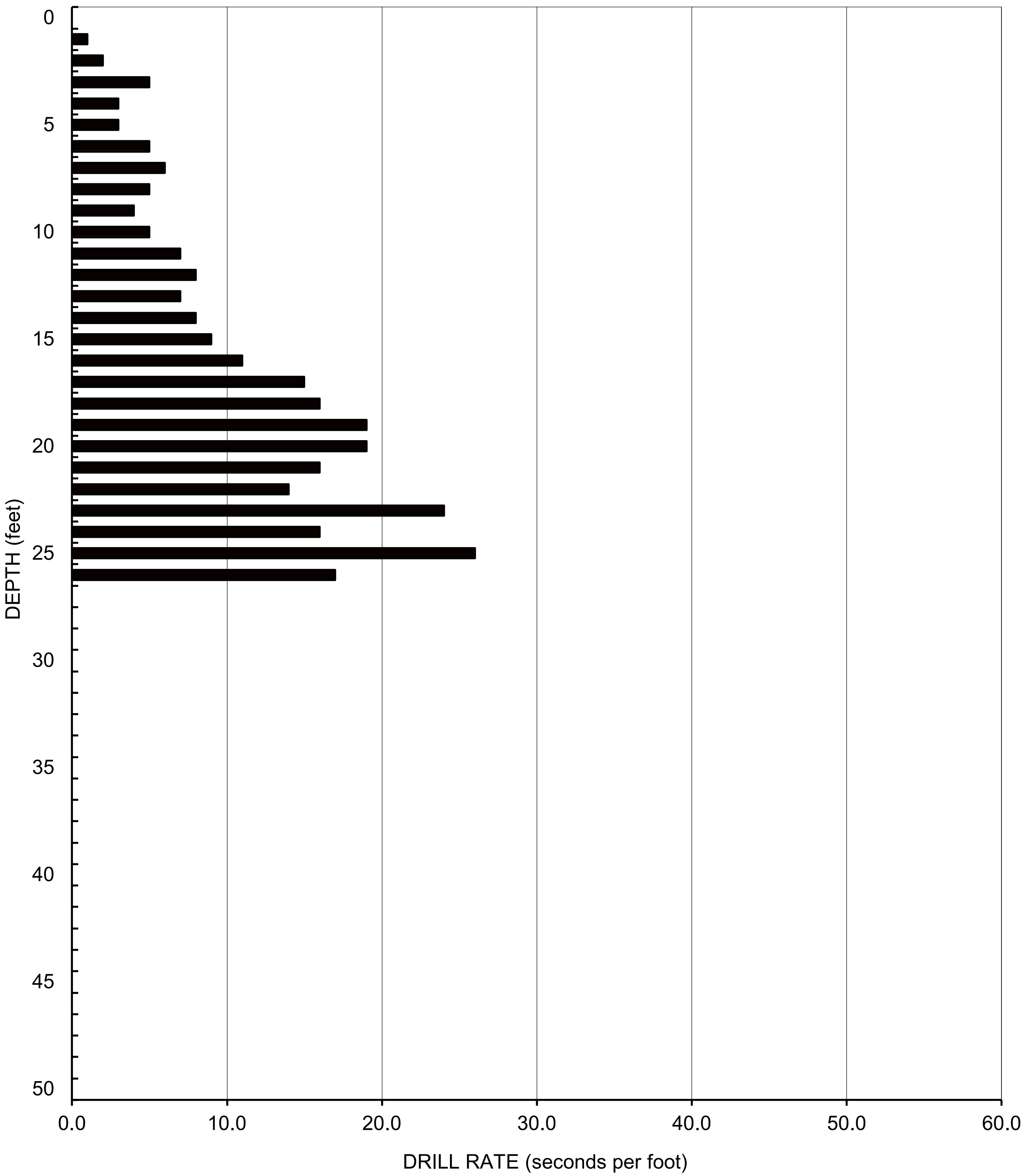
GEOCON INCORPORATED



OAK KNOLL - POWAY

AIR TRACK BORING AT-9
Elevation - 480 Feet (MSL)
Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

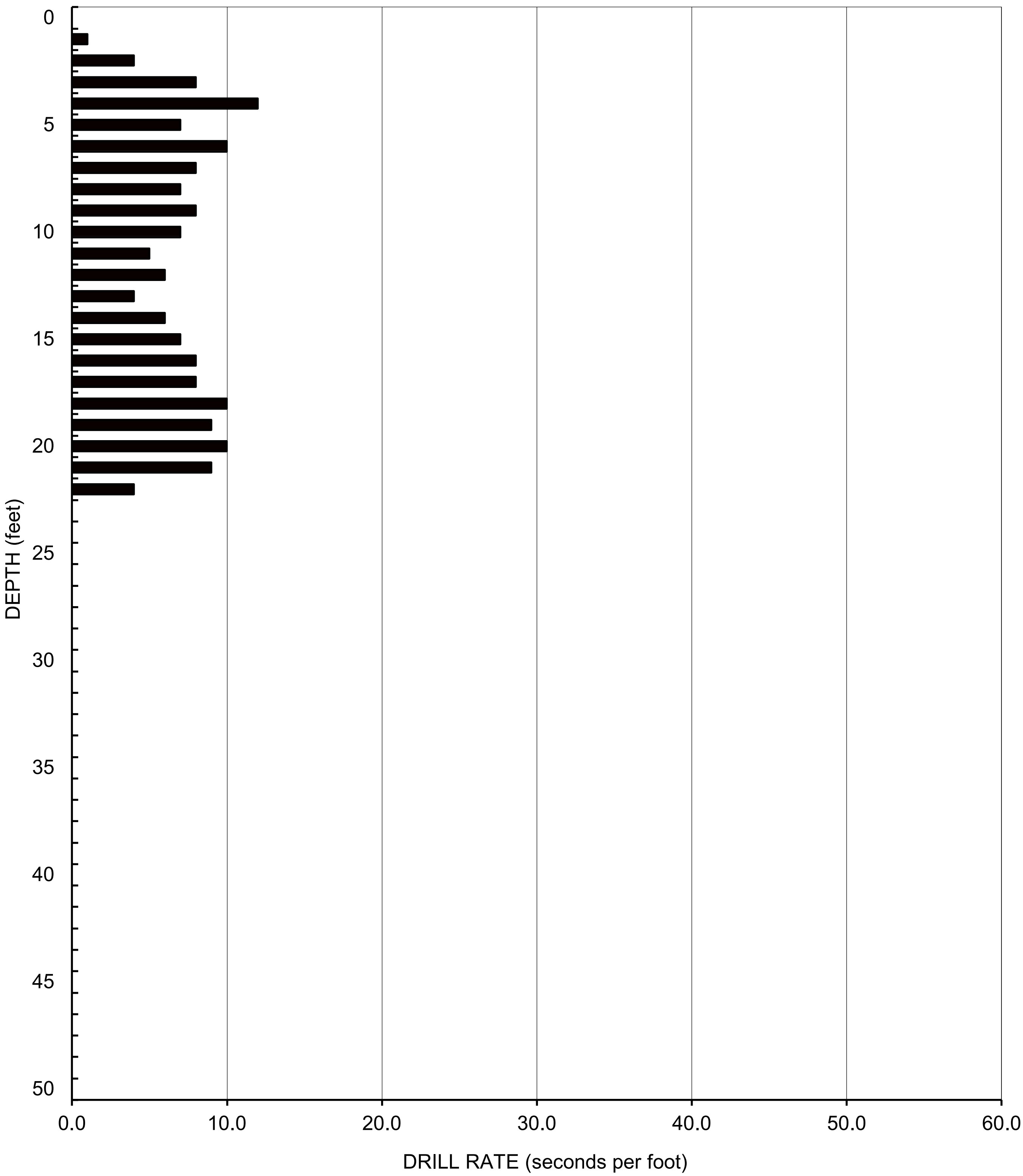
GEOCON INCORPORATED



OAK KNOLL - POWAY

AIR TRACK BORING AT-10
Elevation - 472 Feet (MSL)
Date 05-28-2021 - Equipment: 4-Inch Dia ECM-490

GEOCON INCORPORATED



APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory testing on select soil samples in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures.

Selected disturbed bulk samples were tested for maximum dry density and optimum moisture content, shear strength characteristics, expansion potential, and water-soluble sulfate content. The results of our laboratory tests are presented in Tables B-1 through B-IV.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T1-1	Brown, Silty/Clayey SAND with gravel and cobble (includes 14 percent rock correction)	137.3	6.7
T5-1/T8-1	Dark brown, Sandy CLAY with trace gravel	123.5	11.4
T10-1/T11-1	Reddish-brown, Silty/Clayey, fine to medium SAND	130.0	9.0
T11-2	Light brown, Silty, fine to medium SAND with trace gravel	134.2	8.3

TABLE B-II
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.*	Dry Density (pcf)	Moisture Content (%)		Unit Cohesion (psf) Peak	Angle of Shear Resistance (degrees)
		Initial	Final		
T1-1	120.6	8.0	12.6	450	33
T5-1/T8-1	109.6	13.0	23.8	300	26
T10-1/T11-1	116.8	9.3	13.9	580	30
T11-2	121.5	8.0	13.0	490	33

*Soil samples remolded to 90 percent of laboratory maximum dry density at near optimum moisture content. Ultimate values are shown.

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	ASTM Classification (per 2019 CBC)
	Before Test	After Test			
T1-1	7.6	15.2	118.8	61	Medium
T5-1/T8-1	10.9	26.2	105.7	112	High
T10-1/T11-1	8.6	15.3	115.1	3	Very Low

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

Sample No.	Water-Soluble Sulfate (%)	Sulfate Exposure Class*	Exposure Rating (severity)
T1-1	0.012	Not Applicable	S0
T5-1/T8-1	0.035	Not Applicable	S0

*Reference: Table 4.2.1, ACI 318 report.

APPENDIX C

APPENDIX C

STORM WATER MANAGEMENT

FOR

OAK KNOLL
POWAY, CALIFORNIA

PROJECT NO. G2746-32-02

APPENDIX C

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices are being proposed in accordance with the *2016 City of Poway BMP Design Manual,* commonly referred to as the *Storm Water Standards* (SWS). If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table C-1 presents the descriptions of the hydrologic soil groups. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

TABLE C-1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The northern property is underlain by three units identified as Cieneba rocky coarse sandy loam (CmE2), Olivehain cobbly loam (OhC), and Placentia sandy loam (PfC). Table C-2A presents the information from the USDA NRCS website for the subject property.

TABLE C-2A
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP (NORTH PROPERTY)

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (inches/hour)
Cieneba rocky coarse sandy loam	CmE2	1	D	1.98 – 5.95
Olivehain cobbly loam	OhC	20	D	0.0 – 0.06
Placentia sandy loam	PfC	79	D	0.0 – 0.06

The southern property is underlain by Placentia sandy loam (PfC) and Visalia sandy loam (VaA). Table C-2B presents the information from the USDA NRCS website for the subject property.

TABLE C-2B
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP (SOUTH PROPERTY)

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (inches/hour)
Placentia sandy loam	PfC	73	D	0.0 – 0.06
Visalia sandy loam	VaA	27	A	1.98 – 5.95

In-Situ Testing

The infiltration rate, percolation rates and saturated hydraulic conductivity are different and have different meanings. Percolation rates tend to overestimate infiltration rates and saturated hydraulic conductivities by a factor of 10 or more. Table C-3 describes the differences in the definitions.

TABLE C-3
SOIL PERMEABILITY DEFINITIONS

Term	Definition
Infiltration Rate	The observation of the flow of water through a material into the ground downward into a given soil structure under long term conditions. This is a function of layering of soil, density, pore space, discontinuities and initial moisture content.
Percolation Rate	The observation of the flow of water through a material into the ground downward and laterally into a given soil structure under long term conditions. This is a function of layering of soil, density, pore space, discontinuities and initial moisture content.
Saturated Hydraulic Conductivity (k_{SAT}, Permeability)	The volume of water that will move in a porous medium under a hydraulic gradient through a unit area. This is a function of density, structure, stratification, fines content and discontinuities. It is also a function of the properties of the liquid as well as of the porous medium.

The degree of soil compaction or in-situ density has a significant impact on soil permeability and infiltration. Based on our experience and other studies we performed, an increase in compaction results in a decrease in soil permeability.

We performed one constant head, borehole Infiltration Test, I-1, at location shown on the attached Geologic Map, Figure 2. The test boring was 4 inches in diameter. The results of the tests provide parameters for the saturated hydraulic conductivity characteristics of on-site soil and geologic units. Table C-4 presents the results of the estimated field saturated hydraulic conductivity and estimated infiltration rates obtained from the borehole percolation test. The test results are also attached herein. We applied a feasibility factor of safety of 2 to the field results for use in preparation of Worksheet C.4-1. The results of the testing indicate adjusted soil infiltration rates of 0.0 inches per hour after applying a Factor of Safety of 2.

TABLE C-4
FIELD PERMEAMETER INFILTRATION TEST RESULTS

Test No.	Geologic Unit	Test Depth (feet)	Field-Saturated Hydraulic Conductivity, k_{sat} (inch/hour)	Worksheet[1] Saturated Hydraulic Conductivity, k_{sat} (inch/hour)
I-1	Qt	2.7	0.071	0.036

[1] Using a factor of safety of 2 for Worksheet C.4-1.

STORM WATER MANAGEMENT CONCLUSIONS

The Geologic Map, Figure 2, depicts the existing property, proposed development, the approximate lateral limits of the geologic units, the locations of the field excavations and the in-situ infiltration test locations.

Soil Types

Proposed Compacted Fill – Compacted fill will be placed across the entire property during site development. Proposed remedial grading will consist of removing the surficial soils and replacement as compacted fill. The proposed storm water BMP's will be founded in compacted fill placed above Friars Formation or granitic rock. The compacted fill will be comprised of on-site sandy clay and clayey gravel. The fill will be compacted to a dry density of at least 90 percent of the laboratory maximum dry density. In our experience, compacted fill does not possess infiltration rates appropriate for infiltration BMP's. Hazards that occur as a result of fill soil saturation include a potential for hydro-consolidation of the granular fill soils, heaving of expansive soils, long term fill settlement, differential fill settlement, and lateral movement associated with saturated fill relaxation. The potential for lateral water migration to adversely impact existing or proposed structures, foundations, utilities, and roadways, is high. Therefore, full infiltration should be considered infeasible.

Section D.4.2 of the *2016 Storm Water Standards* (SWS) provides a discussion regarding fill materials used for infiltration. The SWS states:

- *For engineered fills, infiltration rates may still be quite uncertain due to layering and heterogeneities introduced as part of construction that cannot be precisely controlled.* Due to these uncertainties, full and partial infiltration should be considered geotechnically infeasible and liners and subdrains should be used in areas where infiltration BMP's are founded in compacted fill.

- *Where possible, infiltration BMPs on fill material should be designed such that their infiltrating surface extends into native soils.* Full and partial infiltration should be considered geotechnically infeasible within the compacted fill and liners and subdrains should be used. If the infiltration BMP's extended below the compacted fill, partial infiltration may be feasible.

- *Because of the uncertainty of fill parameters as well as potential compaction of the native soils, an infiltration BMP may not be feasible.* Therefore, full infiltration should be considered geotechnically infeasible. Partial infiltration may be feasible if the infiltration BMP extends below the compacted fill.

Infiltration Rates

The results of the infiltration test (including the feasibility factor of safety of 2) obtained within the Terrace Deposits was 0.036 inches per hour (iph). Based on the results of the infiltration testing, the test does not meet the minimum threshold for full or partial infiltration; therefore, full and partial infiltration is considered infeasible.

Groundwater Elevations

Groundwater was encountered during the field investigation and is expected to be a constraint.

Soil or Groundwater Contamination

Based on our review of the Geotracker website, no soil contamination exists or is known to exist on-site.

New or Existing Utilities

Existing utilities are present within right of ways adjacent to the existing streets, generally beneath public sidewalks and roadways. Full infiltration near existing or proposed utilities should be avoided to prevent lateral water migration into the permeable trench backfill materials. Any infiltration BMP's should be setback at least 10 feet from closest utility.

Existing and Planned Structures

Proposed storm water BMP's are shown throughout the development. Any proposed storm water BMP's adjacent to existing or proposed structures should include a horizontal setback of at least 10 feet.

Slopes

The northern property moderately to steeply slopes to the south. Proposed cut and fill slopes of approximately 30 feet and 4 feet high, respectively, are proposed. Proposed storm water BMP's adjacent to existing or proposed cut and fill slopes should include a horizontal setback of H and 1.5H, respectively. For example, considering a 30 foot high cut slope and 4 foot high fill slope, a horizontal setback of 30 feet and 6 feet, respectively, should be used.

Recommendations

Due to the low infiltration rate obtained in the Terrace Deposits, and considering the entire site will be underlain with compacted fill over dense granitic rock or hard Friars Formation, full and partial infiltration of storm water is considered geotechnically infeasible and the proposed development exhibits a "*No Infiltration*" condition. Liners and subdrains should be incorporated into the design and construction of the planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 4 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. Seams and penetrations of the liners should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1 or I-8) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet D.5-1 or Form I-9) that helps the project civil engineer estimate the factor of safety based on several factors. Table C-5 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE C-5
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., Infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Based on our geotechnical investigation and the information in Table C-5, Table C-6 presents the estimated factor values for the evaluation of the factor of safety. This table only provides the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

TABLE D-6
FACTOR OF SAFETY WORKSHEET DESIGN VALUES – PART A[1]

Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	3	0.75
Predominant Soil Texture	0.25	3	0.75
Site Soil Variability	0.25	1	0.25
Depth to Groundwater/ Impervious Layer	0.25	2	0.50
Suitability Assessment Safety Factor, $S_A = \sum p$			2.25

1 The project civil engineer should complete Worksheet D.5-1 or Form I-9 using the data on this table. Additional information is required to evaluate the design factor of safety.

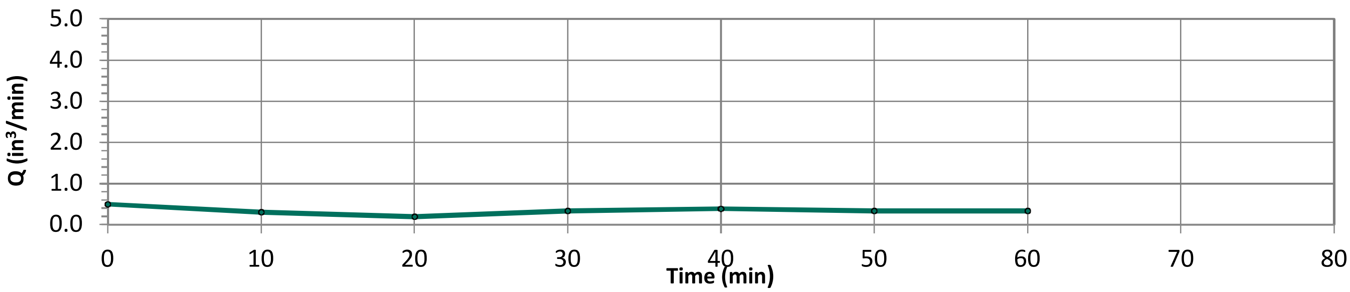
TEST NO.: **I-1**

GEOLOGIC UNIT: **Qt**

EXCAVATION ELEVATION (MSL, FT): **449**

TEST INFORMATION	
BOREHOLE DIAMETER (IN):	4
BOREHOLE DEPTH (FT):	2.7
TEST/BOTTOM ELEVATION (MSL, FT):	446
MEASURED HEAD HEIGHT (IN):	5.5
CALCULATED HEAD HEIGHT (IN):	5.9
FACTOR OF SAFETY:	2.0

TEST RESULTS	
STEADY FLOW RATE (IN^3/MIN):	**0.332**
FIELD-SATURATED INFILTRATION RATE (IN/HR):	**0.071**
FACTORED INFILTRATION RATE (IN/HR):	**0.036**



TEST DATA

Reading	Time Elapsed (min)	Water Weight Consumed (lbs)	Water Volume Consumed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	10.00	0.180	4.98	0.498
3	10.00	0.110	3.05	0.305
4	10.00	0.070	1.94	0.194
5	10.00	0.120	3.32	0.332
6	10.00	0.140	3.88	0.388
7	10.00	0.120	3.32	0.332
8	10.00	0.120	3.32	0.332

GEOCON INCORPORATED
GEOTECHNICAL CONSULTANTS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121-2974
PHONE 858 558-6900 - FAX 858 558-6159

DOWNHOLE PERMEAMETER TEST RESULTS

OAK KNOLL, POWAY, CA

PROJECT NO.: G2746-32-02

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

San Diego County Area, California

Oak Knoll North, Poway

June 8, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


117° 3' 28" W
117° 3' 19" W
32° 57' 11" N
32° 57' 1" N
494580
494620
494660
494700
494740
494780
494820
3646110
3646070
3646030
3645990
3645950
3645910
3645870
3645830
3645790
CmE2
OhC
PfC
Meadow Glen Way
Soil Map may not be valid at this scale.
Map Scale: 1:1,590 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 20 40 80 120
Feet
0 50 100 200 300
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 22, 2018—Aug 31, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded	0.1	1.2%
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes	1.5	19.8%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	5.8	79.0%
Totals for Area of Interest		**7.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

CmE2—Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded

Map Unit Setting

National map unit symbol: hb9t
Elevation: 500 to 4,000 feet
Mean annual precipitation: 8 to 35 inches
Mean annual air temperature: 45 to 64 degrees F
Frost-free period: 110 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Cieneba and similar soils: 60 percent
Rock outcrop: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cieneba

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and granodiorite

Typical profile

H1 - 0 to 8 inches: coarse sandy loam
H2 - 8 to 12 inches: weathered bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 4 to 20 inches to paralithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R019XD060CA - SHALLOW LOAMY (1975)
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile
H1 - 0 to 4 inches: unweathered bedrock

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Vista
Percent of map unit: 5 percent
Hydric soil rating: No

Las posas
Percent of map unit: 5 percent
Hydric soil rating: No

OhC—Olivenhain cobbly loam, 2 to 9 percent slopes

Map Unit Setting
National map unit symbol: hbfb
Elevation: 100 to 600 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 290 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition
Olivenhain and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olivenhain

Setting
Landform: Marine terraces
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly alluvium derived from mixed sources

Typical profile
H1 - 0 to 10 inches: cobbly loam
H2 - 10 to 42 inches: very cobbly clay
H3 - 42 to 60 inches: cobbly clay loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA - CLAYPAN (1975)
Hydric soil rating: No

Minor Components

Diablo

Percent of map unit: 4 percent
Hydric soil rating: No

Linne

Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Huerhuero

Percent of map unit: 2 percent
Hydric soil rating: No

PfC—Placentia sandy loam, thick surface, 2 to 9 percent slo pes

Map Unit Setting

National map unit symbol: hbfn
Elevation: 50 to 2,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Placentia and similar soils: 85 percent
Minor components: 11 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placentia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 34 inches: clay

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA - CLAYPAN (1975)
Hydric soil rating: No

Minor Components

Ramona

Percent of map unit: 5 percent
Hydric soil rating: No

Bonsall

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

San Diego County Area, California

Oak Knoll South, Poway, CA

June 8, 2022

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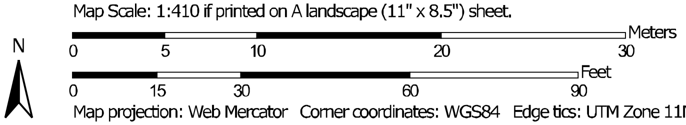
Soil Map

Map Scale: 1:410 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	0.4	73.4%
VaA	Visalia sandy loam, 0 to 2 percent slopes	0.2	26.6%
Totals for Area of Interest		**0.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

PfC—Placentia sandy loam, thick surface, 2 to 9 percent slo pes

Map Unit Setting

National map unit symbol: hbfn
Elevation: 50 to 2,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Placentia and similar soils: 85 percent
Minor components: 11 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Placentia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 34 inches: clay

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R019XD061CA - CLAYPAN (1975)
Hydric soil rating: No

Minor Components

Ramona

Percent of map unit: 5 percent

Hydric soil rating: No

Bonsall

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

VaA—Visalia sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hbh2
Elevation: 600 to 1,200 feet
Mean annual precipitation: 15 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 200 to 350 days
Farmland classification: Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Visalia and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Visalia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Riser, flat
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 12 inches: sandy loam
H2 - 12 to 40 inches: fine sandy loam
H3 - 40 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare

Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: A
Ecological site: R019XG911CA - Loamy Fan
Hydric soil rating: No

Minor Components

Grangeville

Percent of map unit: 5 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 5 percent
Hydric soil rating: No

Placentia

Percent of map unit: 2 percent
Hydric soil rating: No

Tujunga

Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent
Landform: Flood plains
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX D

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RECOMMENDED GRADING SPECIFICATIONS

FOR

OAK KNOLL
POWAY, CALIFORNIA

PROJECT NO. G2746-32-02

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

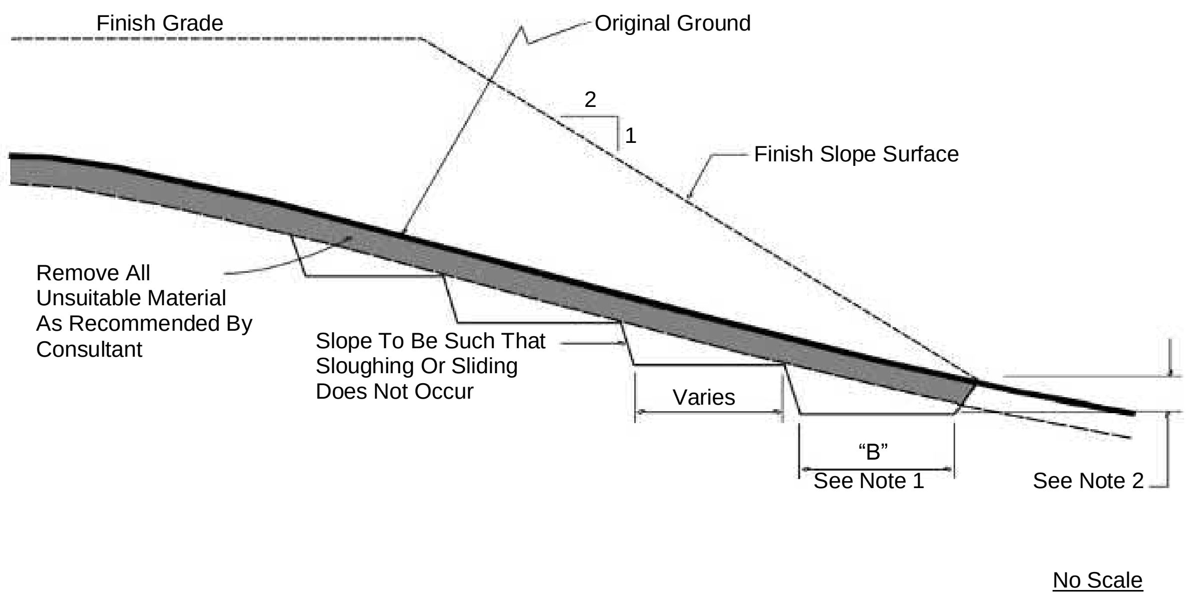
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

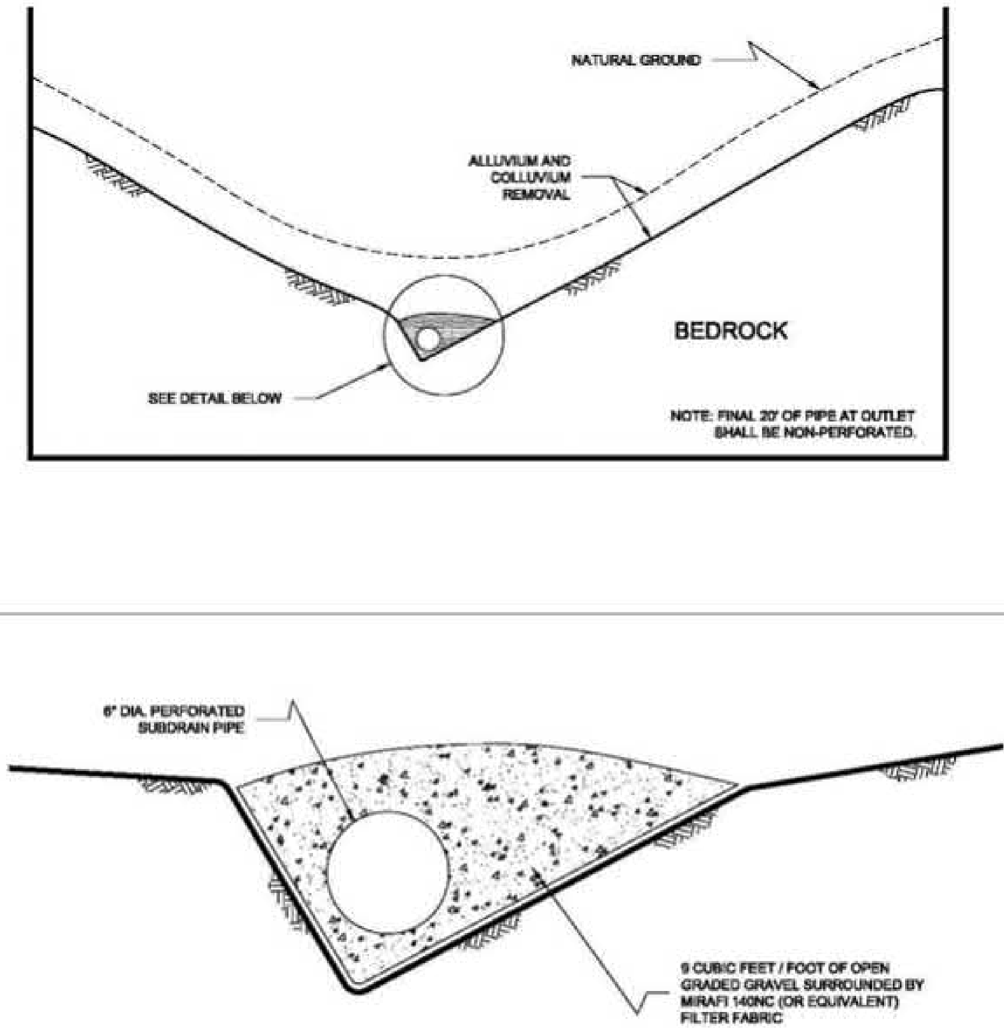
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL



NOTES:

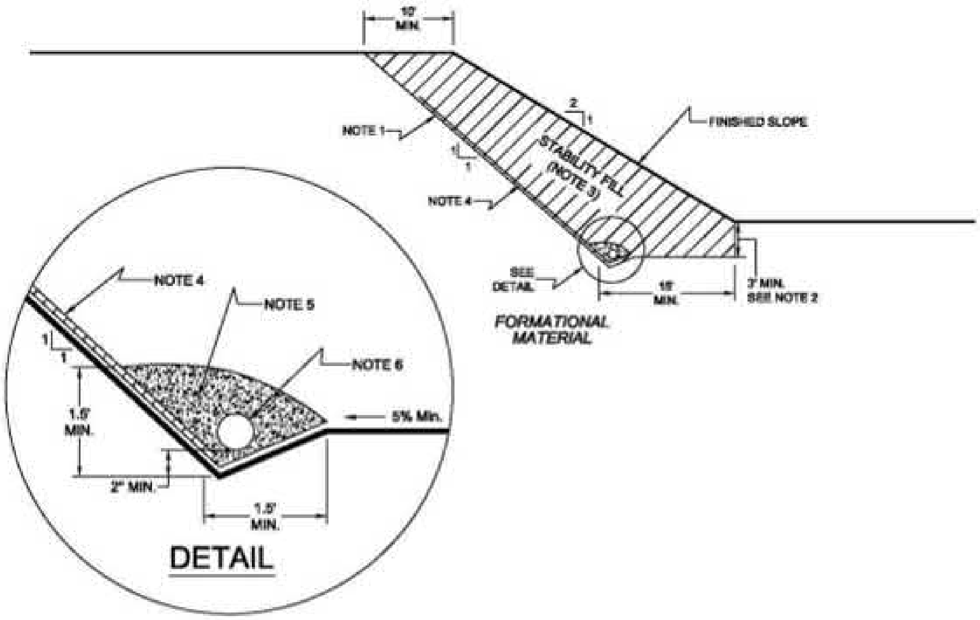
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

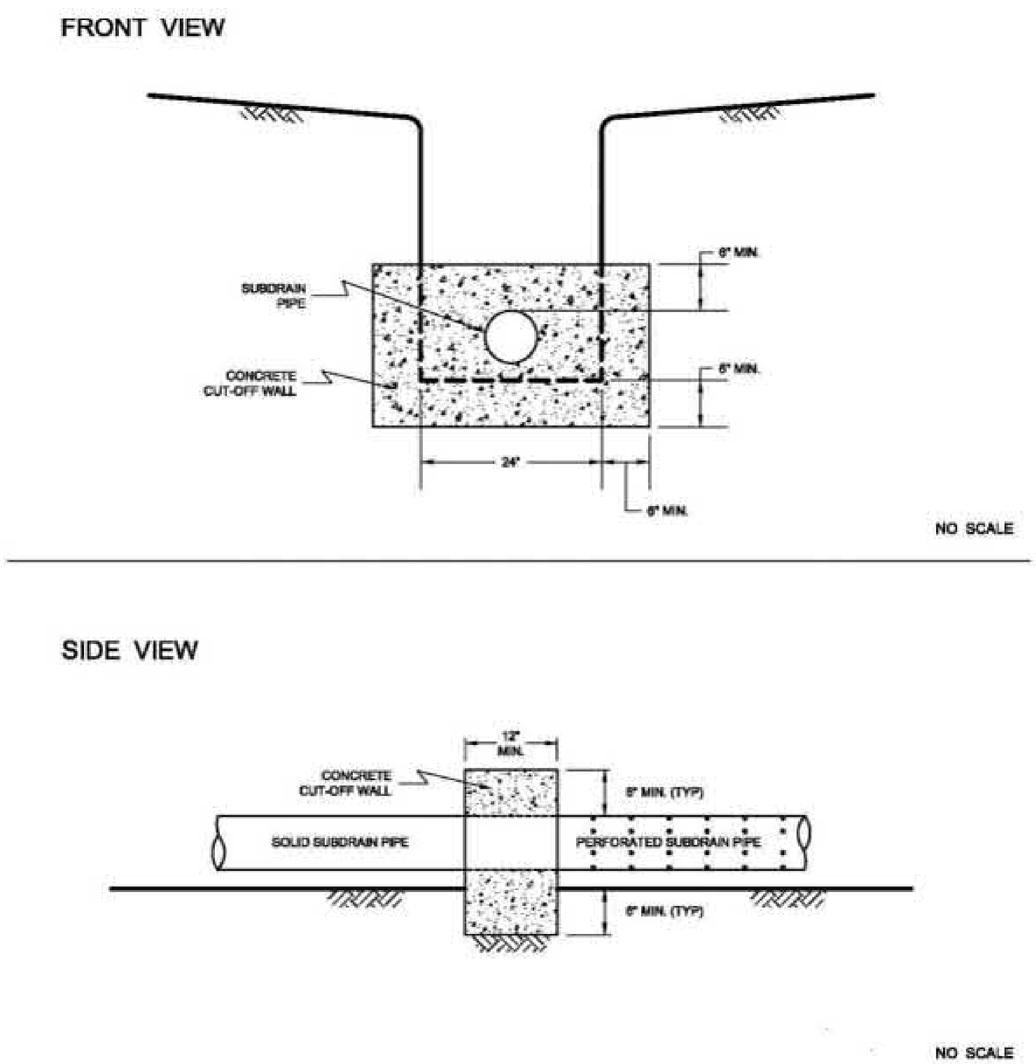
NO SCALE

7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

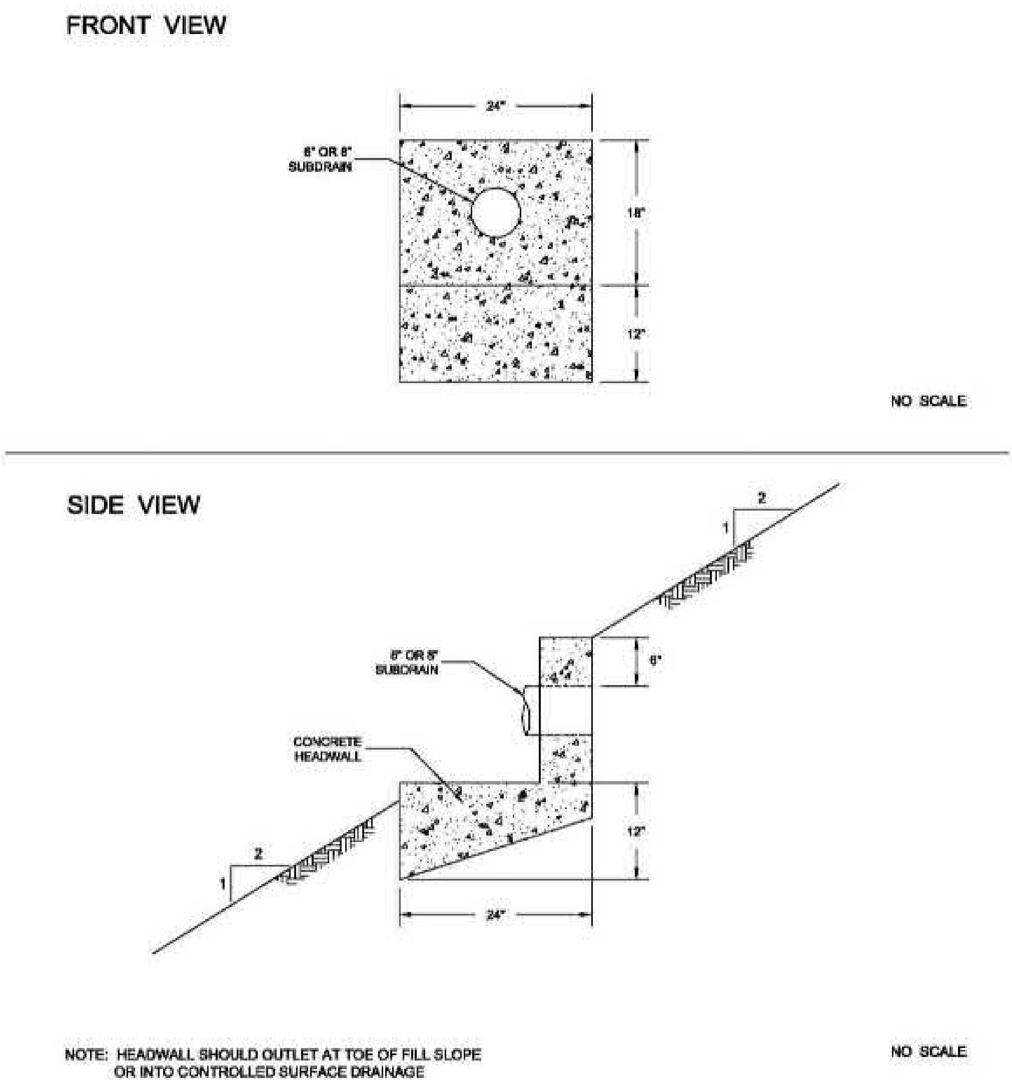
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL



7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)*.

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

1. 2019 California Building Code, California Code of Regulations, Title 24, Part 2, based on the 2018 International Building Code, prepared by California Building Standards Commission, dated July 2019.

2. ACI 330-08, Guide for the Design and Construction of Concrete Parking Lots, prepared by the American Concrete Institute, dated June, 2008.

3. American Concrete Institute, ACI 318-11, Building Code Requirements for Structural Concrete and Commentary, dated August, 2011.

4. American Society of Civil Engineers (ASCE), ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, 2017.

5. County of San Diego, San Diego County Multi-Jurisdiction Hazard Mitigation Plan, San Diego, California – Final Draft, dated October 2017.

6. Historical Aerial Photos. http://www.historicaerials.com

7. http://www.water.ca.gov.

8. http://websoilsurvey.nrcs.usda.gov.

9. http://earthquake.usgs.gov/designmaps/us/application.php.

10. http://geohazards.usgs.gov/designmaps/us/application.php.

11. Jennings, C. W., 1994, California Division of Mines and Geology, Fault Activity Map of California and Adjacent Areas, California Geologic Data Map Series Map No. 6.

12. Landslide Hazards In The Northern Part of the San Diego Metropolitan Area, San Diego County, California, California Division Of Mines And Geology, Open File Report 95-04 (1995), 1953 stereoscopic aerial photographs of the site and surrounding areas.

13. SEAOC (2018), Seismic Design Maps, website interface that queries the U.S. Geological Survey (USGS) web servers and retrieves the seismic design variables using ASCE 7-16, ASCE 7-10, ASCE 41-13, ASCE 41-17, IBC 2015, IBC 2012, NEHRP-2015, and NEHRP 2009 seismic design map data, http://seismicmaps.org.

14. Unpublished reports and maps on file with Geocon Incorporated.