County of San Diego
PRIORITY DEVELOPMENT PROJECT (PDP) SWQMP

1118 North Anza Street Townhomes
PDS2018-TM-5628, PDS2018-REZ-18-003
County of San Diego Tract 5628

1118 N. Anza Street
El Cajon, CA 92021

ASSESSOR'S PARCEL NUMBER(S):
484-092-31, 33, 34, & 35 and 484-291-01

ENGINEER OF WORK:

12/17/19

Allen L. Butcher, PE C47107

REGISTERED PROFESSIONAL ENGINEER
ALLEN L. BUTCHER
No. 47107
CIVIL
STATE OF CALIFORNIA

PREPARED FOR:

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PDP SWQMP PREPARED BY:

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DATE OF SWQMP:
December 17, 2019

PLANS PREPARED BY:
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SWQMP APPROVED BY:

APPROVAL DATE:

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Acronyms

ACP	Alternative Compliance Project
APN	Assessor's Parcel Number
BMP	Best Management Practice
BMP DM	Best Management Practice Design Manual
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDCI	Private Development Construction Inspection Section
PDP	Priority Development Project
PDS	Planning and Development Services
PE	Professional Engineer
RPO	Resource Protection Ordinance
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
WPO	Watershed Protection Ordinance
WQIP	Water Quality Improvement Plan

PDP SWQMP Preparer's Certification Page

Project Name: 1118 North Anza Street Townhomes
Permit Application Number: County of San Diego Tract 5628

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 County of San Diego BMP Design Manual, which is a design manual for compliance with local County of San Diego Watershed Protection Ordinance (Sections 67.801 et seq.) 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 County of San Diego 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 County 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.

Engineer of Work's Signature, PE Number & Expiration Date

Allen L. Butcher PE C47107
Print Name

SB&O, Inc.
Company

December 17, 2019
Date

Engineer's Seal:

REGISTERED PROFESSIONAL ENGINEER
ALLEN L. BUTCHER
No. 47107
CIVIL
STATE OF CALIFORNIA

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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. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Preliminary Design / Planning / CEQA

Submittal Number	Date	Summary of Changes
1	May, 18, 2018	Initial Submittal
2	September 14, 2018	Revised SWMM Model. Revised Pervious Runoff Coeff. Added Anza Tree Wells.
3	April 5, 2019	Update HMP/POC discussion
4	October 15, 2019	Misc Revision / Documentation/ Basin Drain Time
5	December 17,2019	Revised Offsite SD connection point

Final Design

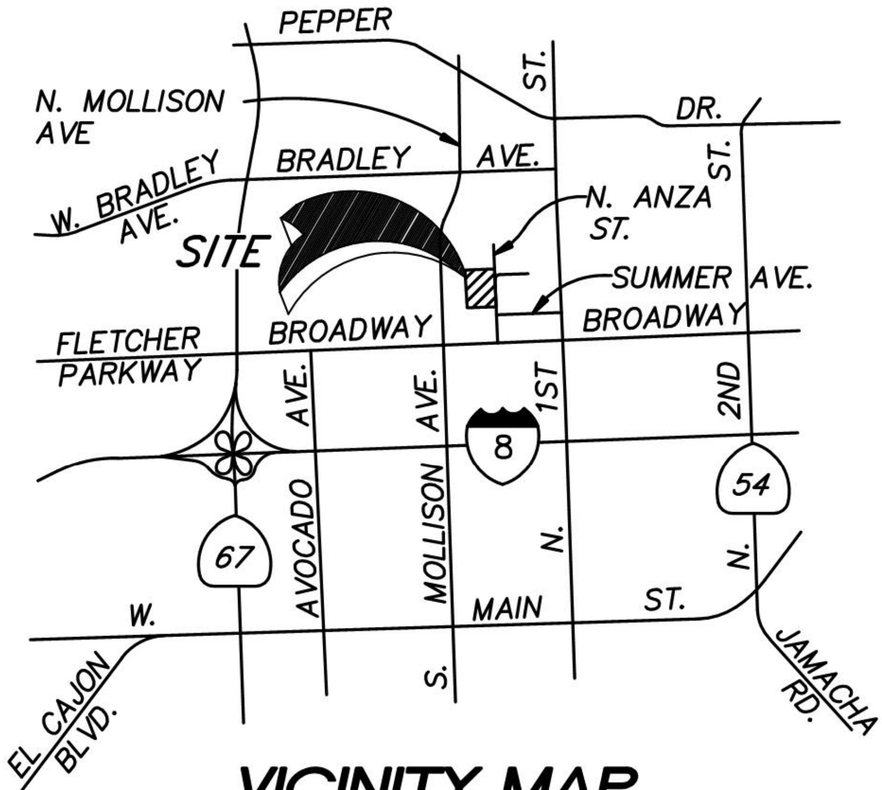
Submittal Number	Date	Summary of Changes
1		Initial Submittal
2		
3		
4		

Plan Changes

Submittal Number	Date	Summary of Changes
1		Initial Submittal
2		
3		
4		

Project Vicinity Map

Project Name: 1118 N Anza Street Townhomes
Record ID: [County of San Diego Tract 5628]



VICINITY MAP

NOT TO SCALE
THOMAS BROTHERS PG. 1251,
GRID H–3 57TH EDITION

Step 1: 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 2.			(☐ Yes ☒ No
The project is (select one): ☐ New Development ☒ Redevelopment[1]			
The total proposed newly created or replaced impervious area is:			94,773 ft²
The total existing (pre-project) impervious area is:			32,658 ft²
The total area disturbed by the project is:			144,097 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 disturbing 1 acre or more, a Waste Discharger Identification (WDID) number must be obtained from the State Water Resources Control Board. WDID: _TBA during Construction Document Phase			
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 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, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance 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; new sidewalks construction; 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 farm 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 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 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). *Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See BMP Design Manual Section 1.4.2 for additional guidance.*
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. *Note: See BMP Design Manual Section 1.4.2 for additional guidance.*

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 <u>not</u> 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: 32,658 ft^2 (A)
The total proposed newly created or replaced impervious area is 94,753 ft^2 (B)
Percent impervious surface created or replaced (B/A)*100: >50 %
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 to stormwater requirements**

Step 1.1: 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 Step 1 Project Type Determination Checklist on Pages 1 and 2, 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 with ACP	If participating in offsite alternative compliance, **complete Step 6.3 and an ACP SWQMP.**
	☐ PDP Exemption	**Go to Step 1.2 below.**

Step 1.2: 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. County concurrence with the exemption is required. *Provide discussion and list any additional requirements below in this form.* **Complete Standard Project SWQMP**
☐ Projects that are only retrofitting or redeveloping existing paved alleys, streets or roads that are designed and constructed in accordance with the County of San Diego Guidance on Green Infrastructure.	**Complete Green Streets PDP Exempt SWQMP.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:	

Step 2: Construction Storm Water BMP Checklist

Minimum Required Standard Construction Storm Water BMPs		
If you answer "Yes" to any of the questions below, your project is subject to Table 1 on the following page (Minimum Required Standard Construction Stormwater BMPs). As noted in Table 1, please select at least the minimum number of required BMPs, or as many as are feasible for your project. If no BMP is selected, an explanation must be given in the box provided. The following questions are intended to aid in determining construction BMP requirements for your project. **Note: All selected BMPs below must be included on the BMP plan incorporated into the construction plan sets.**		
1. Will there be soil disturbing activities that will result in exposed soil areas? (This includes minor grading and trenching.) **Reference Table 1 Items A, B, D, and E** Note: Soil disturbances NOT considered significant include, but are not limited to, change in use, mechanical/electrical/plumbing activities, signs, temporary trailers, interior remodeling, and minor tenant improvement.	☒Yes	☐No
2. Will there be asphalt paving, including patching? **Reference Table 1 Items D and F**	☒Yes	☐No
3. Will there be slurries from mortar mixing, coring, or concrete saw cutting? **Reference Table 1 Items D and F**	☒Yes	☐No
4. Will there be solid wastes from concrete demolition and removal, wall construction, or form work? **Reference Table 1 Items D and F**	☒Yes	☐No
5. Will there be stockpiling (soil, compost, asphalt, concrete, solid waste) for over 24 hours? **Reference Table 1 Items D and F**	☒Yes	☐No
6. Will there be dewatering operations? **Reference Table 1 Items C and D**	☐Yes	☒No
7. Will there be temporary on-site storage of construction materials, including mortar mix, raw landscaping and soil stabilization materials, treated lumber, rebar, and plated metal fencing materials? **Reference Table 1 Items E and F**	☒Yes	☐No
8. Will trash or solid waste product be generated from this project? **Reference Table 1 Item F**	☒Yes	☐No
9. Will construction equipment be stored on site (e.g.: fuels, oils, trucks, etc.?) **Reference Table 1 Item F**	☒Yes	☐No
10. Will Portable Sanitary Services ("Porta-potty") be used on the site? **Reference Table 1 Item F**	☒Yes	☐No

Table 1. Construction Storm Water BMP Checklist

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook[4] Detail or County Std. Detail	✔ BMP Selected	Reference sheet No.'s where each selected BMP is shown on the plans. If no BMP is selected, an explanation must be provided.
A. Select Erosion Control Method for Disturbed Slopes (choose at least one for the appropriate season)			
Vegetation Stabilization Planting[5] (Summer)	SS-2, SS-4	☐	
Hydraulic Stabilization Hydroseeding[2] (Summer)	SS-4	☒	
Bonded Fiber Matrix or Stabilized Fiber Matrix[6] (Winter)	SS-3	☒	
Physical Stabilization Erosion Control Blanket[3] (Winter)	SS-7	☐	
B. Select erosion control method for disturbed flat areas (slope < 5%) (choose at least one)			
County Standard Lot Perimeter Protection Detail	PDS 659[7], SC-2	☒	
Will use erosion control measures from Item A on flat areas also	SS-3, 4, 7	☒	
County Standard Desilting Basin (must treat all site runoff)	PDS 660[8], SC-2	☐	
Mulch, straw, wood chips, soil application	SS-6, SS-8	☐	

4 State of California Department of Transportation (Caltrans). 2003. Storm Water Quality Handbooks, Construction Site Best Management Practices (BMPs) Manual. March. Available online at: http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm.

5 If Vegetation Stabilization (Planting or Hydroseeding) is proposed for erosion control it may be installed between May 1st and August 15th. Slope irrigation is in place and needs to be operable for slopes >3 feet. Vegetation must be watered and established prior to October 1st. The owner must implement a contingency physical BMP by August 15th if vegetation establishment does not occur by that date. If landscaping is proposed, erosion control measures must also be used while landscaping is being established. Established vegetation must have a subsurface mat of intertwined mature roots with a uniform vegetative coverage of 70 percent of the natural vegetative coverage or more on all disturbed areas.

6 All slopes over three feet must have established vegetative cover prior to final permit approval.

7 County of San Diego, Planning & Development Services. 2012. Standard Lot Perimeter Protection Design System. Building Division. PDS 659. Available online at http://www.sandiegocounty.gov/pds/docs/pds659.pdf.

8 County of San Diego, Planning & Development Services. 2012. County Standard Desilting Basin for Disturbed Areas of 1 Acre or Less Building Division. PDS 659. Available online at http://www.sandiegocounty.gov/pds/docs/pds660.pdf.

Table 1. Construction Storm Water BMP Checklist (continued)

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook Detail or County Std. Detail	✔ BMP Selected	Reference sheet No.'s where each selected BMP is shown on the plans. If no BMP is selected, an explanation must be provided.
C. If runoff or dewatering operation is concentrated, velocity must be controlled using an energy dissipater			
Energy Dissipater Outlet Protection[9]	SS-10	☒	
D. Select sediment control method for all disturbed areas (choose at least one)			
Silt Fence	SC-1	☒	
Fiber Rolls (Straw Wattles)	SC-5	☒	
Gravel & Sand Bags	SC-6 & 8	☒	
Dewatering Filtration	NS-2	☐	
Storm Drain Inlet Protection	SC-10	☒	
Engineered Desilting Basin (sized for 10-year flow)	SC-2	☐	
E. Select method for preventing offsite tracking of sediment (choose at least one)			
Stabilized Construction Entrance	TC-1	☒	
Construction Road Stabilization	TC-2	☐	
Entrance/Exit Tire Wash	TC-3	☐	
Entrance/Exit Inspection & Cleaning Facility	TC-1	☒	
Street Sweeping and Vacuuming	SC-7	☒	
F. Select the general site management BMPs			
F.1 Materials Management			
Material Delivery & Storage	WM-1	☒	
Spill Prevention and Control	WM-4	☒	
F.2 Waste Management[10]			
Waste Management Concrete Waste Management	WM-8	☒	
Solid Waste Management	WM-5	☒	
Sanitary Waste Management	WM-9	☒	
Hazardous Waste Management	WM-6	☐	

Note: The Construction General Permit (Order No. 2009-0009-DWQ) also requires all projects not subject to the BMP Design Manual to comply with runoff reduction requirements through the implementation of post-construction BMPs as described in Section XIII of the order.

9 Regional Standard Drawing D-40 – Rip Rap Energy Dissipater is also acceptable for velocity reduction.

10 Not all projects will have every waste identified. The applicant is responsible for identifying wastes that will be onsite and applying the appropriate BMP. For example, if concrete will be used, BMP WM-8 must be selected.

Step 3: County of San Diego PDP SWQMP Site Information Checklist

Step 3.1: Description of Existing Site Condition

Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	San Diego - Santee HSA 907.12

Current Status of the Site (select all that apply):
☒ Existing development
☒ Previously graded but not built out
☐ Demolition completed without new construction
☐ Agricultural or other non-impervious use
☐ Vacant, undeveloped/natural

Description / Additional Information:
Single Family Residential (5)

Existing Land Cover Includes (select all that apply and provide each area on site):
☐ Vegetative Cover 2.558 Acres (111,439 Square Feet)
☐ Non-Vegetated Pervious Areas _______ Acres (_______ Square Feet)
☐ Impervious Areas 0.750 Acres (32,658 Square Feet)

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 (GW) (or N/A if no infiltration is used): X
☐ GW Depth < 5 feet
☐ 5 feet < GW Depth < 10 feet
☐ 10 feet < GW Depth < 20 feet
☐ GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):
☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
☒ None
☐ Other

Description / Additional Information:

Step 3.2: Description of Existing Site Drainage Patterns

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) Is runoff from offsite conveyed through the site? if yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
(3) Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
(4) Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:
The project site was previously graded and developed as single family residential.

At the northern boundary, a portion of the adjoining backyards (approximately 25' width) drain southerly and then southwesterly through the site (approx. 0.18 ac).

The majority of the site drains westerly and southerly with surface discharge along the westerly and southerly boundaries of site. No formal drainage or storm drain systems are located onsite. Site drainage is predominately overland flow from the existing yards & houses. All of the site is tributary to the City of El Cajon / Broadway concrete flood control channel located approximately 300 feet south of the site.

The frontage along Anza is directed easterly toward the existing street paving, which drains southerly in the Anza gutter to the inlet connected to the box culvert at the flood control channel. The Anza gutter includes runoff from the existing paved street adjacent and upstream of the site, and other developed properties located northeast of the project.

See Drainage Report (Attachment 6) for additional details.

Step 3.3: Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:
Multifamily residential product with private streets. Minor street widening.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):
Roofs, private roads, driveways, walkways, parking areas

List/describe proposed pervious features of the project (e.g., landscape areas):
Landscape yards, landscape islands @ parking, recreation areas and the 2 biofiltration basins

Does the project include grading and changes to site topography?
☒Yes
☐No

Description / Additional Information:
Existing site runoff is directed overland in a southwesterly direction. To avoid concentrated discharge impacts, the site grading will include imported fill to raise the site, direct flows easterly, and with the proposed Anza storm drain system, convey flows directly to the flood channel located 300 feet south of the site.

Insert acreage or square feet for the different land cover types in the table below:

Change in Land Cover Type Summary			
Land Cover Type	Existing (acres or ft^2)	Proposed (acres or ft^2)	Percent Change
Vegetation	2.558	1.089	-57%
Pervious (non-vegetated)			
Impervious	0.750	2.218	+296%

Step 3.4: Description of Proposed Site Drainage Patterns

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☒Yes

☐No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:

Existing site runoff is directed overland in a southwesterly direction. To avoid concentrated discharge impacts to the properties immediately downstream, the site grading will include imported fill to raise the entire site, including retaining walls at the north, west and south property lines. The run-on from the northerly properties will be routed westerly and southerly along the face of the boundary wall to be discharge at the western boundary.

Flows for the developed portion of the site will be directed easterly via yard swales, private street gutters, and private area & storm drains to the two biofiltration basins (which include HMP storage & controls). Discharge from these basins will be connected to a proposed public Anza Street storm drain line to convey flows to the existing City of El Cajon Broadway Flood Control channel, just downstream of the Anza Street concrete box culvert crossing.

Runoff along the boundary (between the face of wall and the property line) will be directed westerly and southerly to the adjacent properties.

The pavement along the Anza street frontage will be widened by 2 feet. Improvements will include new asphalt pavement, curb & gutter and sidewalk. Runoff from the street and right-of-way will be intercepted by 7 tree wells along the frontage. The tree wells will provide treatment and HMP controls. Excess runoff will continue southerly in the gutter to the existing Anza street inlet at the City of El Cajon box culvert undercrossing.

The project proposes a new 18” RCP storm drain line in N. Anza Street to convey post development runoff directly to the Broadway channel. The proposed storm drain will be connected to the Broadway flood channel, just downstream of the existing box culvert crossing (double 7’ x 5’), located 300 feet south of the project. The new discharge location will transfer the majority of the site runoff (approximately 3.1 acres) from the Mollison Ave undercrossing to near the Anza Street box culvert under-crossing, approximately 800 feet upstream of the current location. See POC discussion in the HMP Section.

See Drainage Report (Attachment 6) for area comparison and additional details.

Step 3.5: Potential Pollutant Source Areas

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply). Select “Other” if the project is a phased development and provide a description:

☒ On-site 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
☒ Other (provide description)

Description / Additional Information:
Pet Waste Receptacle, Parking areas to include private streets/walks/driveways

Step 3.6: Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):
Proposed storm drain main to the concrete channel 300' south of project, then westerly and then northwesterly (via concrete & unlined channels) to Forrester Creek and San Diego River.

List any 303(d) impaired water bodies[11] 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 and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
Forrester Creek	*Fecal Coliform, Selenium and TDS, pH*	*Bacteria*
San Diego River (Lower)	*Enterococcus, Fecal Coliform, Low Oxygen, Manganese, Nitrogen, Phosphorous, TDS, Toxicity*	*Bacteria*

Identification of Project Site Pollutants*

*Identification of project site pollutants below is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs. Note the project must also participate in an alternative compliance program (unless prior lawful approval to meet earlier PDP requirements is demonstrated).

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☐	☐	☐
Nutrients	☐	☐	☐
Heavy Metals	☐	☐	☐
Organic Compounds	☐	☐	☐
Trash & Debris	☐	☐	☐
Oxygen Demanding Substances	☐	☐	☐
Oil & Grease	☐	☐	☐

11 The current list of Section 303(d) impaired water bodies can be found at http://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/#impaired

Bacteria & Viruses	☐	☐	☐
Pesticides	☐	☐	☐

Step 3.7: Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)?

☒Yes, hydromodification management requirements for flow control and preservation of critical coarse sediment yield areas are applicable.

☐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[12] for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):

12 The Watershed Management Area Analysis (WMAA) is an optional element for inclusion in the Water Quality Improvement Plans (WQIPs) described in the 2013 MS4 Permit [Provision B.3.b.(4)]. It is available online at the Project Clean Water website: http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=248

Step 3.7.1: Critical Coarse Sediment Yield Areas*

*This Section only required if hydromodification management requirements apply
Projects must satisfy critical coarse sediment yield area (CCSYA) requirements by characterizing the project as one of the scenario-types presented below and satisfying associated criteria. Projects must appropriately satisfy all requirements for identification, avoidance, and bypass, OR may alternatively elect to demonstrate no net impact. ☐ **Scenario 1**: Project is subject to and in compliance with RPO requirements *(without utilization of RPO exemptions 86.604(e)(2)(cc) or 86.604(e)(3) that result in impacts to more than 15% of the project-scale CCSYAs)*. ☐ Identify: Project has identified both onsite and upstream CCSYAs as areas that are coarse, ≥25% slope, and ≥50' tall. *(Optional refinement methods may be performed per guidance in Section H.1.2). AND,* ☐ Avoid: Project has avoided onsite CCSYAs per existing RPO steep slope encroachment criteria. AND, ☐ Bypass: Project has demonstrated that both onsite and upstream CCSYAs are bypassed through or around the project site with a 2 year peak storm velocity of 3 feet per second or greater. OR, ☐ No Net Impact: Project does not satisfy all Scenario 1 criteria above and must alternatively demonstrate no net impact to the receiving water. ☒ **Scenario 2**: Project is entirely exempt/not subject to RPO requirements without utilization of RPO exemptions 86.604(e)(2)(cc) or 86.604(e)(3). ☒ Identify: Project has identified upstream CCSYAs that are coarse, ≥25% slope, and ≥50' tall. *(Optional refinement methods may be performed per guidance in Section H.1.2). AND,* ☒ Avoid: Project is not required to avoid onsite CCSYAs as none were identified in the previous step. AND, ☒ Bypass: Project has demonstrated that upstream CCSYAs are bypassed through or around the project site with a 2 year peak storm velocity of 3 feet per second or greater. OR, ☐ No Net Impact: Project does not satisfy all Scenario 2 criteria above and must alternatively demonstrate no net impact to the receiving water. *(Skip to next row).* ☐ **Scenario 3**: Project utilizes exemption(s) via RPO Section 86.604(e)(2)(cc) or 86.604(e)(3) and impacts more than 15% of the project-scale CCSYAs. ☐ No Net Impact: Project is not eligible for traditional methods of identification, avoidance, and bypass. Project must demonstrate no net impact to the receiving water.

Critical Coarse Sediment Yield Areas Continued
Demonstrate No Net Impact
If the project elects to satisfy CCSYA criteria through demonstration of no net impact to the receiving water. Applicants must identify the methods utilized from the list below and provide supporting documentation in Attachment 2c of the SWQMP. Check all that are applicable. ☒ N/A, the project appropriately identifies, avoids, and bypasses CCSYAs. ☐ Project has performed additional analysis to demonstrate that impacts to CCSYAs satisfy the no net impact standard of Ep/Sp≤1.1. ☐ Project has provided alternate mapping of CCSYAs. ☐ Project has implemented additional onsite hydromodification flow control measures. ☐ Project has implemented an offsite stream rehabilitation project to offset impacts. ☐ Project has implemented other applicant-proposed mitigation measures.

Step 3.7.2: 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. Project will use 2 Points of Compliance – each located at the HMP discharge points.
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)*

Step 3.8: 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. Project is subject to minimum improvements widths for street, sidewalks, parkway improvements, driveways, setbacks, etc. Property is constrained by the lack of existing storm drain or defined drainage facilities at the current discharge locations. Biofiltration to be BF-2 Nutrient Sensitive Media

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 4: Source Control BMP Checklist

Source Control BMPs			
All development projects must implement source control BMPs 4.2.1 through 4.2.6 where applicable and feasible. See Chapter 4.2 and Appendix E of the County BMP Design 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 4.2 and/or Appendix E of the County BMP Design 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 must be provided.			
Source Control Requirement	**Applied?**		
4.2.1 Prevention of Illicit Discharges into the MS4	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.1 not implemented:			
4.2.2 Storm Drain Stenciling or Signage	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.2 not implemented:			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐No	☒N/A
Discussion / justification if 4.2.3 not implemented:			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐No	☒N/A
Discussion / justification if 4.2.4 not implemented:			

Source Control Requirement	Applied?		
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐No	☒N/A
Discussion / justification if 4.2.5 not implemented: Trash cans are located in garages.			
4.2.6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below):			
☒ A. On-site storm drain inlets	☒Yes	☐No	☐N/A
☐ B. Interior floor drains and elevator shaft sump pumps	☐Yes	☐No	☒N/A
☐ C. Interior parking garages	☐Yes	☐No	☒N/A
☒ D. Need for future indoor & structural pest control	☒Yes	☐No	☐N/A
☒ E. Landscape/outdoor pesticide use	☒Yes	☐No	☐N/A
☐ F. Pools, spas, ponds, fountains, and other water features	☐Yes	☐No	☒N/A
☐ G. Food service	☐Yes	☐No	☒N/A
☐ H. Refuse areas	☐Yes	☐No	☒N/A
☐ I. Industrial processes	☐Yes	☐No	☒N/A
☐ J. Outdoor storage of equipment or materials	☐Yes	☐No	☒N/A
☐ K. Vehicle and equipment cleaning	☐Yes	☐No	☒N/A
☐ L. Vehicle/equipment repair and maintenance	☐Yes	☐No	☒N/A
☐ M. Fuel dispensing areas	☐Yes	☐No	☒N/A
☐ N. Loading docks	☐Yes	☐No	☒N/A
☒ O. Fire sprinkler test water	☒Yes	☐No	☐N/A
☒ P. Miscellaneous drain or wash water	☒Yes	☐No	☐N/A
☒ Q. Plazas, sidewalks, and parking lots	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for <u>all</u> "No" answers shown above.			

Note: Show all source control measures described above that are included in design capture volume calculations in the plan sheets of Attachment 5.

Step 5: Site Design BMP Checklist

Site Design BMPs
All development projects must implement site design BMPs SD-A through SD-H where applicable and feasible. See Chapter 4.3 and Appendix E of the County BMP Design 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 4.3 and/or Appendix E of the County BMP Design 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 must be provided.

Site Design Requirement	Applied?		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	☐Yes	☐No	☒N/A
Discussion / justification if 4.3.1 not implemented: Site was previously graded / developed/compacted.			
4.3.2 Conserve Natural Areas, Soils, and Vegetation	☐Yes	☐No	☒N/A
Discussion / justification if 4.3.2 not implemented: Site was previously graded / developed.			
4.3.3 Minimize Impervious Area	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.3 not implemented: Minimal dimensions used for paving, sidewalks, parking spaces. Attached product used.			
4.3.4 Minimize Soil Compaction	☐Yes	☐No	☒N/A
Discussion / justification if 4.3.4 not implemented: Site was previously graded / developed. Engineered fill placement to raise the site and provide stability for finished product requires soil compaction.			
4.3.5 Impervious Area Dispersion	☐Yes	☒No	☐N/A
Discussion / justification if 4.3.5 not implemented: Pervious areas have insufficient dimension, soil type and/or area ratio to provide effective dispersion. Geotechnical report recommends against infiltration.			

Site Design Requirement	Applied?		
4.3.6 Runoff Collection	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.6 not implemented: Yard swales, area drain systems, street gutters and multiple drainage inlets direct runoff to 2 biofiltration basins.			
4.3.7 Landscaping with Native or Drought Tolerant Species	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.7 not implemented:			
4.3.8 Harvesting and Using Precipitation	☐Yes	☒No	☐N/A
Discussion / justification if 4.3.8 not implemented: Re-use is not feasible based upon Irrigation Needs < 25% of DCV, No Infiltration recommendation. Due to the product type and garage orientation, the individual yards areas are limited to the rear yards, which are extremely small (varies from 400 to 600 sf).			

Note: Show all site design measures described above that are included in design capture volume calculations in the plan sheets of Attachment 5.

Step 6: PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design 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 BMP Design 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 County at the completion of construction. This may include requiring the project owner or project owner's representative and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the County must confirm the maintenance (see Section 7 of the BMP Design Manual).

Use this section 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 (Step 6.2) for each structural BMP within the project (copy the BMP summary information sheet [Step 6.2] as many times as needed to provide summary information for each individual structural BMP).

Step 6.1: Description of structural BMP strategy

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 BMP Design 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. At the end of this discussion provide a summary of all the structural BMPs within the project including the type and number. *Infiltration is not feasible based upon site testing (either full or partial). Harvest & Reuse is not feasible based upon volume and No Infiltration recommendation. Surface area for biofiltration basins we determined using 3% minimum of adjusted tributary impervious area. Basins meet the criteria for volume reduction.* **Biofiltration to be BF-2 Nutrient Sensitive Media**

POC-1 Combined discharge from the following;

Northern portion of Site: Biofiltration Basin BIO-1 & Hydromodification facility HMP-1.

Southern portion of Site: Biofiltration Basin BIO-2 & Hydromodification facility HMP-2

Hydromodification to be addressed by using an underground cistern located underneath the biofiltration basins. Treated flows will enter through the top of the storage volume. HMP storage volumes were confirmed through continuous simulation modeling (SWMM). Low flow control will be low orifice at the bottom of the HMP storage volume and a grated overflow inlet at the 6" above the floor of the biofiltration basin above. See drainage study for detention routing and drain time calculations.

(Continue on following page as necessary.)

Description of structural BMP strategy continued
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)

(Continued from previous page)

POC-2 – Anza Street frontage

Runoff from the frontage street and right-of-way will be intercepted by tree wells along the frontage. The tree wells will provide treatment and HMP control in accordance with County Methodology (DCV Multiplier for Tree Well Soil Depth). Trees wells will include a 15' mature canopy tree with a soil depth of 34". The corresponding DCV multiplier (Type "D" soils) is 3.08 x 0.52", resulting in an adjusted rainfall depth of 1.60".

The pavement along the Anza street frontage will be widened by 2 feet. Improvements will include new asphalt pavement (2' wide), curb & gutter (2' wide) and sidewalk (5' wide), the remaining 4.5' of the affected area will be landscaped. The required treatment area is 13.5' wide x 413' long = 5,576 square feet. The adjusted DCV is 543 cubic feet.

A 15' diameter canopy has a mature area of 176.7 sf, which requires 353 cubic feet of soil (using 2 cf/sf), providing a maximum DCV credit of 100 cubic feet. The provided soil volume based upon 15' long x 8.5' wide top area (extending under the sidewalk) with a depth of 2.83' is 278.1 cubic feet (adjusted for sloped excavation). The proposed soil volume is 79% of required volume, resulting in a reduced DCV credit of 78.7 cubic feet.

A total of 7 tree wells will be installed to meet the HMP compliance for the required treatment area at the Anza frontage. Excess runoff from larger storms will continue southerly in the gutter to the existing Anza street inlet at the City of El Cajon box culvert undercrossing approximately 300 feet south of the project.

Note: The proposed gutter will receive runoff from the existing Anza pavement in front of the project and upstream, as well as other properties located north of the site. The proposed street trees and wells will provide a greater treatment, volume reduction and additional HMP compliance than required for the project. See Drainage Study (Attachment 6) for additional details regarding the Anza frontage.

Although the physical post-development POC-1 differs from the pre-development location, the approach is consistent with the Chapter 6 of the BMP Manual as noted; *When runoff from the project site does not meet a natural or un-lined channel onsite, instead traveling some distance downstream of the project in storm drain systems or lined channels prior to discharge to natural or un-lined channels, the POC(s) for flow control analysis must be placed at the project boundary (i.e., comparing the pre-development and post-project flows from the project area only, not analyzing the total watershed draining to the offsite POC), unless the project is draining to and accommodated by an approved master planned or regional flow control BMP.*

The project specific Continuous Simulation Modeling using SWMM software confirms that the post project site discharge will comply with the Hydromodification Management criteria.

Step 6.2: Structural BMP Checklist

(Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BIO-1/HMP-1 & BIO-2/HMP-2	
Construction Plan Sheet No. See TM	
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) ☒ Biofiltration with Nutrient Sensitive Media Design (BF-2) ☐ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F ☐ 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 (See Section 1.12 of the BMP Design Manual)	Allen L Butcher SB&O, Inc 3990 Ruffin Road #120 San Diego CA 92123
Who will be the final owner of this BMP?	☒ HOA ☐ Property Owner ☐ County ☐ Other (describe)
Who will maintain this BMP into perpetuity?	☒ HOA ☐ Property Owner ☐ County ☐ Other (describe)
What Category (1-4) is the Structural BMP? Refer to the Category definitions in Section 7.3 of the BMP DM. Attach the appropriate maintenance agreement in Attachment 3.	2

Discussion (as needed):

Each basin consists of a surface Biofiltration Basin (BF-2) with supplemental storage (cistern) below with outlet controls to provide HMP control. The facility provides pollutant treatment using a standard sized biofiltration basin (nutrient sensitive media) plus HMP compliance using a orifice control opening downstream of the storage volume.

(Continue on subsequent pages as necessary)

Step 6.3: Offsite Alternative Compliance Participation Form

PDP INFORMATION	
Record ID:	Not Applicable
Assessor's Parcel Number(s) [APN(s)]	
What are your PDP Pollutant Control Debits? *See Attachment 1 of the PDP SWQMP	
What are your PDP HMP Debits? (if applicable) *See Attachment 2 of the PDP SWQMP	
ACP Information	
Record ID:	
Assessor's Parcel Number(s) [APN(s)]	
Project Owner/Address	
What are your ACP Pollutant Control Credits? *See Attachment 1 of the ACP SWQMP	
What are your ACP HMP Debits? (if applicable) *See Attachment 2 of the ACP SWQMP	
Is your ACP in the same watershed as your PDP? ☐ Yes ☐ No	Will your ACP project be completed prior to the completion of the PDP? ☐ Yes ☐ No
Does your ACP account for all Deficits generated by the PDP? ☐ Yes ☐ No (PDP and/or ACP must be redesigned to account for all deficits generated by the PDP.	What is the difference between your PDP debits and ACP Credits? *(ACP Credits -Total PDP Debits = Total Earned Credits)

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.3-1 (Required) -Worksheet B.1-1 (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)	☒ 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 1d	Individual Structural BMP DMA Mapbook (Required) -Place each map on 8.5”x11” paper. -Show at a minimum the DMA, Structural BMP, and any existing hydrologic features within the DMA.	☐ Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

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)
☐ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Step 3.5)
☐ Structural BMPs (identify location, structural BMP ID#, type of BMP, and size/detail)

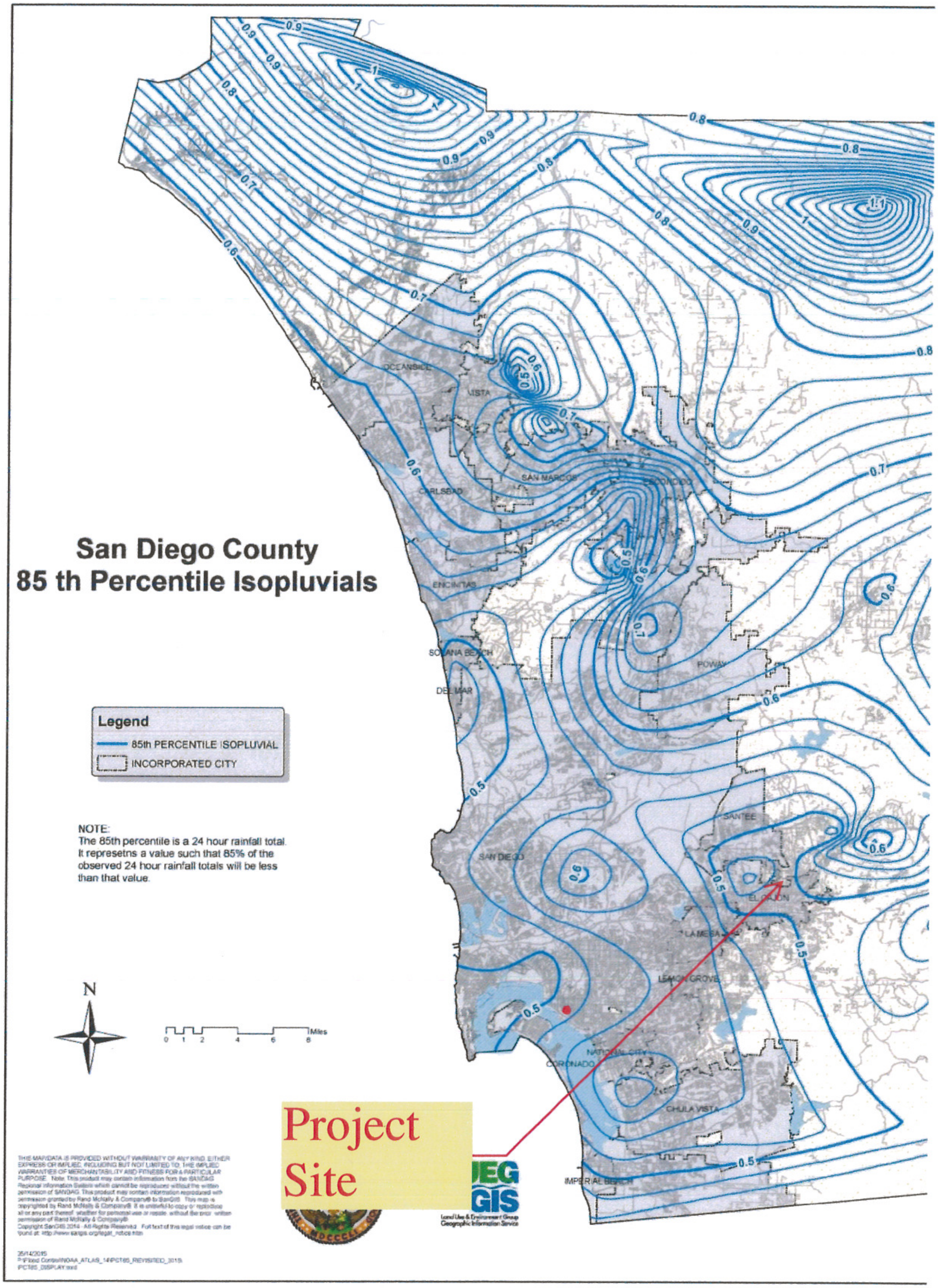


Figure B.1-1: 85th Percentile 2

Automated Worksheet B.3-1: Project-Scale BMP Feasibility Analysis (V1.3)

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	4,028	cubic-feet
	1	Proposed Development Type	Residential	unitless
	2	Number of Residents or Employees at Proposed Development	117	#
	3	Total Planted Area within Development	39,287	sq-ft
	4	Water Use Category for Proposed Planted Areas	Low	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	Yes	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	Yes	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	Yes	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	No	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	1.86	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	218	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	52.14	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	47	cubic-feet
	13	Total Anticipated Use Over 36 Hours	265	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.07	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	No	yes/no
Result	18	Feasibility Category	5	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

A. Applicants may use this worksheet to determine the types of structural BMPs that are acceptable for implementation at their project site (as required in Section 5 of the BMPDM). User input should be provided for yellow shaded cells, values for all other cells will be automatically generated. Projects demonstrating feasibility or potential feasibility via this worksheet are encouraged to incorporate capture and use features in their project.

B. Negative impacts associated with retention may include geotechnical, groundwater, water balance, or other issues identified by a geotechnical engineer and substantiated through completion of Form I-8.

C. Feasibility Category 1: Applicant must implement capture & use, retention, and/or infiltration elements for the entire DCV.

D. Feasibility Category 2: Applicant must implement capture & use elements for the entire DCV.

E. Feasibility Category 3: Applicant must implement retention and/or infiltration elements for all DMAs with Design Infiltration Rates greater than 0.50 in/hr.

F. Feasibility Category 4: Applicant must implement standard unlined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.011 to 0.50 in/hr. Applicants may be permitted to implement lined BMPs, reduced size BMPs, and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

G. Feasibility Category 5: Applicant must implement standard lined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.010 in/hr or less. Applicants may also be permitted to implement reduced size and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

H. PDPs participating in an offsite alternative compliance program are not held to the feasibility categories presented herein.

DVC based upon areas tributary to Biofiltration Basins and Anza Street widening for Tree Wells

Automated Worksheet B.1-1: Calculation of Design Capture Volume (V1.3)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	BIO-1	BIO-2	Anza								unitless
	1	Basin Drains to the Following BMP Type	Biofiltration (specialized)	Biofiltration (specialized)	Other								unitless
	2	85th Percentile 24-hr Storm Depth	0.52	0.52	1.60								inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000								in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	33,246	57,562	3,965								sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)	0										sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)	0										sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)	0										sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)	0										sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	17,443	21,844	1,611								sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	Yes	No	No	No	No	No	No	No	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	19	Number of Tree Wells Proposed per SD-A			7								#
	20	Average Mature Tree Canopy Diameter			15								ft
	21	Number of Rain Barrels Proposed per SD-E											#
	22	Average Rain Barrel Size											gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	No	No	No	No	No	No	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series											unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas											percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	0	0	0	0	0	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	0	0	0	0	0	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	50,689	79,406	5,576	0	0	0	0	0	0	0	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.69	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	30	Initial Runoff 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	unitless
	31	Initial Weighted Runoff Factor	0.69	0.73	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	32	Initial Design Capture Volume	1,516	2,512	543	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	34	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.69	0.73	0.73	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	38	Design Capture Volume After Dispersion Techniques	1,516	2,512	543	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	0	700	0	0	0	0	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.69	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	42	Final Effective Tributary Area	34,975	57,966	0	0	0	0	0	0	0	0	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	700	0	0	0	0	0	0	0	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	1,516	2,512	0	0	0	0	0	0	0	0	cubic-feet

Worksheet B.1-1 General Notes:

A. Applicants may use this worksheet to calculate design capture volumes for up to 10 drainage areas User input must be provided for yellow shaded cells, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Upon completion of this worksheet, proceed to the appropriate BMP Sizing worksheet(s).

BIO-1 area includes DMA 1, 2 & 3 (excludes DMA 9 = Biofiltration basin)
BIO-2 area includes DMA 4, 5, 6 & 7 (excludes DMA 10 = Biofiltration basin)
Anza area includes widening / limits of work along frontage (13.5' wide strip)
Excludes DeMinimis / self treating area outside exterior retaining wall.

Automated Worksheet B.5-2: Sizing Specialized Biofiltration BMPs (V1.3)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
BMP Inputs	0	Drainage Basin ID or Name	BIO-1	BIO-2	-	-	-	-	-	-	-	-	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	-	-	-	-	-	-	-	-	in/hr
	2	Effective Tributary Area	34,975	57,966	-	-	-	-	-	-	-	-	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	-	-	-	-	-	-	-	-	-	-	ratio
	4	Design Capture Volume Tributary to BMP	1,516	2,512	-	-	-	-	-	-	-	-	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Lined	Lined									yes/no
	6	Provided Biofiltration BMP Surface Area	1,180	1,755									sq-ft
	7	Provided Surface Ponding Depth	12	12									inches
	8	Provided Soil Media Thickness	18	18									inches
	9	Provided Depth of Gravel Above Underdrain Invert	36.04	27.64									inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	1.00	1.00									inches
	11	Provided Depth of Gravel Below the Underdrain	3	3									inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	13	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
	14	Gravel Pore Space Available for Retention	0.97	0.97	0.40	0.95	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	15	Effective Retention Depth	3.81	3.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	120	120	0	0	0	0	0	0	0	0	hours
	17	Volume Retained by BMP	375	557	0	0	0	0	0	0	0	0	cubic-feet
	18	Fraction of DCV Retained	0.25	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	19	Portion of Retention Performance Standard Satisfied	0.26	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.14	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	21	Design Capture Volume Remaining for Biofiltration	1,304	2,185	0	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	0.0614	0.0573	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	2.25	1.41	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	in/hr
	24	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
	25	Soil Media Filtration Rate to be used for Sizing	2.25	1.41	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	13.48	8.46	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	inches
	27	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
	28	Effective Depth of Biofiltration Storage	50.56	42.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	29	Drawdown Time for Surface Ponding	5	9	0	0	0	0	0	0	0	0	hours
	30	Drawdown Time for Effective Biofiltration Depth	23	30	0	0	0	0	0	0	0	0	hours
	31	Total Depth Biofiltered	64.04	50.87	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	1,956	3,278	0	0	0	0	0	0	0	0	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	1,956	3,278	0	0	0	0	0	0	0	0	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	978	1,639	0	0	0	0	0	0	0	0	cubic-feet
	35	Option 2 - Provided Storage Volume	978	1,639	0	0	0	0	0	0	0	0	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	-	-	-	-	-	-	-	-	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	-	-	-	-	-	-	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	cubic-feet

Worksheet B.5-2 General Notes:

A. Applicants may use this worksheet to size lined or unlined Specialized Biofiltration BMPs (BF-3) for up to 10 basins. Note that applicants proposing specialized biofiltration BMPs must satisfy minimum annual retention criteria and provide documentation demonstrating compliance with all Appendix F criteria. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red/orange and summarized below. BMPs fully satisfying the pollutant control performance standards will have a deficit treated volume of zero and be highlighted in green.

Summary of Stormwater Pollutant Control Calculations (V1.3)

Category	#	Description											Units
General Info	0	Drainage Basin ID or Name	BIO-1	BIO-2	Anza	-	-	-	-	-	-	-	unitless
	1	85th Percentile Storm Depth	0.52	0.52	1.58	-	-	-	-	-	-	-	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	-	-	-	-	-	-	-	in/hr
	3	Total Tributary Area	50,689	79,406	5,576	-	-	-	-	-	-	-	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	2,197	3,441	732	-	-	-	-	-	-	-	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.69	0.73	0.73	-	-	-	-	-	-	-	unitless
	6	Initial Design Capture Volume	1,516	2,512	534	-	-	-	-	-	-	-	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	0	0	-	-	-	-	-	-	-	cubic-feet
	8	Tree Well and Rain Barrel Reductions	0	0	700	-	-	-	-	-	-	-	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	34,975	57,966	0	-	-	-	-	-	-	-	square feet
	10	Final Design Capture Volume Tributary to BMP	1,516	2,512	0	-	-	-	-	-	-	-	cubic-feet
	11	Basin Drains to the Following BMP Type	Biofiltration (specialized)	Biofiltration (specialized)	Other	-	-	-	-	-	-	-	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	212	327	0	-	-	-	-	-	-	-	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	0.14	0.13	1.31	-	-	-	-	-	-	-	fraction
	14	Percent of Average Annual Runoff Retention Provided	20.1%	18.9%	88.1%	-	-	-	-	-	-	-	%
	15	Percent of Average Annual Runoff Retention Required	4.5%	4.5%	1.5%	-	-	-	-	-	-	-	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	100.0%	0.0%	-	-	-	-	-	-	-	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	-	-	-	-	-	-	-	-	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	0	0	-	-	-	-	-	-	-	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	-	-	-	-	-	-	-	-	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	-	-	-	-	-	-	-	-	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	0	0	-	-	-	-	-	-	-	cubic-feet

Summary Notes:
All fields in this summary worksheet are populated based on previous user inputs. If applicable, drainage basin elements that require revisions and/or supplemental information outside the scope of these worksheets are highlighted in orange and summairzed in the red text below. If all drainage basins achieve full compliance without a need for supplemental information, a green message will appear below.

Attention!

-Applicant is proposing a structural BMP 'other' that is not currently supported by this automated worksheet and must provide appropriate supporting calculations to the satisfaction of the County.

-Use of specialized biofiltration BMPs is supported by these worksheets but must be supplemented with information demonstrating satisfaction of all criteria in Appendix F of the BMPDM.

Tree wells provide Treatment & HMP for Anza Street runoff.
Specialized Biofiltration provides 3% surface area for treatment plus additional underground storage for HMP compliance.

DCV Multipliers by Tree Well Soil Depth and Underlying Hydrologic Soil Group; Applies to sites subject to Pollutant Control AND Hydromodification Management Performance Requirements

Tree Well Soil Depth (inches)	Hydrologic Soil Group A	B	C	D (Default)
	DCV Multiplier			
30"	1.60	2.20	2.50	**2.90**
31"	1.63	2.24	2.56	**2.94**
32"	1.67	2.29	2.61	**2.99**
33"	1.70	2.33	2.67	**3.03**
34"	1.73	2.38	2.72	**3.08**
35"	1.77	2.42	2.78	**3.12**
36"	1.80	2.47	2.83	**3.17**
37"	1.83	2.51	2.89	**3.21**
38"	1.87	2.56	2.94	**3.26**
39"	1.90	2.60	3.00	**3.30**
40"	1.93	2.64	3.06	**3.34**
41"	1.97	2.69	3.11	**3.39**
42"	2.00	2.73	3.17	**3.43**
43"	2.03	2.78	3.22	**3.48**
44"	2.07	2.82	3.28	**3.52**
45"	2.10	2.87	3.33	**3.57**
46"	2.13	2.91	3.39	**3.61**
47"	2.17	2.96	3.44	**3.66**
48"	2.20	3.00	3.50	**3.70**
<30" OR >48"	Determination based on applicant-submitted modeling results			

Categorization of Infiltration Feasibility Condition			Worksheet C.4-1
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: Based on results of permeability testing in 3 locations across the site, the unfactored infiltration rate was measured to be 0.016, 0.038, and 0.229 inches/hour using a constant head borehole permeameter. If applying a feasibility factor of safety of 2.0, the infiltration rates would be 0.008, 0.019 and 0.115 iph, which are less than the required threshold value of 0.5 iph. The USDA web soil survey website indicates the vast 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 Aardvark 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 of approximately 10 to 13 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.			

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 2 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants 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.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP’s adversely impacting groundwater is considered negligible.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

It is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all answers to rows 1 - 4 are “Yes” a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is “No”, infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a “full infiltration” design. Proceed to Part 2</td><td>No Full Infiltration</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Worksheet C.4-1 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	**Yes**	**No**
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** 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: Based on results of permeability testing in 3 locations across the site, the unfactored infiltration rate was measured to be 0.016, 0.038, and 0.229 inches/hour using a constant head borehole permeameter. If applying a feasibility factor of safety of 2.0, the infiltration rates would be 0.008, 0.019 and 0.115 iph, therefore, 2 of the 3 tests indicated rates below 0.05 iph, which should be considered the low bound threshold for partial infiltration (based on 2016 City of San Diego Storm Water Manual). After grading, the actual BMP's would be situated in compacted fill over granitic rock, and infiltration BMP's founded in compacted fill are not recommended (see discussion in Appendix C of the Geotechnical Investigation).

Criteria	Screening Question	**Yes**	**No**
6	**Can Infiltration in any appreciable quantity 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 of approximately 10 to 13 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.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 4 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:
Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: It is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.

If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td>No Infiltration</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

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) See DMA Exhibit	☐ 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.	☐ 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

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

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)

See DMA Exhibit

PROPOSED D.M.A./H.M.P. DRAINAGE EXHIBIT FOR:
N. ANZA STREET TOWNHOMES

LEGEND

- PROJECT BOUNDARY
- LIMITS OF DRAINAGE BASIN
- NODE NUMBER
- Q_{100} (C.F.S.)
- DRAINAGE MANAGEMENT AREA (D.M.A.) DESIGNATION
- D.M.A. AREA (AC.)
- BUILDING NO.
- CURB AND GUTTER
- IMPERVIOUS SURFACE
- DIRECTION OF DRAINAGE
- CONCRETE
- PRIVATE AREA DRAIN SYSTEM

D.M.A. SUMMARY TABLE

D.M.A.	AREA(SF)	DESCRIPTION	TYPE
1	15,746	AREA DRAINS TO 8" UNDER DWY–A	DRAINS TO BASIN 1
2	7,216	DWY–A AND DRIVES TO C.I.–1	DRAINS TO BASIN 1
3	27,727	AREA DRAINS TO BASIN–1	DRAINS TO BASIN 1
4	29,304	DWYS B&C AND DRIVES TO C.I.–3	DRAINS TO BASIN 2
5	32,344	AREA DRAINS TO C.I.–2	DRAINS TO BASIN 2
6	2,905	DRY–B AND DRIVES TO C.I.–2	DRAINS TO BASIN 2
7	14,853	AREA DRAINS TO BASIN 2	DRAINS TO BASIN 2
8	1,634	PERIMETER RETAINING WALL	SELF–TREATING
9	2,881	BIOFILTRATION BASIN 1	BASIN 1
10	2,716	BIOFILTRATION BASIN 2	BASIN 2
D	566	STREET FRONTAGE	TREE WELLS

NOTE: BASIN INCLUDES TREATMENT AND HMP.

D.M.A./H.M.P. SUMMARY

UNDERLYING HYDROLOGIC SOILS GROUP:	TYPE "D"
APPROXIMATE DEPTH TO GROUNDWATER:	GREATER THAN 15 FEET
EXISTING NATURAL HYDROLOGIC FEATURES:	NONE
POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS:	NONE
EXISTING TOPOGRAPHY:	EXISTING CONTOURS SHOWN
EXISTING IMPERVIOUS AREAS:	SEE EXISTING DRAINAGE MAP IN ATTACHMENT 5
EXISTING DRAINAGE SYSTEM:	OVERLAND FLOW
PROPOSED DRAINAGE SYSTEM:	PRIVATE AREA DRAINS, GUTTERS & STORM DRAIN TO TREATMENT BMPs.
PROPOSED GRADING:	SHOWN
PROPOSED IMPERVIOUS SURFACES:	SEE LEGEND FOR SURFACE TYPES
DMA AREAS:	SEE DMA SUMMARY TABLE
POLLUTANT SOURCES:	PAVEMENT AND LANDSCAPE AREAS
STRUCTURAL SOURCE CONTROL:	NONE
INLET SIGNAGE:	YES
TRASH ENCLOSURE CONTROLS:	N/A
PET WASTE RECEPTACLE:	NONE
TREATMENT BMP:	BIOFILTRATION BASIN (2)
HMP FACILITY:	CISTERNS UNDER BIOFILTRATION BASINS
TREATMENT / HMP FACILITY:	TREE WELLS (7)

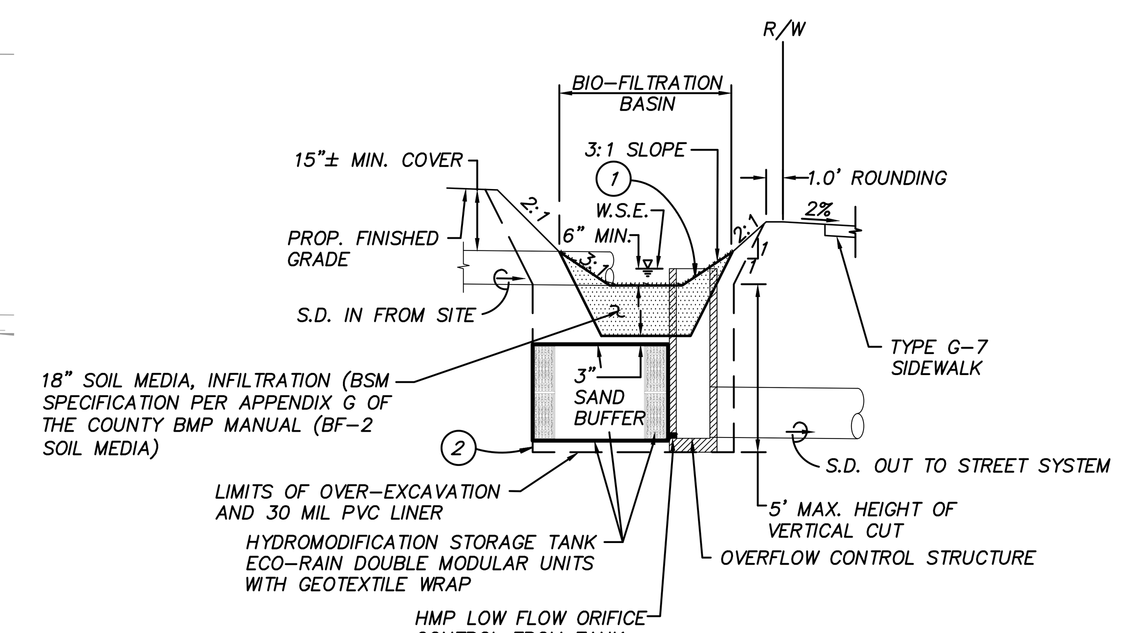
SEE DRAINAGE STUDY EXHIBITS FOR PREDEVELOPMENT STRUCTURES AND DRAINAGE AREAS.

SOURCE CONTROL BMPS

1. STORM DRAIN INLETS.
2. LANDSCAPE/OUTDOOR PESTICIDE USE.
3. FIRE SPRINKLER TEST WATER.
4. MISCELLANEOUS DRAIN OR WASH WATER.
5. PLAZAS, SIDEWALKS, AND PARKING LOTS.
6. MINIMIZE IMPERVIOUS AREA.

SITE DESIGN BMPS

7. RUNOFF COLLECTION.
8. LANDSCAPE WITH NATIVE OR DRAUGHT TOLERANT SPECIES.
9. MINIMIZE SITE COMPACTION.
10. INDOOR/STRUCTURAL PEST CONTROL.

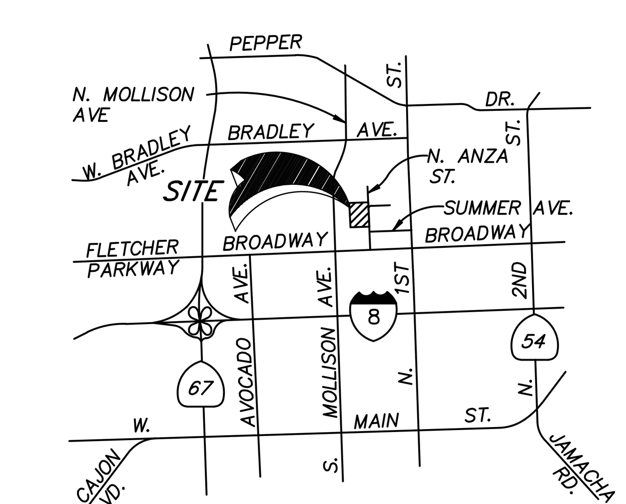


NOTES

1. INSTALL 3" WELL AGED SHREDDED HARDWOOD MULCH THAT HAS BEEN STOCKED PILED OR STORED FOR AT LEAST 12 MONTHS. MULCH MUST BE NON–FLOATING.
2. 30 MIL PVC LINER SHALL BE FULLY WATER TIGHT. ALL JOINTS SHALL OVERLAP 12" MIN. AND BE SEALED. LINER SHALL BE SEALED WITH MASTIC TO ALL STRUCTURES. ALL PENETRATIONS SHALL BE SEALED.
3. PLACE RIP–RAP PER SDRSD D–40 OR EQUIVALENT ENERGY DISSIPATER FOR ALL VELOCITIES GREATER THAN 3' PER SECOND TO BE DETAILED IN FINAL DESIGN.

A DETAIL ~ BIOFILTRATION BASIN BF-2 WITH HMP CISTERN

NOT TO SCALE



VICINITY MAP

NOT TO SCALE
THOMAS BROTHERS PG. 1251, GRID H–3 57TH EDITION

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REGISTERED PROFESSIONAL ENGINEER
STEPHEN C. OTT
No. C70666
CIVIL
STATE OF CALIFORNIA

STEPHEN C. OTT
DATE

Anza Street

Biofiltration #1 / HMP-1 — Prelim Design — 29-Mar-19

DMAs	1.164	ac
Basin #1	0.062	ac
Total	1.226	ac

6-Hour Rational Method Hydrograph

		Elev	Storage (cf)	Storage (ac-ft)	Depth (ft)
Bottom of Storage		449.10	0		
Top of HMP Storage		452.00	4,108	0.09	2.9
Floor of Basin		453.65	5,937	0.14	4.6
Surface Area @ 6" Depth	1,198	454.15	6,247	0.14	5.1
Grated Overflow		454.10	6,247	0.14	5.0
Emergency Spillway		455.35			
Top of Basin		455.55	8,460	0.19	6.4

Storm Frequency	Qexist (cfs)	Qin (cfs)	Qout (cfs)	WSEL (ft)	Total Depth (ft)
2 YEAR					
5 YEAR					
10 YEAR					
25 YEAR					
50 YEAR					
100 YEAR		5.95	0.88	454.25	5.2

Outlet Control Structure — Use 4' x 4' structure (Inside Dimension)

Opening	#1	#2	#3	Overflow - Grate
Elevation	449.1	Not Used	Not Used	454.1
Width (in)	1.00	0	Not	4 feet
Height (in)	Round	0	Used	4 feet

Drain Time - Surface Volume below overflow elevation

		Elevations / Dimensions	
Total Volume @12"'	7,018 cf	Top 12"	454.65 fg
Surface Area @ Overflow	1,118 sf	Overflow	454.10 grate
Surface Area Btm	797 sf	Btm	453.65 fg
Depth @ Overflow	0.45 ft	Orifice	449.10 fl
Avg Area	957 sf	Dia	1.000 in
Surface Volume	431 cf	Area	0.0055 sf
Drain Time	2.093 hrs	C	0.6
Qavg	0.057 cfs	Hi	4.96 ft
		Hf	4.51 ft

Anza Street

Biofiltration #2 / HMP-2 — Prelim Design — 29-Mar-19

DMAs	1.824	ac
Basin #2	0.064	ac
Total	1.888	ac

6-Hour Rational Method Hydrograph

		Elev	Storage (cf)	Storage (ac-ft)	Depth (ft)
Bottom of Storage		448.40	0		
Top of HMP Storage		450.60	7,789	0.18	2.2
Floor of Basin		452.35	8,614	0.20	4.0
Surface Area @ 6" Depth	1,755	452.85	9,416	0.22	4.5
Grated Overflow		452.85	9,416	0.22	4.5
Emergency Spillway		454.05			
Top of Basin		454.15	12,026	0.28	5.8

Storm Frequency	Qexist (cfs)	Qin (cfs)	Qout (cfs)	WSEL (ft)	Total Depth (ft)	Surface Depth (ft)
2 YEAR						
5 YEAR						
10 YEAR						
25 YEAR						
50 YEAR						
100 YEAR		9.60	0.88	452.95	4.6	0.60

Outlet Control Structure — Use 4' x 4' structure (Inside Dimension)

Opening	#1	#2	#3	Overflow - Grate
Elevation	448.4	Not Used	Not Used	452.9
Width (in)	1.00	0	Not	4 feet
Height (in)	Round	0	Used	4 feet

Drain Time - Surface Volume below overflow elevation

		Elevations / Dimensions	
Total Volume @12"'	10,368 cf	Top 12"	453.35 fg
Surface Area @ Overflow	1,755 sf	Overflow	452.85 grate
Surface Area Btm	1,453 sf	Btm	452.35 fg
Depth @ Overflow	0.50 ft	Orifice	448.40 fl
Avg Area	1,604 sf	Dia	1.000 in
Surface Volume	802 cf	Area	0.0055 sf
Drain Time	4.157 hrs	C	0.6
Qavg	0.054 cfs	Hi	4.41 ft
		Hf	3.91 ft

ATTACHMENT

S.W.M.M. ~ HMP CONTINUOUS SIMULATION MODEL FOR:

1118 N. ANZA STREET TOWNHOMES

CITY OF EL CAJON, CA

September 16, 2018

PREPARED BY:

SB&O INC.

PLANNING ENGINEERING SURVEYING

3990 RUFFIN ROAD, SUITE 120

SAN DIEGO, CA 92123

858-560-1141

TABLE OF CONTENTS

INTRODUCTION

This report, "S.W.M.M. ~ HMP CONTINUOUS SIMULATION MODELING FOR 1118 N. ANZA STREET TOWNHOMES", is an attachment to the project Storm Water Quality Management Plan (SWQMP) and is not intended to be an independent document.

The San Diego County final Hydromodification Management Plan (HMP) became effective in January of 2011, and is applicable to all priority projects regardless of size. The HMP model seeks to limit post development increases in runoff (magnitude and duration) for runoff event ranging from a fraction of the Q2 up to Q10.

Hydromodification flow control is achieved for this project by routing runoff through the HMP control facility (basins). Outflow is restricted by using multiple control openings at each discharge. To determine the hydromodification controls and tank dimensions, Continuous Simulation Modeling was done using the EPA Storm Water Management Model (SWMM) software. Separate reports have been prepared to analyze the onsite 100-year storm capacity and to analyze the capacity of the downstream public drainage system.

STORM WATER MANAGEMENT MODEL SOFTWARE

EPA's Storm Water Management Model (SWMM) was first developed in 1971, and has since undergone several major upgrades. It continues to be widely used throughout the world for planning, analysis and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems in urban areas, with many applications in non-urban areas as well.

This general purpose urban hydrology and conveyance system hydraulics software is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subcatchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff generated within each subcatchment, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

EPA has recently extended SWMM 5 to explicitly model the hydrologic performance of specific types of low impact development (LID) controls, such as porous pavement, bio-retention areas (e.g., rain gardens, green roofs, and street planters), rain barrels, infiltration trenches, and vegetative swales. The updated model allows engineers and planners to accurately represent any combination of LID controls within a study area to determine their effectiveness in managing stormwater and combined sewer overflows.

POINT OF COMPLIANCE (POC)

The lower flow threshold is determined by the sensitivity of the receiving water. Depending upon the downstream erosion potential, the allowable low flow threshold is set at 10% of pre-development Q2

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A field review revealed that the Erosion Susceptibility Rating of the channel bed and banks will likely be "High" and therefore a Southern California Coastal Water Research Project (SCCWRP) field screening was not performed.

Assuming a low-flow threshold of 0.1 Q2, we have assigned one POC to the project, as shown on the DMA Exhibit.

ANALYSIS

For each POC, two models were simulated: pre-development and post-development-mitigated. The pre-development condition simulation is a representation of the undeveloped site. The post-developed site adds BMPs and the detention facilities to reduce flows to meet the HMP requirements.

The performance standard requires the following:

1. For flow rates from 10% of the pre-project 2-year runoff event (0.1Q2) to the pre-project 10-year runoff event (Q10), the post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10% over more than 10% of the length of the flow duration curve.
2. For flow rates from 0.1 Q2 to Q5, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post-project peak flows may exceed pre-project flows by up to 10% for a 1-year frequency interval. For example, post-project flows could exceed pre-project flows by up to 10% for the interval from Q9 to Q10 or from Q5.5 to Q6.5, but not from Q8 to Q10.

RAINFALL DATA

Precipitation is the principal driving variable in rainfall-runoff-quantity simulation. The volume and rate of stormwater runoff depends directly on the precipitation magnitude, and its spatial and temporal distribution over the catchment. Each subcatchment in SWMM is linked to a Rain Gage object that describes the format and source of the rainfall input for the subcatchment. The same rain gage and time series is applied to all scenarios for this project.

Long-term hourly rainfall records have been prepared for the San Diego rainfall stations. Sources of the rainfall data include ALERT data from the County of San Diego (which extend back to 1982), the California Climatic Data Archive, National Oceanic and Atmospheric Administration (NOAA), the National Climatic Data Center, and the Western Regional Climate Center. In all cases, the length of the overall rainfall station record is 35 years or the overall length of the rainfall record, whichever is longer. The Oceanside ALERT Station rainfall data was used for this project and can be found at, www.projectcleanwater.org.

SANTEE was chosen for this site due to is geographic proximity and similarity in elevation to this site.

EVAPORATION

Single event simulations are usually insensitive to the evaporation rate. Thus, evaporation is typically neglected when a single rainfall event or a synthetic storm is simulated. However, this process is more significant when a continuous simulation is performed because it is through

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evaporation that depression storage is recovered and water levels in extended detention and wet ponds are reduced; thus it becomes an important component of the overall water budget.

This project is located in the California Irrigation Management Information System (CIMIS) Zone 6. Monthly averages are applied to this site as provided by CIMIS.

SUBCATCHMENTS

SWMM is a distributed model, which means that a study area can be subdivided into any number of irregular subcatchments to best capture the effect that spatial variability in topography, drainage pathways, land cover, and soil characteristics have on runoff generation. Each subcatchment can be further divided into three subareas: an impervious area with depression (detention) storage, an impervious area without depression storage, and a pervious area with depression storage. Only the latter area allows for rainfall losses due to infiltration into the soil. Described below are some of the characteristics of a subcatchment.

Width/Length

W = AREA ÷ LENGTH OF OVERLAND FLOW

The width can be defined as the subcatchment area divided by the length of the longest un-concentrated overland flow path that water can travel. If there are several such paths, then one would use an average of their lengths to compute a width. In urbanized catchments, true overland flow can be very short before it is collected into channels or pipes.

Slope
This is the slope of the land surface over which runoff flows, and is the same for both the pervious and impervious surfaces. It is the slope of what one considers to be the overland flow path, or its area-weighted average, if there are several such paths in the subcatchment.

The undeveloped site is sheet graded with an average overall gradient of 1%.

The proposed site has variable grades throughout the development. Most of the site is graded to an average of 0.5%.

Imperviousness
This is the percentage of the subcatchment area that is covered by impervious surfaces, such as roofs and roadways, through which rainfall cannot infiltrate. Imperviousness tends to be the most sensitive parameter in the hydrologic characterization of a catchment, and can range anywhere from 0% for undeveloped areas up to 100% for high-density areas.

The developed condition ranges from 65%-73% impervious. The percentage varies between different DMAs and is shown on the project DMA Exhibit

Roughness Coefficient

The roughness coefficient reflects the amount of resistance that overland flow encounters as it runs off of the subcatchment surface. Since SWMM uses the Manning equation to compute the overland flow rate, this coefficient is the same as Manning's roughness coefficient *n*. Separate values are required for the impervious and pervious fractions of a subcatchment since the pervious *n* is generally an order of magnitude higher than the impervious *n*.

N-imperv = 0.012
N-perv = 0.10

Depression Storage "Dstore"

Depression storage corresponds to a volume that must be filled prior to the occurrence of any runoff. Different values can be used for the pervious and impervious areas of a subcatchment. It represents initial abstractions such as surface ponding, interception by flat roofs and vegetation, and surface wetting.

Typical "D" values:

Surface	D (in)
Impervious surfaces (AC,PCC)	0.05
Proposed Landscaping	0.10
Existing Natural Terrain	0.15

Percent of Impervious Area without Depression Storage

This parameter accounts for immediate runoff that occurs at the beginning of rainfall before depression storage is satisfied. It represents pavement close to the gutters that has no surface storage, pitched rooftops that drain directly to street gutters, new pavement that may not have surface ponding, etc. By default the value of this variable is 25%, but it can be changed in each subcatchment. Unless special circumstances are known to exist, a percent imperviousness area without depression storage of 25% is recommended.

Subarea Routing

Choice of internal routing of runoff between pervious and impervious areas:
IMPERVIOUS: Runoff from pervious areas flow to impervious areas
PERVIOUS: Runoff from impervious areas flow to pervious areas.
OUTLET: Runoff from both areas flow directly to outlets.

This project utilizes only the OUTLET routing option, as recommended in the San Diego County BMP Design Manual.

Percent Routed

The percentage of runoff from the subcatchment that is to be routed. In all cases this is 100%.

Infiltration Model

Three different methods for computing infiltration loss on the pervious areas of a subcatchment are available in SWMM. They are the Horton, Green-Ampt and Curve Number models. There is no general agreement on which model is best. The Horton model has a long history of use in dynamic simulations, the Green-Ampt model is more physically-based, and the Curve Number model is derived from (but not the same as) the well-known SCS Curve Number method used in simplified runoff models

We have chosen to use the Green-Ampt model for this project for type "D" soil:
Suction Head = 9.0 inches
Conductivity = 0.025
Initial Deficit = 0.33

A 25% reduction is applied to the conductivity to account for compacted soil conditions.

Low Impact Development (LID) Controls
LID Controls are low impact development practices designed to capture surface runoff and provide some combination of detention, infiltration, and evapotranspiration. They are considered as properties of a given subcatchment, similar to how Aquifers and Snow Packs are treated. SWMM can explicitly model five different generic types of LID controls: Bio-retention Cells (with impermeable liner option), Infiltration Trenches, Continuous Porous Pavement Systems, Rain Barrels (or Cisterns) and Vegetative Swales.

Bio-retention cells, infiltration trenches, and porous pavement systems can all contain optional underdrain systems in their gravel storage beds to convey captured runoff off of the site rather than letting it all infiltrate. They can also have an impermeable floor or liner that prevents any infiltration into the native soil from occurring. Infiltration trenches and porous pavement systems can also be subject to a decrease in hydraulic conductivity over time due to clogging.

This project models BMPs as Biofiltration Cells with a liner (no infiltration). The program is set up to route all flows from a Subcatchment into a smaller subcatchment that is fully occupied by the LID control. The project geotechnical engineer has recommended that all BMPs on the site be lined due to geotechnical concerns. The subdrain used in the biofiltration model is sized exceedingly large in order to simulate the free-discharge from the biofiltration basin directly down into the storage facility.

STORAGE

SWMM routes runoff through storage units such as ponds and tanks with outlet orifices and weirs. Tanks can be modeled using either a storage curve function or a depth-area table. For this project we inputted a depth-area table and do not allow for any storage infiltration.

The storage volume modeled in this project are open ponds S-1 and S-2. The storage has a small orifice at the bottom and an overflow weir.

STATISTICS

SWMM computes peak flow frequency statistics by constructing a partial-duration series. This involves examining the entire runoff time series generated by the model, dividing the runoff time series into a set of discrete unrelated events, determining the peak flow for each event, ranking the peak flows for all events and then computing the recurrence interval or plotting position for each storm event. A separation event, defined as a time period in which runoff does not exceed a prescribed threshold, is required to parse the long-term flow records into discrete runoff events. The separation event corresponds to the required number of consecutive time intervals (24 hours in this case) with a flow value less than Flow Floor 1 (0.002 cfs/acre)

SWMM uses the Weibull method for construction of the partial-duration series, but the Final HMP gives preference to the Cunnane method. Both the Weibull and Cunnane methods result in very similar return periods and frequencies for events that occur below the Q10, and do not begin significantly contrasting until the low frequency (high flow) ranges. We have converted the SWMM partial duration series to a Cunnane plotting for this report and have included a table at the end of this report

RESULTS

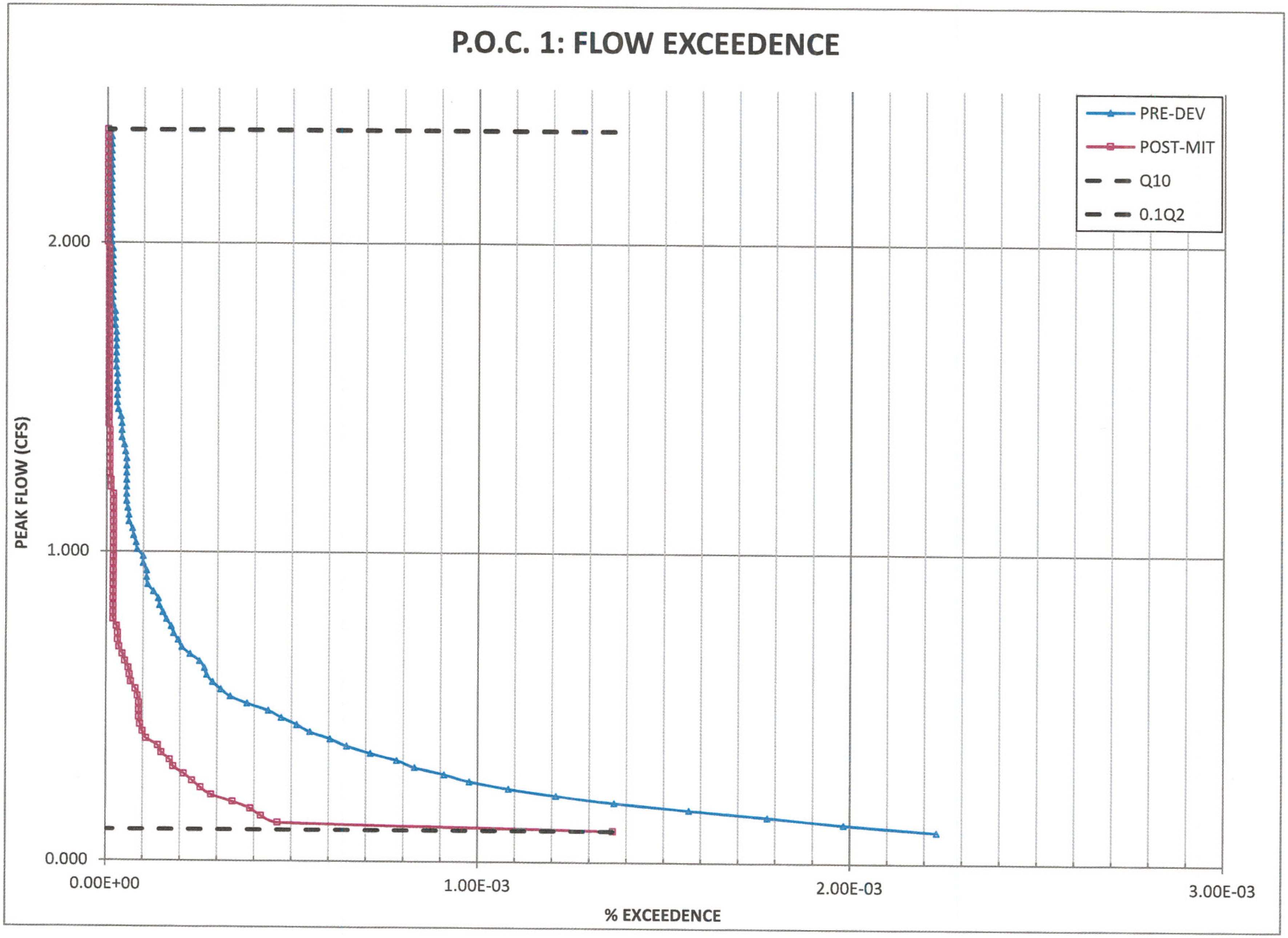
For each HMP facility (each POC) the results are included at the end of this report and are summarized as follows:

A. PEAK FLOW-EXCEEDANCE CURVE
B. RUNOFF-DURATION CURVE (LOGARITHMIC)
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING (INCLUDES Q2-Q10 THRESHOLDS)
E. PEAK EVENT TABLE – POST-MITIGATED

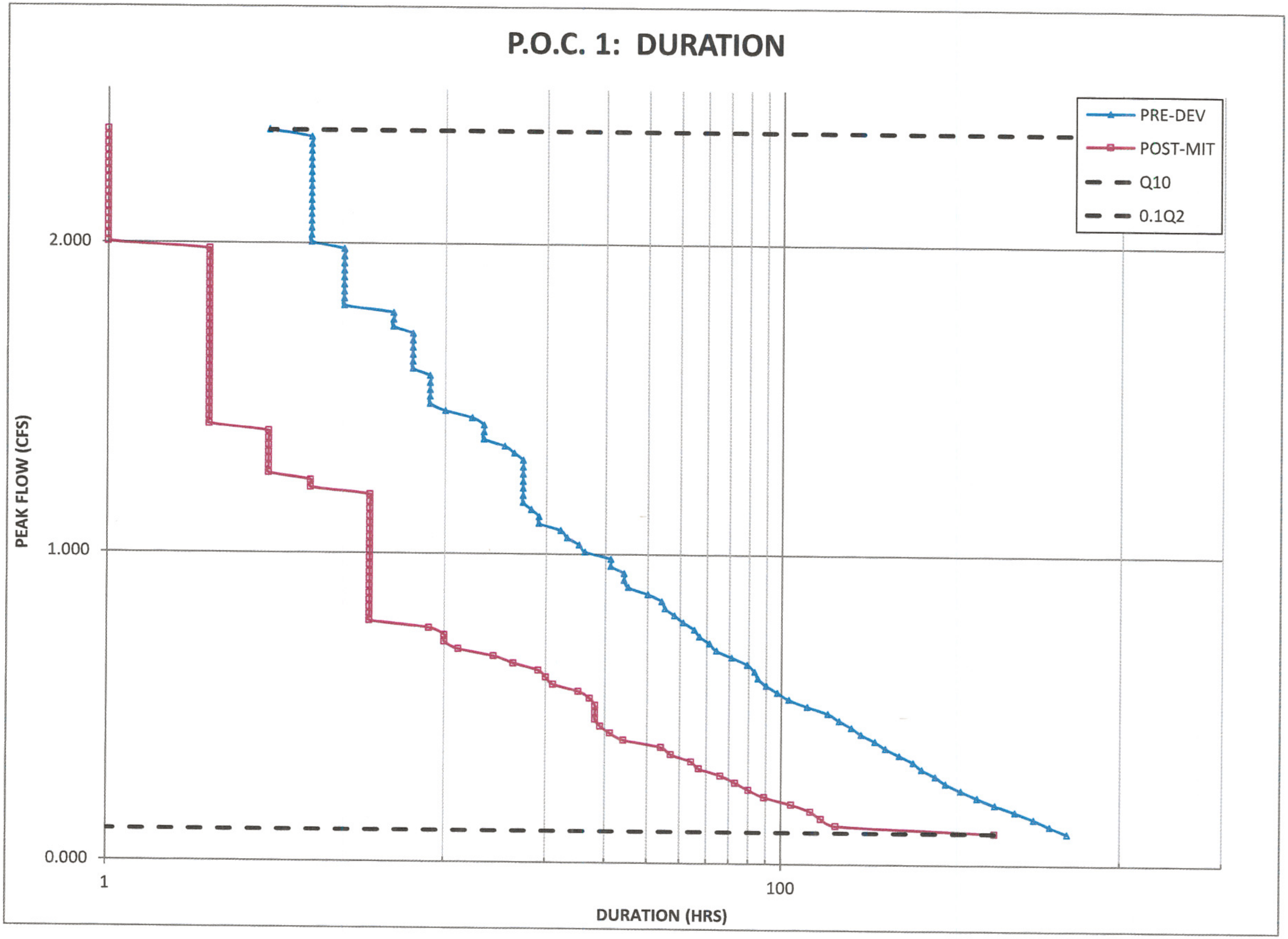
Observing flows between 0.1Q2 and Q10, each of these charts or tables show the flow control openings for the project HMP facility reduces the runoff from the site to below the pre-developed condition, and meets the performance standard requirements described above

APPENDIX I: POC #1 SWMM RESULTS

A. PEAK FLOW-EXCEEDANCE CURVE
B. RUNOFF-DURATION CURVE (LOGARITHMIC)
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING (INCLUDES Q2-Q10 THRESHOLDS)
E. PEAK EVENT TABLE – POST-MITIGATED
F. INPUT DATA



P.O.C. 1: FLOW EXCEEDENCE
PRE-DEV
POST-MIT
Q10
0.1Q2
PEAK FLOW (CFS)
2.000
1.000
0.000
0.00E+00
1.00E-03
2.00E-03
3.00E-03
% EXCEEDENCE



P.O.C. 1: DURATION
PEAK FLOW (CFS)
2.000
1.000
0.000
1
100
DURATION (HRS)
PRE-DEV
POST-MIT
Q10
0.1Q2

POC. #1: FLOW-DURATION TABLE

Q2 =	1.016	CFS	FRACTION =	1.0%
0.1Q2=	0.1016	CFS		
Q10 =	2.364	CFS		
STEP =	0.023	CFS		

INTERVAL	EXISTING			POST-MITIGATED		PERCENT	PASS OR
	Q (CFS)	HRS>Q	% EXCEEDED	HRS>Q	% EXCEEDED	POST/PRE	FAIL
0	0.102	699	2.23E-03	427	1.36E-03	61%	PASS
1	0.124	621	1.98E-03	145	4.63E-04	23%	PASS
2	0.147	557	1.78E-03	131	4.18E-04	24%	PASS
3	0.169	491	1.57E-03	122	3.90E-04	25%	PASS
4	0.192	428	1.37E-03	107	3.42E-04	25%	PASS
5	0.215	379	1.21E-03	89	2.84E-04	23%	PASS
6	0.237	339	1.08E-03	80	2.55E-04	24%	PASS
7	0.260	306	9.77E-04	73	2.33E-04	24%	PASS
8	0.283	285	9.10E-04	66	2.11E-04	23%	PASS
9	0.305	260	8.30E-04	57	1.82E-04	22%	PASS
10	0.328	245	7.82E-04	54	1.72E-04	22%	PASS
11	0.350	223	7.12E-04	47	1.50E-04	21%	PASS
12	0.373	203	6.48E-04	44	1.40E-04	22%	PASS
13	0.396	189	6.03E-04	34	1.09E-04	18%	PASS
14	0.418	172	5.49E-04	31	9.90E-05	18%	PASS
15	0.441	161	5.14E-04	29	9.26E-05	18%	PASS
16	0.464	148	4.73E-04	28	8.94E-05	19%	PASS
17	0.486	137	4.37E-04	28	8.94E-05	20%	PASS
18	0.509	119	3.80E-04	28	8.94E-05	24%	PASS
19	0.531	105	3.35E-04	27	8.62E-05	26%	PASS
20	0.554	97	3.10E-04	25	7.98E-05	26%	PASS
21	0.577	90	2.87E-04	21	6.70E-05	23%	PASS
22	0.599	85	2.71E-04	20	6.39E-05	24%	PASS
23	0.622	83	2.65E-04	19	6.07E-05	23%	PASS
24	0.645	79	2.52E-04	16	5.11E-05	20%	PASS
25	0.667	71	2.27E-04	14	4.47E-05	20%	PASS
26	0.690	64	2.04E-04	11	3.51E-05	17%	PASS
27	0.712	61	1.95E-04	10	3.19E-05	16%	PASS
28	0.735	57	1.82E-04	10	3.19E-05	18%	PASS
29	0.758	55	1.76E-04	9	2.87E-05	16%	PASS
30	0.780	51	1.63E-04	6	1.92E-05	12%	PASS
31	0.803	48	1.53E-04	6	1.92E-05	13%	PASS
32	0.826	45	1.44E-04	6	1.92E-05	13%	PASS
33	0.848	44	1.40E-04	6	1.92E-05	14%	PASS
34	0.871	40	1.28E-04	6	1.92E-05	15%	PASS
35	0.893	35	1.12E-04	6	1.92E-05	17%	PASS
36	0.916	34	1.09E-04	6	1.92E-05	18%	PASS
37	0.939	34	1.09E-04	6	1.92E-05	18%	PASS
38	0.961	31	9.90E-05	6	1.92E-05	19%	PASS
39	0.984	31	9.90E-05	6	1.92E-05	19%	PASS
40	1.007	26	8.30E-05	6	1.92E-05	23%	PASS
41	1.029	25	7.98E-05	6	1.92E-05	24%	PASS
42	1.052	23	7.34E-05	6	1.92E-05	26%	PASS
43	1.074	22	7.02E-05	6	1.92E-05	27%	PASS
44	1.097	19	6.07E-05	6	1.92E-05	32%	PASS
45	1.120	19	6.07E-05	6	1.92E-05	32%	PASS
46	1.142	18	5.75E-05	6	1.92E-05	33%	PASS
47	1.165	17	5.43E-05	6	1.92E-05	35%	PASS
48	1.188	17	5.43E-05	6	1.92E-05	35%	PASS

49	1.210	17	5.43E-05	4	1.28E-05	24%	PASS
50	1.233	17	5.43E-05	4	1.28E-05	24%	PASS
51	1.255	17	5.43E-05	3	9.58E-06	18%	PASS
52	1.278	17	5.43E-05	3	9.58E-06	18%	PASS
53	1.301	17	5.43E-05	3	9.58E-06	18%	PASS
54	1.323	16	5.11E-05	3	9.58E-06	19%	PASS
55	1.346	15	4.79E-05	3	9.58E-06	20%	PASS
56	1.369	13	4.15E-05	3	9.58E-06	23%	PASS
57	1.391	13	4.15E-05	3	9.58E-06	23%	PASS
58	1.414	13	4.15E-05	2	6.39E-06	15%	PASS
59	1.436	12	3.83E-05	2	6.39E-06	17%	PASS
60	1.459	10	3.19E-05	2	6.39E-06	20%	PASS
61	1.482	9	2.87E-05	2	6.39E-06	22%	PASS
62	1.504	9	2.87E-05	2	6.39E-06	22%	PASS
63	1.527	9	2.87E-05	2	6.39E-06	22%	PASS
64	1.550	9	2.87E-05	2	6.39E-06	22%	PASS
65	1.572	9	2.87E-05	2	6.39E-06	22%	PASS
66	1.595	8	2.55E-05	2	6.39E-06	25%	PASS
67	1.617	8	2.55E-05	2	6.39E-06	25%	PASS
68	1.640	8	2.55E-05	2	6.39E-06	25%	PASS
69	1.663	8	2.55E-05	2	6.39E-06	25%	PASS
70	1.685	8	2.55E-05	2	6.39E-06	25%	PASS
71	1.708	8	2.55E-05	2	6.39E-06	25%	PASS
72	1.731	7	2.23E-05	2	6.39E-06	29%	PASS
73	1.753	7	2.23E-05	2	6.39E-06	29%	PASS
74	1.776	7	2.23E-05	2	6.39E-06	29%	PASS
75	1.798	5	1.60E-05	2	6.39E-06	40%	PASS
76	1.821	5	1.60E-05	2	6.39E-06	40%	PASS
77	1.844	5	1.60E-05	2	6.39E-06	40%	PASS
78	1.866	5	1.60E-05	2	6.39E-06	40%	PASS
79	1.889	5	1.60E-05	2	6.39E-06	40%	PASS
80	1.912	5	1.60E-05	2	6.39E-06	40%	PASS
81	1.934	5	1.60E-05	2	6.39E-06	40%	PASS
82	1.957	5	1.60E-05	2	6.39E-06	40%	PASS
83	1.979	5	1.60E-05	2	6.39E-06	40%	PASS
84	2.002	4	1.28E-05	1	3.19E-06	25%	PASS
85	2.025	4	1.28E-05	1	3.19E-06	25%	PASS
86	2.047	4	1.28E-05	1	3.19E-06	25%	PASS
87	2.070	4	1.28E-05	1	3.19E-06	25%	PASS
88	2.093	4	1.28E-05	1	3.19E-06	25%	PASS
89	2.115	4	1.28E-05	1	3.19E-06	25%	PASS
90	2.138	4	1.28E-05	1	3.19E-06	25%	PASS
91	2.160	4	1.28E-05	1	3.19E-06	25%	PASS
92	2.183	4	1.28E-05	1	3.19E-06	25%	PASS
93	2.206	4	1.28E-05	1	3.19E-06	25%	PASS
94	2.228	4	1.28E-05	1	3.19E-06	25%	PASS
95	2.251	4	1.28E-05	1	3.19E-06	25%	PASS
96	2.274	4	1.28E-05	1	3.19E-06	25%	PASS
97	2.296	4	1.28E-05	1	3.19E-06	25%	PASS
98	2.319	4	1.28E-05	1	3.19E-06	25%	PASS
99	2.341	4	1.28E-05	1	3.19E-06	25%	PASS
100	2.364	3	9.58E-06	1	3.19E-06	33%	PASS

P.O.C. #1: PEAK EVENTS - EXISTING

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35.76
Total number of events (nr) 197

	Weibull		Cunnane		
m or i	F	Return (yrs)	F	Return	Q
1	0.51%	36.76	0.30%	59.93	2.512
2	1.01%	18.38	0.81%	22.47	2.504
3	1.52%	12.25	1.32%	13.83	2.391
4	2.02%	9.19	1.83%	9.99	2.364
5	2.53%	7.35	2.33%	7.82	1.999
6	3.03%	6.13	2.84%	6.42	1.781
7	3.54%	5.25	3.35%	5.45	1.778
8	4.04%	4.59	3.85%	4.73	1.714
9	4.55%	4.08	4.36%	4.18	1.580
10	5.05%	3.68	4.87%	3.75	1.469
11	5.56%	3.34	5.38%	3.39	1.440
12	6.06%	3.06	5.88%	3.10	1.436
13	6.57%	2.83	6.39%	2.85	1.342
14	7.07%	2.63	6.90%	2.64	1.130
15	7.58%	2.45	7.40%	2.46	1.085
16	8.08%	2.30	7.91%	2.30	1.080
17	8.59%	2.16	8.42%	2.17	1.044
18	9.09%	2.04	8.92%	2.04	1.016
19	9.60%	1.93	9.43%	1.93	0.995
20	10.10%	1.84	9.94%	1.83	0.985
21	10.61%	1.75	10.45%	1.75	0.985
22	11.11%	1.67	10.95%	1.66	0.950
23	11.62%	1.60	11.46%	1.59	0.941
24	12.12%	1.53	11.97%	1.52	0.912
25	12.63%	1.47	12.47%	1.46	0.893
26	13.13%	1.41	12.98%	1.40	0.887
27	13.64%	1.36	13.49%	1.35	0.871
28	14.14%	1.31	14.00%	1.30	0.864
29	14.65%	1.27	14.50%	1.26	0.857
30	15.15%	1.23	15.01%	1.21	0.827
31	15.66%	1.19	15.52%	1.18	0.809
32	16.16%	1.15	16.02%	1.14	0.806
33	16.67%	1.11	16.53%	1.10	0.803
34	17.17%	1.08	17.04%	1.07	0.798
35	17.68%	1.05	17.55%	1.04	0.764
36	18.18%	1.02	18.05%	1.01	0.759
37	18.69%	0.99	18.56%	0.98	0.745
38	19.19%	0.97	19.07%	0.96	0.734
39	19.70%	0.94	19.57%	0.93	0.731
40	20.20%	0.92	20.08%	0.91	0.730
41	20.71%	0.90	20.59%	0.89	0.721
42	21.21%	0.88	21.10%	0.86	0.700
43	21.72%	0.85	21.60%	0.84	0.673
44	22.22%	0.84	22.11%	0.82	0.664

SUMMARY OF PEAK EVENTS

Q2	**1.016**
Q3	**1.398**
Q4	**1.534**
Q5	**1.738**
Q6	**1.780**
Q7	**1.871**
Q8	**2.030**
Q9	**2.198**
Q10	**2.364**

START	1/3/1973 1:00
END	9/26/2008 20:00
TOTAL YRS	35.76
TOTAL HRS	313219

45	22.73%	0.82	22.62%	0.81	0.659
46	23.23%	0.80	23.12%	0.79	0.658
47	23.74%	0.78	23.63%	0.77	0.651
48	24.24%	0.77	24.14%	0.76	0.648
49	24.75%	0.75	24.65%	0.74	0.644
50	25.25%	0.74	25.15%	0.72	0.626
51	25.76%	0.72	25.66%	0.71	0.602
52	26.26%	0.71	26.17%	0.70	0.597
53	26.77%	0.69	26.67%	0.68	0.596
54	27.27%	0.68	27.18%	0.67	0.587
55	27.78%	0.67	27.69%	0.66	0.571
56	28.28%	0.66	28.19%	0.65	0.564
57	28.79%	0.64	28.70%	0.64	0.561
58	29.29%	0.63	29.21%	0.62	0.545
59	29.80%	0.62	29.72%	0.61	0.537
60	30.30%	0.61	30.22%	0.60	0.531
61	30.81%	0.60	30.73%	0.59	0.526
62	31.31%	0.59	31.24%	0.58	0.524
63	31.82%	0.58	31.74%	0.57	0.518
64	32.32%	0.57	32.25%	0.57	0.516
65	32.83%	0.57	32.76%	0.56	0.512
66	33.33%	0.56	33.27%	0.55	0.511
67	33.84%	0.55	33.77%	0.54	0.510
68	34.34%	0.54	34.28%	0.53	0.508
69	34.85%	0.53	34.79%	0.52	0.507
70	35.35%	0.53	35.29%	0.52	0.503
71	35.86%	0.52	35.80%	0.51	0.501
72	36.36%	0.51	36.31%	0.50	0.492
73	36.87%	0.50	36.82%	0.50	0.474
74	37.37%	0.50	37.32%	0.49	0.472
75	37.88%	0.49	37.83%	0.48	0.465
76	38.38%	0.48	38.34%	0.48	0.457
77	38.89%	0.48	38.84%	0.47	0.457
78	39.39%	0.47	39.35%	0.46	0.455
79	39.90%	0.47	39.86%	0.46	0.450
80	40.40%	0.46	40.37%	0.45	0.449
81	40.91%	0.45	40.87%	0.45	0.440
82	41.41%	0.45	41.38%	0.44	0.419
83	41.92%	0.44	41.89%	0.44	0.416
84	42.42%	0.44	42.39%	0.43	0.413
85	42.93%	0.43	42.90%	0.43	0.400
86	43.43%	0.43	43.41%	0.42	0.389
87	43.94%	0.42	43.91%	0.42	0.383
88	44.44%	0.42	44.42%	0.41	0.382
89	44.95%	0.41	44.93%	0.41	0.379
90	45.45%	0.41	45.44%	0.40	0.375
91	45.96%	0.40	45.94%	0.40	0.370
92	46.46%	0.40	46.45%	0.39	0.366
93	46.97%	0.40	46.96%	0.39	0.353
94	47.47%	0.39	47.46%	0.38	0.349
95	47.98%	0.39	47.97%	0.38	0.343
96	48.48%	0.38	48.48%	0.38	0.343
97	48.99%	0.38	48.99%	0.37	0.343
98	49.49%	0.38	49.49%	0.37	0.342
99	50.00%	0.37	50.00%	0.36	0.340
100	50.51%	0.37	50.51%	0.36	0.334
101	51.01%	0.36	51.01%	0.36	0.330
102	51.52%	0.36	51.52%	0.35	0.323
103	52.02%	0.36	52.03%	0.35	0.323

104	52.53%	0.35	52.54%	0.35	0.314
105	53.03%	0.35	53.04%	0.34	0.310
106	53.54%	0.35	53.55%	0.34	0.305
107	54.04%	0.34	54.06%	0.34	0.304
108	54.55%	0.34	54.56%	0.33	0.304
109	55.05%	0.34	55.07%	0.33	0.297
110	55.56%	0.33	55.58%	0.33	0.294
111	56.06%	0.33	56.09%	0.33	0.294
112	56.57%	0.33	56.59%	0.32	0.293
113	57.07%	0.33	57.10%	0.32	0.292
114	57.58%	0.32	57.61%	0.32	0.289
115	58.08%	0.32	58.11%	0.31	0.288
116	58.59%	0.32	58.62%	0.31	0.284
117	59.09%	0.31	59.13%	0.31	0.283
118	59.60%	0.31	59.63%	0.31	0.276
119	60.10%	0.31	60.14%	0.30	0.273
120	60.61%	0.31	60.65%	0.30	0.272
121	61.11%	0.30	61.16%	0.30	0.269
122	61.62%	0.30	61.66%	0.30	0.258
123	62.12%	0.30	62.17%	0.29	0.257
124	62.63%	0.30	62.68%	0.29	0.254
125	63.13%	0.29	63.18%	0.29	0.252
126	63.64%	0.29	63.69%	0.29	0.252
127	64.14%	0.29	64.20%	0.28	0.247
128	64.65%	0.29	64.71%	0.28	0.244
129	65.15%	0.28	65.21%	0.28	0.237
130	65.66%	0.28	65.72%	0.28	0.235
131	66.16%	0.28	66.23%	0.28	0.232
132	66.67%	0.28	66.73%	0.27	0.232
133	67.17%	0.28	67.24%	0.27	0.227
134	67.68%	0.27	67.75%	0.27	0.224
135	68.18%	0.27	68.26%	0.27	0.222
136	68.69%	0.27	68.76%	0.27	0.213
137	69.19%	0.27	69.27%	0.26	0.213
138	69.70%	0.27	69.78%	0.26	0.212
139	70.20%	0.26	70.28%	0.26	0.211
140	70.71%	0.26	70.79%	0.26	0.208
141	71.21%	0.26	71.30%	0.26	0.202
142	71.72%	0.26	71.81%	0.25	0.202
143	72.22%	0.26	72.31%	0.25	0.200
144	72.73%	0.26	72.82%	0.25	0.197
145	73.23%	0.25	73.33%	0.25	0.194
146	73.74%	0.25	73.83%	0.25	0.190
147	74.24%	0.25	74.34%	0.25	0.189
148	74.75%	0.25	74.85%	0.24	0.186
149	75.25%	0.25	75.35%	0.24	0.182
150	75.76%	0.25	75.86%	0.24	0.178
151	76.26%	0.24	76.37%	0.24	0.178
152	76.77%	0.24	76.88%	0.24	0.176
153	77.27%	0.24	77.38%	0.24	0.175
154	77.78%	0.24	77.89%	0.23	0.175
155	78.28%	0.24	78.40%	0.23	0.172
156	78.79%	0.24	78.90%	0.23	0.171
157	79.29%	0.23	79.41%	0.23	0.167
158	79.80%	0.23	79.92%	0.23	0.164
159	80.30%	0.23	80.43%	0.23	0.161
160	80.81%	0.23	80.93%	0.23	0.156
161	81.31%	0.23	81.44%	0.22	0.148
162	81.82%	0.23	81.95%	0.22	0.146

163	82.32%	0.23	82.45%	0.22	0.143
164	82.83%	0.22	82.96%	0.22	0.141
165	83.33%	0.22	83.47%	0.22	0.141
166	83.84%	0.22	83.98%	0.22	0.136
167	84.34%	0.22	84.48%	0.22	0.129
168	84.85%	0.22	84.99%	0.21	0.129
169	85.35%	0.22	85.50%	0.21	0.127
170	85.86%	0.22	86.00%	0.21	0.124
171	86.36%	0.21	86.51%	0.21	0.123
172	86.87%	0.21	87.02%	0.21	0.123
173	87.37%	0.21	87.53%	0.21	0.122
174	87.88%	0.21	88.03%	0.21	0.114
175	88.38%	0.21	88.54%	0.21	0.107
176	88.89%	0.21	89.05%	0.20	0.104
177	89.39%	0.21	89.55%	0.20	0.101
178	89.90%	0.21	90.06%	0.20	0.101
179	90.40%	0.21	90.57%	0.20	0.098
180	90.91%	0.20	91.08%	0.20	0.097
181	91.41%	0.20	91.58%	0.20	0.096
182	91.92%	0.20	92.09%	0.20	0.096
183	92.42%	0.20	92.60%	0.20	0.094
184	92.93%	0.20	93.10%	0.20	0.091
185	93.43%	0.20	93.61%	0.19	0.091
186	93.94%	0.20	94.12%	0.19	0.090
187	94.44%	0.20	94.62%	0.19	0.090
188	94.95%	0.20	95.13%	0.19	0.090
189	95.45%	0.19	95.64%	0.19	0.088
190	95.96%	0.19	96.15%	0.19	0.087
191	96.46%	0.19	96.65%	0.19	0.086
192	96.97%	0.19	97.16%	0.19	0.086
193	97.47%	0.19	97.67%	0.19	0.080
194	97.98%	0.19	98.17%	0.19	0.073
195	98.48%	0.19	98.68%	0.18	0.072
196	98.99%	0.19	99.19%	0.18	0.072
197	99.49%	0.19	99.70%	0.18	0.071

POC #1: PEAK EVENTS - POST MITIGATED

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n):	35.76
Total number of events (nr)	111

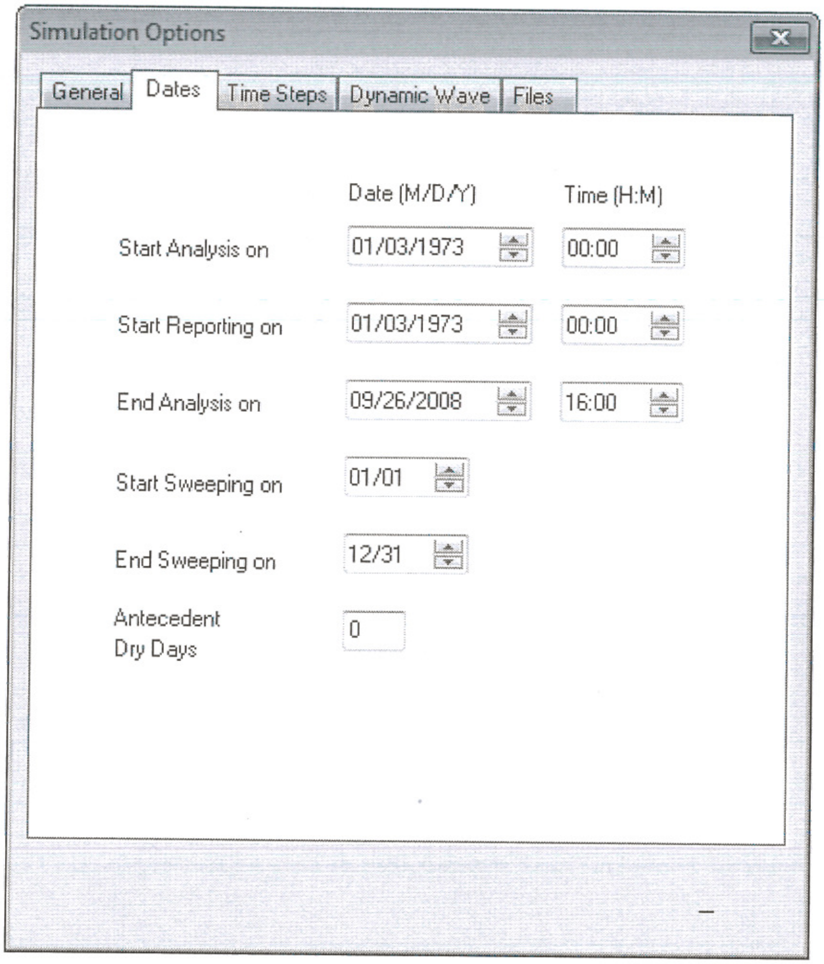
	Weibull		Cunnane		
m or i	F	Return (yrs)	F	Return	Q
1	0.89%	36.76	0.54%	59.93	2.721
2	1.79%	18.38	1.44%	22.47	1.982
3	2.68%	12.25	2.34%	13.83	1.244
4	3.57%	9.19	3.24%	9.99	0.764
5	4.46%	7.35	4.14%	7.82	0.742
6	5.36%	6.13	5.04%	6.42	0.677
7	6.25%	5.25	5.94%	5.45	0.637
8	7.14%	4.59	6.83%	4.73	0.574
9	8.04%	4.08	7.73%	4.18	0.515
10	8.93%	3.68	8.63%	3.75	0.461
11	9.82%	3.34	9.53%	3.39	0.425
12	10.71%	3.06	10.43%	3.10	0.404
13	11.61%	2.83	11.33%	2.85	0.292
14	12.50%	2.63	12.23%	2.64	0.255
15	13.39%	2.45	13.13%	2.46	0.143
16	14.29%	2.30	14.03%	2.30	0.107
17	15.18%	2.16	14.93%	2.17	0.104
18	16.07%	2.04	15.83%	2.04	0.104
19	16.96%	1.93	16.73%	1.93	0.100
20	17.86%	1.84	17.63%	1.83	0.098
21	18.75%	1.75	18.53%	1.75	0.097
22	19.64%	1.67	19.42%	1.66	0.097
23	20.54%	1.60	20.32%	1.59	0.097
24	21.43%	1.53	21.22%	1.52	0.096
25	22.32%	1.47	22.12%	1.46	0.095
26	23.21%	1.41	23.02%	1.40	0.095
27	24.11%	1.36	23.92%	1.35	0.093
28	25.00%	1.31	24.82%	1.30	0.091
29	25.89%	1.27	25.72%	1.26	0.090
30	26.79%	1.23	26.62%	1.21	0.090
31	27.68%	1.19	27.52%	1.18	0.090
32	28.57%	1.15	28.42%	1.14	0.090
33	29.46%	1.11	29.32%	1.10	0.090
34	30.36%	1.08	30.22%	1.07	0.089
35	31.25%	1.05	31.12%	1.04	0.088
36	32.14%	1.02	32.01%	1.01	0.088
37	33.04%	0.99	32.91%	0.98	0.087
38	33.93%	0.97	33.81%	0.96	0.086

SUMMARY OF PEAK EVENTS

Q2	**0.090**
Q3	**0.100**
Q4	**1.094**
Q5	**0.540**
Q6	**0.741**
Q7	**0.817**
Q8	**0.861**
Q9	**0.783**
Q10	**0.824**

39	34.82%	0.94	34.71%	0.93	0.086
40	35.71%	0.92	35.61%	0.91	0.086
41	36.61%	0.90	36.51%	0.89	0.086
42	37.50%	0.88	37.41%	0.86	0.086
43	38.39%	0.85	38.31%	0.84	0.085
44	39.29%	0.84	39.21%	0.82	0.085
45	40.18%	0.82	40.11%	0.81	0.084
46	41.07%	0.80	41.01%	0.79	0.083
47	41.96%	0.78	41.91%	0.77	0.082
48	42.86%	0.77	42.81%	0.76	0.082
49	43.75%	0.75	43.71%	0.74	0.081
50	44.64%	0.74	44.60%	0.72	0.080
51	45.54%	0.72	45.50%	0.71	0.079
52	46.43%	0.71	46.40%	0.70	0.079
53	47.32%	0.69	47.30%	0.68	0.078
54	48.21%	0.68	48.20%	0.67	0.078
55	49.11%	0.67	49.10%	0.66	0.077
56	50.00%	0.66	50.00%	0.65	0.076
57	50.89%	0.64	50.90%	0.64	0.076
58	51.79%	0.63	51.80%	0.62	0.076
59	52.68%	0.62	52.70%	0.61	0.076
60	53.57%	0.61	53.60%	0.60	0.076
61	54.46%	0.60	54.50%	0.59	0.075
62	55.36%	0.59	55.40%	0.58	0.075
63	56.25%	0.58	56.29%	0.57	0.075
64	57.14%	0.57	57.19%	0.57	0.075
65	58.04%	0.57	58.09%	0.56	0.074
66	58.93%	0.56	58.99%	0.55	0.074
67	59.82%	0.55	59.89%	0.54	0.074
68	60.71%	0.54	60.79%	0.53	0.074
69	61.61%	0.53	61.69%	0.52	0.074
70	62.50%	0.53	62.59%	0.52	0.073
71	63.39%	0.52	63.49%	0.51	0.073
72	64.29%	0.51	64.39%	0.50	0.073
73	65.18%	0.50	65.29%	0.50	0.072
74	66.07%	0.50	66.19%	0.49	0.072
75	66.96%	0.49	67.09%	0.48	0.071
76	67.86%	0.48	67.99%	0.48	0.070
77	68.75%	0.48	68.88%	0.47	0.070
78	69.64%	0.47	69.78%	0.46	0.070
79	70.54%	0.47	70.68%	0.46	0.070
80	71.43%	0.46	71.58%	0.45	0.070
81	72.32%	0.45	72.48%	0.45	0.070
82	73.21%	0.45	73.38%	0.44	0.069
83	74.11%	0.44	74.28%	0.44	0.069
84	75.00%	0.44	75.18%	0.43	0.068
85	75.89%	0.43	76.08%	0.43	0.068
86	76.79%	0.43	76.98%	0.42	0.068
87	77.68%	0.42	77.88%	0.42	0.068
88	78.57%	0.42	78.78%	0.41	0.067
89	79.46%	0.41	79.68%	0.41	0.067
90	80.36%	0.41	80.58%	0.40	0.066
91	81.25%	0.40	81.47%	0.40	0.066

92	82.14%	0.40	82.37%	0.39	0.066
93	83.04%	0.40	83.27%	0.39	0.066
94	83.93%	0.39	84.17%	0.38	0.066
95	84.82%	0.39	85.07%	0.38	0.065
96	85.71%	0.38	85.97%	0.38	0.065
97	86.61%	0.38	86.87%	0.37	0.065
98	87.50%	0.38	87.77%	0.37	0.065
99	88.39%	0.37	88.67%	0.36	0.065
100	89.29%	0.37	89.57%	0.36	0.065
101	90.18%	0.36	90.47%	0.36	0.065
102	91.07%	0.36	91.37%	0.35	0.065
103	91.96%	0.36	92.27%	0.35	0.064
104	92.86%	0.35	93.17%	0.35	0.064
105	93.75%	0.35	94.06%	0.34	0.064
106	94.64%	0.35	94.96%	0.34	0.064
107	95.54%	0.34	95.86%	0.34	0.063
108	96.43%	0.34	96.76%	0.33	0.062
109	97.32%	0.34	97.66%	0.33	0.062
110	98.21%	0.33	98.56%	0.33	0.062
111	99.11%	0.33	99.46%	0.33	0.062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General
Dates
Time Steps
Dynamic Wave
Files
Date (M/D/Y)
Time (H:M)
Start Analysis on
01/03/1973
00:00
Start Reporting on
01/03/1973
00:00
End Analysis on
09/26/2008
16:00
Start Sweeping on
01/01
End Sweeping on
12/31
Antecedent Dry Days
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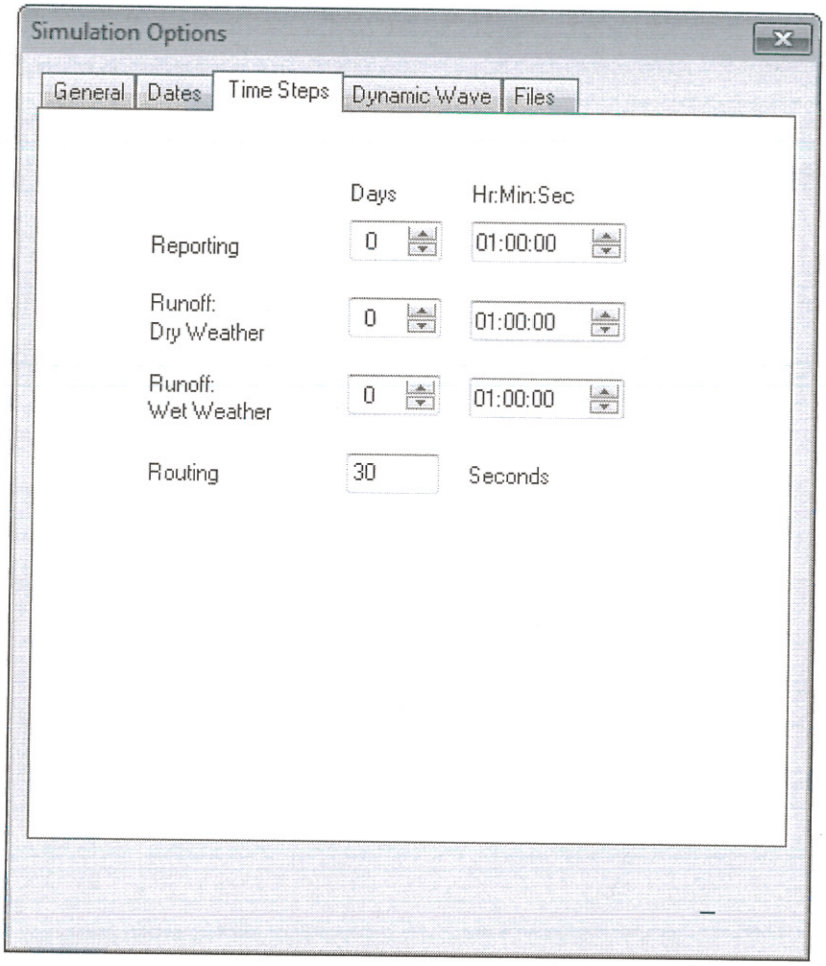
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General
Dates
Time Steps
Dynamic Wave
Files
Days
Hr:Min:Sec
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Dry Weather
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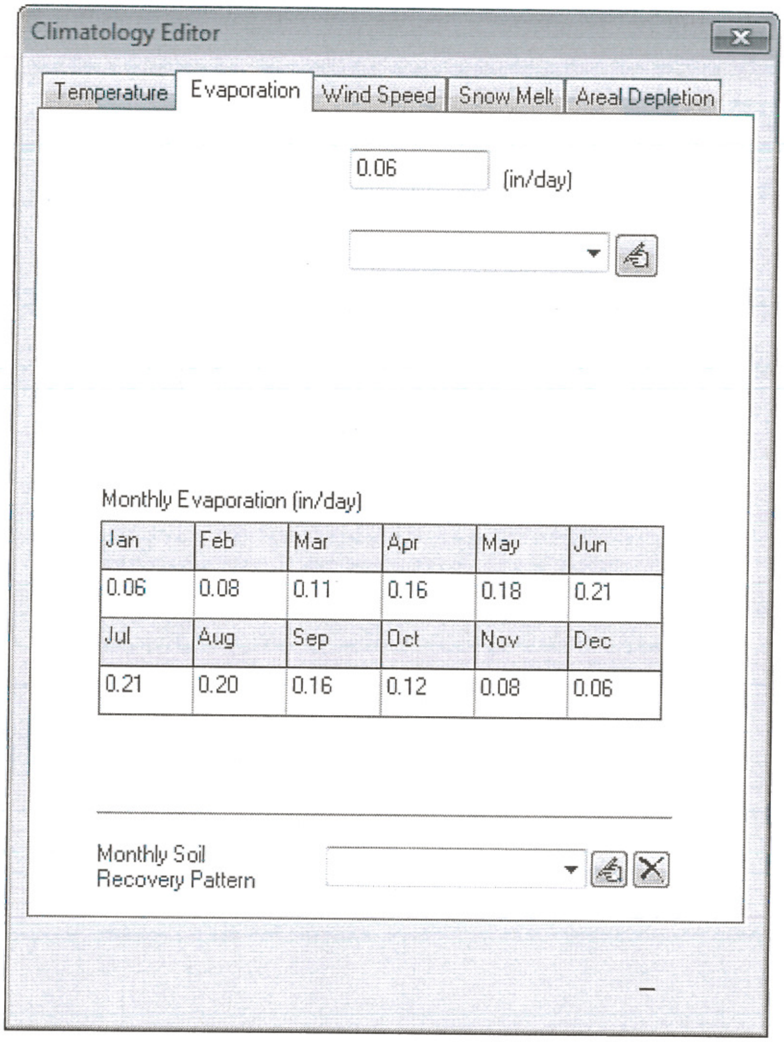
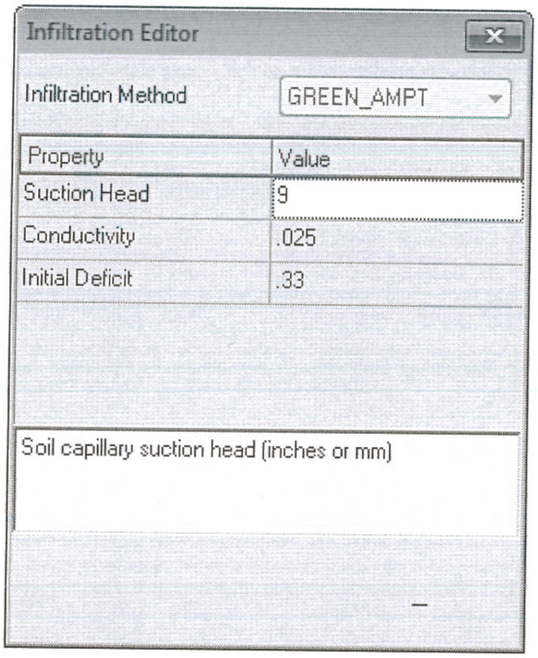
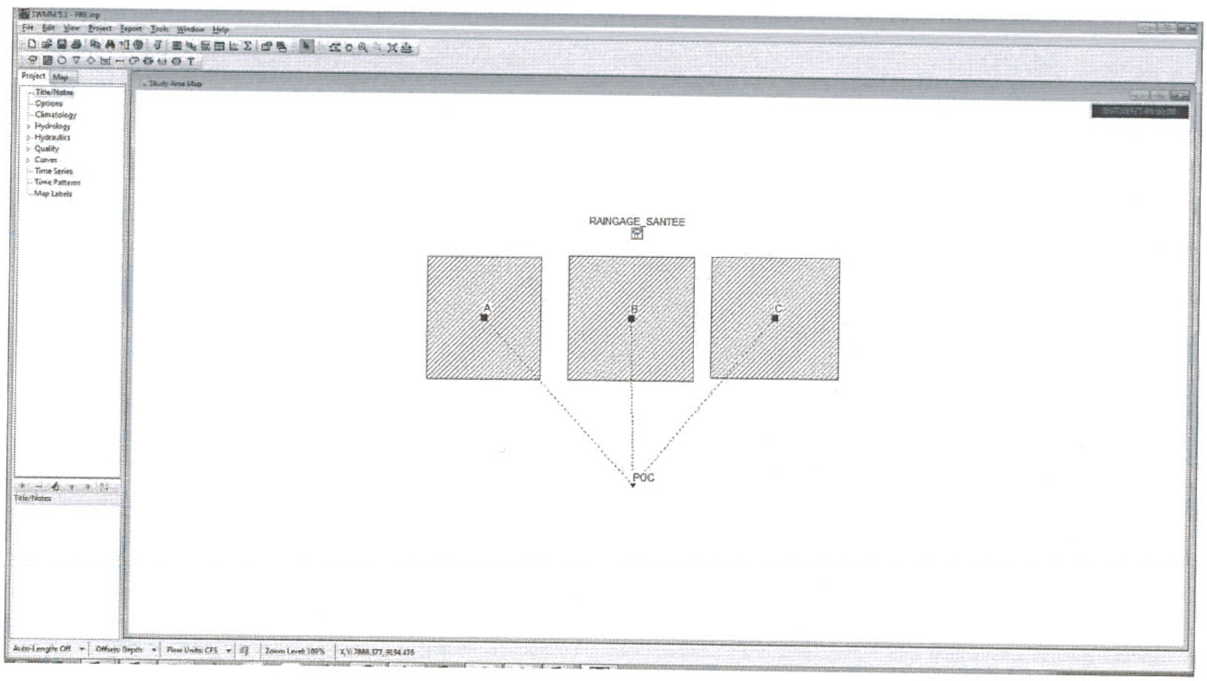
01:00:00
Routing
30
Seconds


Climatology Editor
Temperature
Evaporation
Wind Speed
Snow Melt
Areal Depletion
0.06
(in/day)
Monthly Evaporation (in/day)
Jan Feb Mar Apr May Jun
0.06 0.08 0.11 0.16 0.18 0.21
Jul Aug Sep Oct Nov Dec
0.21 0.20 0.16 0.12 0.08 0.06
Monthly Soil
Recovery Pattern


Infiltration Editor
Infiltration Method
GREEN_AMPT
Property
Value
Suction Head
9
Conductivity
.025
Initial Deficit
.33
Soil capillary suction head (inches or mm)


Title/Notes
Options
Climatology
Hydrology
Hydraulics
Quality
Curves
Time Series
Time Patterns
Map Labels
RAINGAGE_SANTEE
A
B
C
POC

Subcatchment A

Property	Value
Name	A
X-Coordinate	1703.107
Y-Coordinate	5886.076
Description	EXIST. CONDITION
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	POC
Area	1.69
Width	210
% Slope	.8
% Imperv	0
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Average surface slope (%)

Subcatchment B

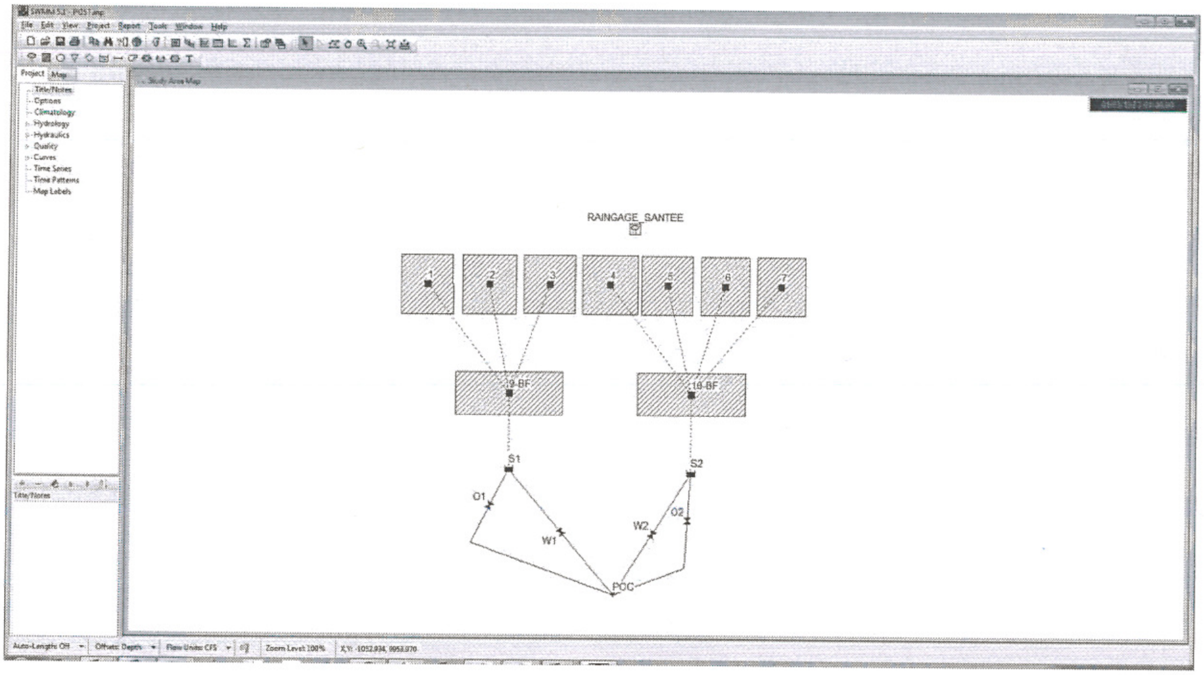
Property	Value
Name	B
X-Coordinate	4441.887
Y-Coordinate	5903.338
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	POC
Area	1.56
Width	348
% Slope	1.3
% Imperv	0
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment C

Property	Value
Name	C
X-Coordinate	7117.377
Y-Coordinate	5943.614
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	POC
Area	0.08
Width	46
% Slope	1.2
% Imperv	0
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment



SWMM 5.1 - POST.inp
File Edit View Project Report Tools Window Help
Project Map
Title/Notes
Options
Climatology
Hydrology
Hydraulics
Quality
Curves
Time Series
Time Patterns
Map Labels
Title/Notes
Study Area Map
RAINGAGE_SANTEE
1
2
3
4
5
6
7
19-BF
18-BF
S1
S2
O1
W1
W2
O2
POC
Auto-Length: Off
Offsets: Depth
Flow Units: CFS
Zoom Level: 100%

Subcatchment 1

Property	Value
Name	1
X-Coordinate	684.695
Y-Coordinate	6441.312
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	9-BF
Area	0.361
Width	310
% Slope	2
% Imperv	65.6
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 2

Property	Value
Name	2
X-Coordinate	1835.443
Y-Coordinate	6444.908
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	9-BF
Area	0.166
Width	55
% Slope	.5
% Imperv	65.6
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 3

Property	Value
Name	3
X-Coordinate	2950.230
Y-Coordinate	6446.706
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	9-BF
Area	0.637
Width	555
% Slope	2
% Imperv	65.6
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 4

Property	Value
Name	4
X-Coordinate	4072.210
Y-Coordinate	6442.750
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	10-BF
Area	0.673
Width	55
% Slope	.5
% Imperv	72.49
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 5

Property	Value
Name	5
X-Coordinate	5138.090
Y-Coordinate	6433.760
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	10-BF
Area	0.743
Width	647
% Slope	2
% Imperv	72.49
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 6

Property	Value
Name	6
X-Coordinate	6209.724
Y-Coordinate	6426.208
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	10-BF
Area	.067
Width	36
% Slope	0.5
% Imperv	72.49
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 7

Property	Value
Name	7
X-Coordinate	7255.466
Y-Coordinate	6426.208
Description	
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	10-BF
Area	0.341
Width	300
% Slope	2
% Imperv	72.49
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 9-BF

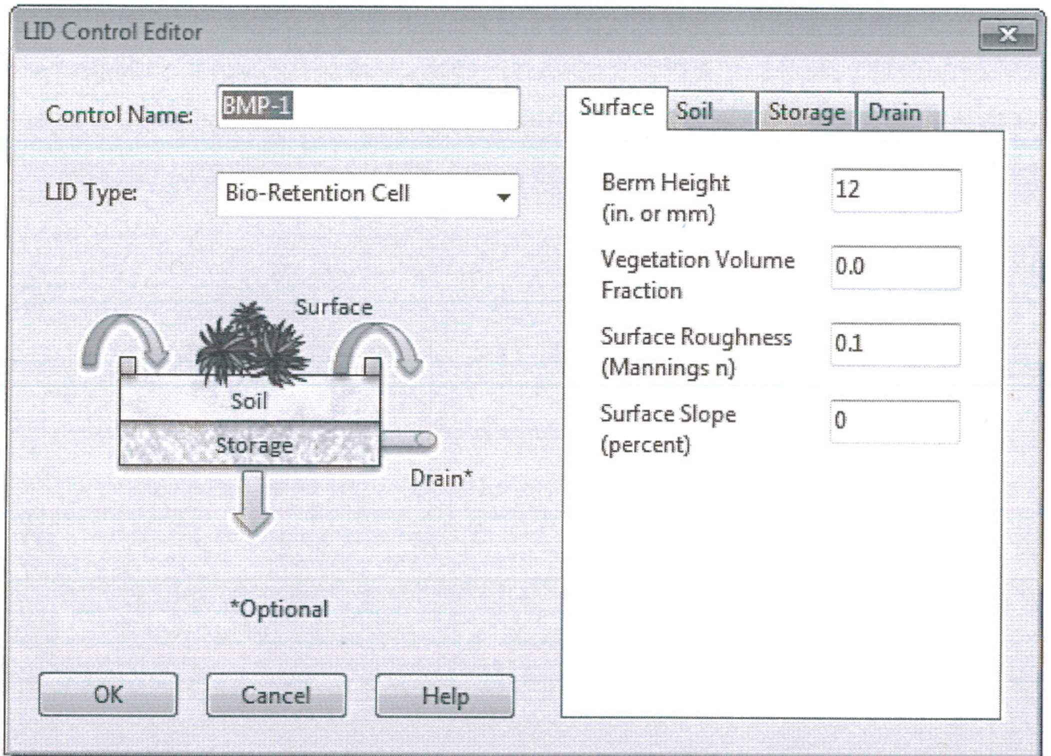
Property	Value
Name	9-BF
X-Coordinate	2218.067
Y-Coordinate	4439.010
Description	BIO-FITRATION BMP
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	S1
Area	0.066
Width	50
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment 10-BF

Property	Value
Name	10-BF
X-Coordinate	5598.389
Y-Coordinate	4431.818
Description	BIO-FITRATION BMP
Tag	
Rain Gage	RAINGAGE_SANTEE
Outlet	S2
Area	0.62
Width	50
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment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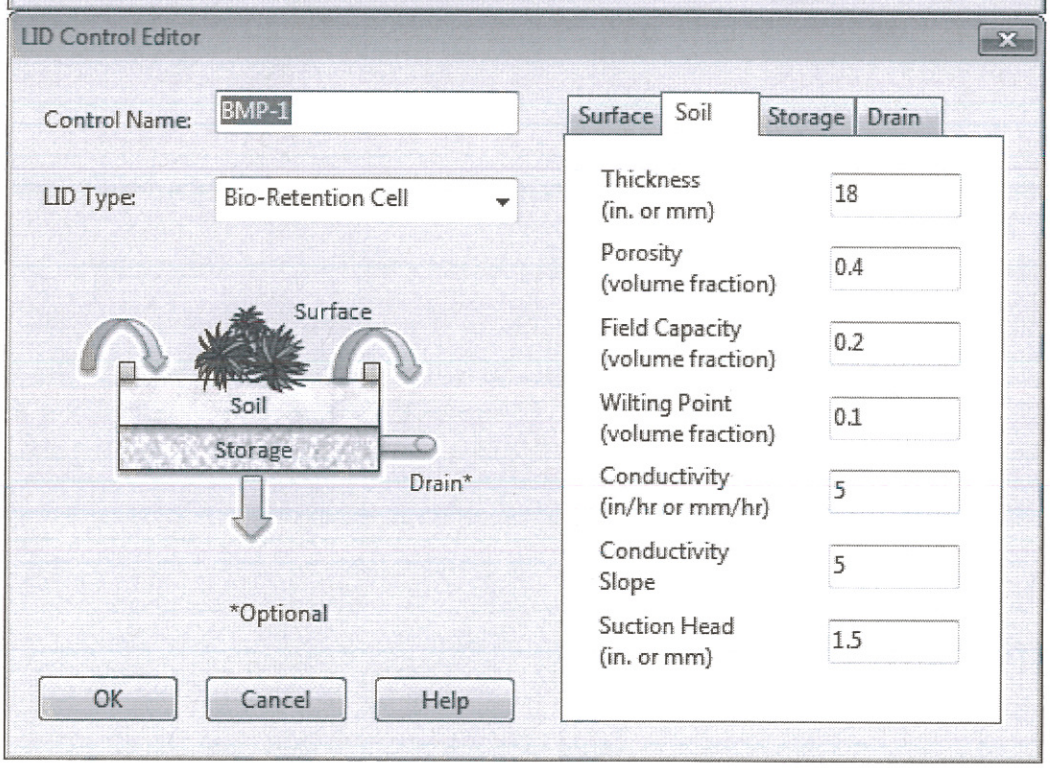
Control Name: BMP-1
LID Type: Bio-Retention Cell
Surface
Soil
Storage
Drain*
*Optional
OK
Cancel
Help
Surface
Soil
Storage
Drain
Berm Height (in. or mm) 12
Vegetation Volume Fraction 0.0
Surface Roughness (Mannings n) 0.1
Surface Slope (percent) 0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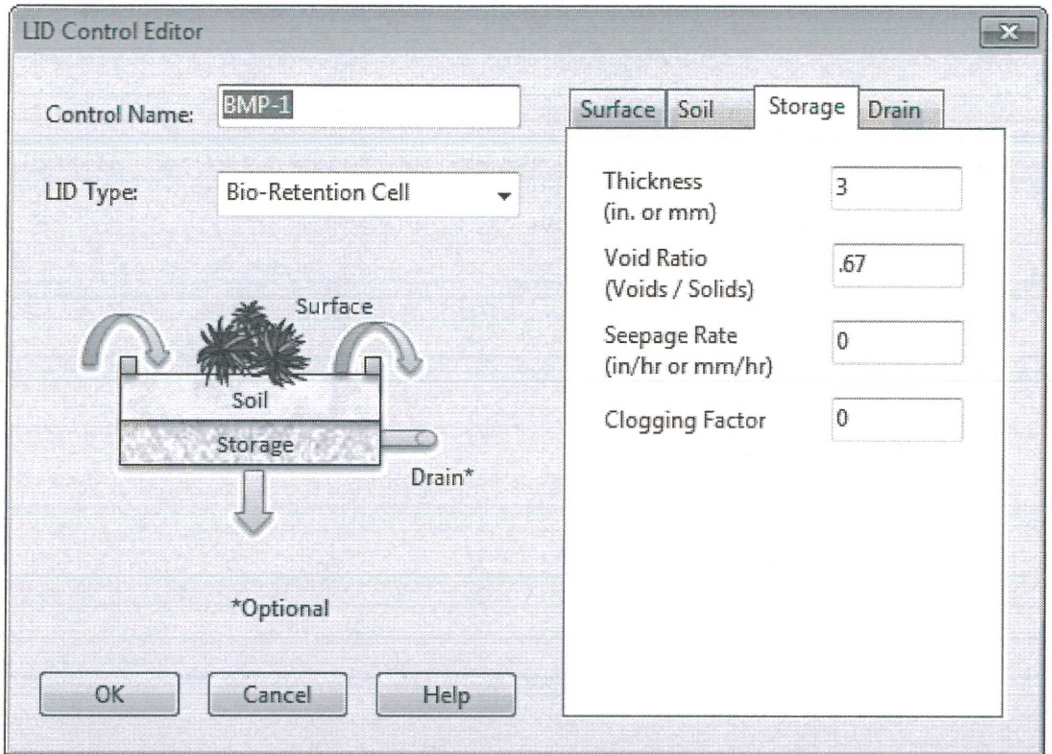
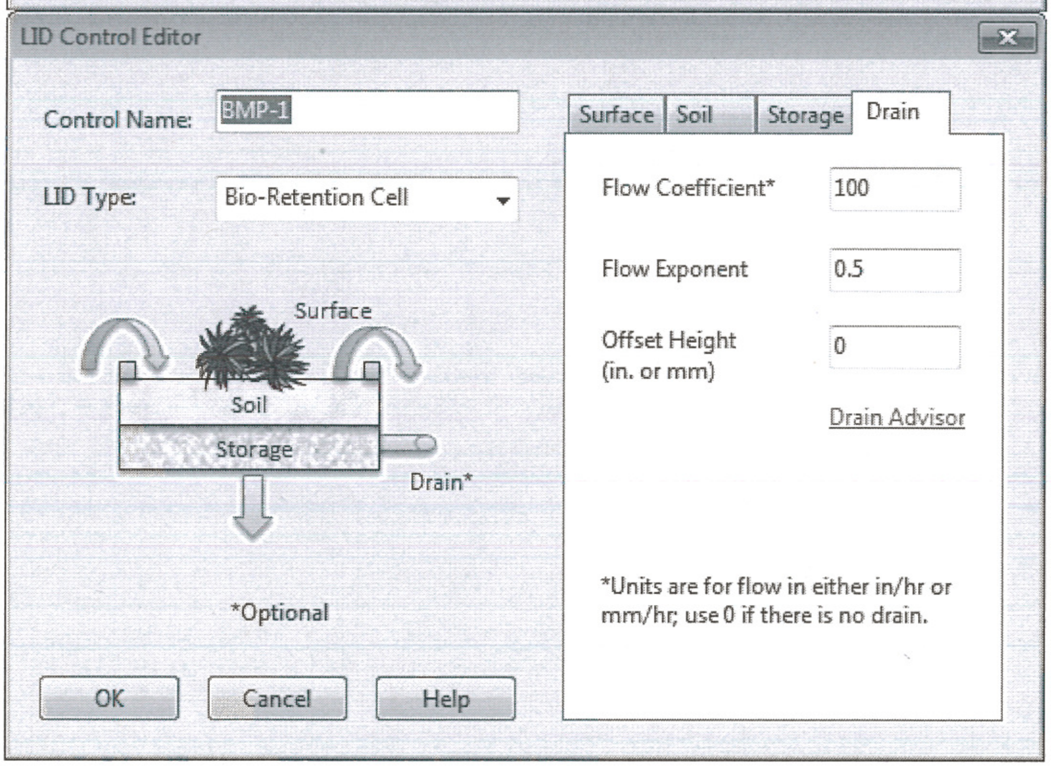
Control Name: BMP-1
LID Type: Bio-Retention Cell
Surface
Soil
Storage
Drain*
*Optional
OK
Cancel
Help
Surface
Soil
Storage
Drain
Thickness (in. or mm) 18
Porosity (volume fraction) 0.4
Field Capacity (volume fraction) 0.2
Wilting Point (volume fraction) 0.1
Conductivity (in/hr or mm/hr) 5
Conductivity Slope 5
Suction Head (in. or mm) 1.5


LID Control Editor
Control Name:
BMP-1
LID Type:
Bio-Retention Cell
Surface
Soil
Storage
Drain
Thickness
(in. or mm)
3
Void Ratio
(Voids / Solids)
.67
Seepage Rate
(in/hr or mm/hr)
0
Clogging Factor
0
Surface
Soil
Storage
Drain*
*Optional
OK
Cancel
Help


LID Control Editor
Control Name:
BMP-1
LID Type:
Bio-Retention Cell
Surface
Soil
Storage
Drain
Flow Coefficient*
100
Flow Exponent
0.5
Offset Height
(in. or mm)
0
Drain Advisor
*Units are for flow in either in/hr or mm/hr; use 0 if there is no drain.
Surface
Soil
Storage
Drain*
*Optional
OK
Cancel
Help

Storage Unit S1

Property	Value
Name	S1
X-Coordinate	2215.190
Y-Coordinate	3037.975
Description	eco-rain storage
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	6.7
Initial Depth	0
Ponded Area	0
Evap. Factor	0
Seepage Loss	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	V1

User-assigned name of storage unit

Storage Unit S2

Property	Value
Name	S2
X-Coordinate	5598.389
Y-Coordinate	2968.930
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	6
Initial Depth	0
Ponded Area	0
Evap. Factor	0
Seepage Loss	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	V2

User-assigned name of storage unit

Orifice O1

Property	Value
Name	O1
Inlet Node	S1
Outlet Node	POC
Description	
Tag	
Type	SIDE
Shape	CIRCULAR
Height	.08
Width	0
Inlet Offset	.25
Discharge Coeff.	0.65
Flap Gate	NO
Time to Open/Close	0

User-assigned name of orifice

Weir W1

Property	Value
Name	W1
Inlet Node	S1
Outlet Node	POC
Description	
Tag	
Type	TRANSVERSE
Height	.5
Length	16
Side Slope	0
Inlet Offset	5.7
Discharge Coeff.	3.33
Flap Gate	NO
End Contractions	0
End Coeff.	0
Can Surcharge	YES
Roadway Weir	
Road Width	0
Road Surface	PAVED

User-assigned name of weir

Orifice O2

Property	Value
Name	O2
Inlet Node	S2
Outlet Node	POC
Description	
Tag	
Type	SIDE
Shape	CIRCULAR
Height	.08
Width	0
Inlet Offset	.25
Discharge Coeff.	0.65
Flap Gate	NO
Time to Open/Close	0

User-assigned name of orifice

Weir W2

Property	Value
Name	W2
Inlet Node	S2
Outlet Node	POC
Description	
Tag	
Type	TRANSVERSE
Height	.5
Length	16
Side Slope	0
Inlet Offset	5
Discharge Coeff.	3.33
Flap Gate	NO
End Contractions	0
End Coeff.	0
Can Surcharge	YES
Roadway Weir	
Road Width	0
Road Surface	PAVED

User-assigned name of weir

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	Structural BMP Maintenance Plan (Required)	☐ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3b	Draft Stormwater Maintenance Notification / Agreement (when applicable)	☐ Included ☒ Not Applicable

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Attachment 3a 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

Attachment 3b: For all Structural BMPs, Attachment 3b must include a draft maintenance agreement in the County's standard format depending on the Category (PDP applicant to contact County staff to obtain the current maintenance agreement forms). Refer to Section 7.3 in the BMP Design Manual for a description of the different categories.

BF-1
Biofiltration

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

Biofiltration facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Biofiltration facilities have limited or no infiltration. They are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Typical biofiltration components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure

Normal Expected Maintenance

Biofiltration requires routine maintenance to: remove accumulated materials such as sediment, trash or debris; maintain vegetation health; maintain infiltration capacity of the media layer; replenish mulch; and maintain integrity of side slopes, inlets, energy dissipators, and outlets. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The BMP is not drained between storm events. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.
- Sediment, trash, or debris accumulation greater than 25% of the surface ponding volume within one month. This means the load from the tributary drainage area is too high, reducing BMP function or clogging the BMP. This would require pretreatment measures within the tributary area draining to the BMP to intercept the materials. Pretreatment components, especially for sediment, will extend the life of components that are more expensive to replace such as media, filter course, and aggregate layers.
- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

Biofiltration is a vegetated structural BMP. Vegetated structural BMPs that are constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of the United States Army Corps of Engineers, SDRWQCB, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, **routine maintenance is key to preventing this scenario**.

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION

The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district.

Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintenance when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintenance when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION (Continued from previous page)

Threshold/Indicator	Maintenance Action	Typical Maintenance Frequency
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintenance when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 1 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Accumulation of sediment, litter, or debris Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials, without damage to the vegetation ☐ If sediment, litter, or debris accumulation exceeds 25% of the surface ponding volume within one month (25% full*), add a forebay or other pre-treatment measures within the tributary area draining to the BMP to intercept the materials. ☐ Other / Comments:		
Poor vegetation establishment Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 2 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Dead or diseased vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		
Overgrown vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Mow or trim as appropriate ☐ Other / Comments:		
2/3 of mulch has decomposed, or mulch has been removed Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 3 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Erosion due to concentrated irrigation flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas and adjust the irrigation system ☐ Other / Comments:		
Erosion due to concentrated storm water runoff flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan ☐ If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 4 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Obstructed inlet or outlet structure Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Underdrain clogged (inspect underdrain if standing water is observed for longer than 24-96 hours following a storm event) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Damage to structural components such as weirs, inlet or outlet structures Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 5 of 5

Threshold/Indicator	Maintenance Recommendation	Date	Description of Maintenance Conducted
Standing water in BMP for longer than 24-96 hours following a storm event* Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

*Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.

**If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.

MAINTENANCE PARAMETERS

ECORAIN AMERICA TANKS, 1” (25 mm) & 2” (50mm) DRAINAGE CELLS

EcoRain America Tank Systems’ philosophy recommends **Point Source** filtration of water before it enters the EcoRain America Tanks or Drainage Cells.

POINT SOURCE (BIOSWALE) WATER FILTRATION:
Water filtration occurs through a permeable surface above the EcoRain America Tank structure. Large suspended solids such as silt, fines and trash, are filtered out before water enters the system - there is nothing to clean out of the Tank structure.
*Inspect the permeable surface every twelve months for clogging and clean if necessary.

COMMERCIAL FILTER:
If water enters the Tank structure via pipe, a filter should be installed on the inlet pipe, in the case of EcoRain America filters "on top" of tanks or inline maintenance is relegated to the top basket, easy removal clean and reinstall, all cleanout must be done BEFORE rain season.

CATCH BASIN:
When a catchment basin with a filter insert is used, maintenance is relegated to removal of gross pollutants from the catch basin. A catch basin designed to handle the appropriate volume of water will not allow trash or large sediments to enter the Eco-Rain Tank.
*Inspect the catch basin at least every six months and clean-out as necessary.

When using the 2” Drainage Cells to line a catchment basin with sand in the bottom, use CLEAN river sand; scrape the surface at least every six months to keep it open and available to freely filter water into the system.

MAINTENANCE LOG:
Keep a log of all inspection and maintenance preformed on the Eco-Rain Tank structure. Keep this log on-site.
Eco-Rain Tank Systems warranty is void if unfiltered water is directed into the Tank structure.

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP HU-1 CISTERN

Cisterns are containers that capture runoff (typically rooftop runoff) and store it for future use such as irrigation or alternative grey water between storm events. Cisterns can be aboveground or below ground systems. Typical cistern components include:

- Storage container, barrel or tank for holding captured flows
- Inlet and associated valves and piping
- Outlet and associated valves and piping
- Overflow outlet
- Access riser or tank serviceway (i.e., access for underground and above-ground cisterns)
- Optional pump
- Optional first flush diverters
- Optional debris screen or pretreatment BMP (e.g., roof drain filter, drainage inlet insert)
- Optional roof, supports, foundation, level indicator, and other accessories

Normal Expected Maintenance

Cisterns can be expected to accumulate sediment and debris that is small enough to pass through the inlet into the storage container. Larger debris such as leaves or trash may accumulate at the inlet. While the storage container is generally a permanent structure, ancillary parts including valves, piping, screens, level indicators, and other accessories will wear and require occasional replacement. Maintenance of a cistern generally involves: removing accumulated sediment and debris from the inlet and storage container on a routine basis; and replacement of ancillary parts on an as-needed basis. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet. If the system as a whole includes a pump or other electrical equipment, maintenance of the equipment shall be based on the manufacturer's recommended maintenance plan.

Non-Standard Maintenance or BMP Failure

If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The inlet is found to be obstructed at every inspection such that storm water bypasses the cistern. The cistern is not functioning properly if it is not capturing storm water. This would require addition of ancillary features to protect the inlet, or pretreatment measures within the watershed draining to the cistern to intercept larger debris, such as screens on roof gutters, or drainage inserts within catch basins. Increase the frequency of inspection until the issue is resolved.
- Accumulation of sediment within one year is greater than 25% of the volume of the cistern. This means the sediment load from the tributary drainage area has diminished the storage volume of the cistern and the cistern will not capture the required volume of storm water. This would require pretreatment measures within the tributary area draining to the cistern to intercept sediment.
- The cistern is not drained between storm events. If the cistern is not drained between storm events, the storage volume will be diminished and the cistern will not capture the required volume of storm water from subsequent storms. This would require implementation of practices onsite to drain and use the stored water, or a different BMP if onsite use cannot be reliably sustained.

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR HU-1 CISTERN

The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district.

Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.

Threshold/Indicator	Maintenance Action	Typical Inspection and Maintenance Frequency
Accumulation of sediment, litter, or debris at the inlet	Remove and properly dispose of accumulated materials.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Outlet blocked	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Accumulation of sediment, litter, or debris in the storage container	Remove and properly dispose of accumulated materials.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove materials annually (minimum), or more frequently when BMP is 25% full* (or at manufacturer threshold if manufacturer threshold is less than 25% full*) in less than one year, or if accumulation blocks outlet
Standing water in storage container between storm events outside of normal use timeframe for the stored water. Normal use timeframe is 36 to 96 hours following a storm event depending on the purpose and design of the cistern.	Use the water as intended, or disperse to landscaping. Implement practices onsite to drain and use the stored water. Contact the [City Engineer] to determine a solution if onsite use cannot be reliably sustained.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure)

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR HU-1 CISTERN (Continued from previous page)

Threshold/Indicator	Maintenance Action	Typical Inspection and Maintenance Frequency
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by using the water as intended for irrigation or alternative grey water, or by dispersing to landscaping; second, check cistern outlet for blockage and clear blockage if applicable to restore drainage; third, install barriers such as screens that prevent mosquito access to the storage container.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Leaks or other damage to ancillary parts including valves, piping, screens, level indicators, and other accessories	Repair or replace as applicable.	• Inspect twice per year. • Maintenance when needed.
Leaks or other damage to storage container	Repair or replace as applicable.	• Inspect twice per year. • Maintenance when needed.
Cistern leaning or unstable, damage to roof, supports, anchors, or foundation	Make repairs as appropriate to correct the problem and stabilize the system.	• Inspect twice per year. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/
California Storm Water Quality Association (CASQA). 2003. Municipal BMP Handbook.
https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook
County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html
San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet HU-1.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

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Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR HU-1 CISTERN PAGE 1 of 4

Threshold/Indicator	Maintenance Recommendation	Date	Description of Maintenance Conducted
Accumulation of sediment, litter, or debris at the inlet Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials ☐ If the inlet is found to be obstructed at every inspection, add features to protect the inlet, or pretreatment measures within the watershed ☐ Other / Comments:		
Outlet blocked Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR HU-1 CISTERN PAGE 2 of 4			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Standing water in storage container between storm events outside of normal use timeframe for the stored water. Normal use timeframe is 36 to 96 hours following a storm event depending on the purpose and design of the cistern. Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Use the water as intended, or disperse to landscaping ☐ Implement practices onsite to drain and use the stored water ☐ Contact the [City Engineer] to determine a solution if onsite use cannot be reliably sustained ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Use the water as intended, or disperse to landscaping ☐ Install barriers such as screens that prevent mosquito access to the storage container ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR HU-1 CISTERN PAGE 3 of 4

Threshold/Indicator	Maintenance Recommendation	Date	Description of Maintenance Conducted
Accumulation of sediment, litter, or debris in the storage container – to be cleared once per year or when debris accumulation is 25% of the total container volume, or accumulation blocks outlet, whichever is more frequent Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials ☐ If accumulation of sediment within one year is >25% of the volume of the cistern, add pretreatment measures within the watershed ☐ Other / Comments:		
Leaks or other damage to storage container Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR HU-1 CISTERN PAGE 4 of 4

Threshold/Indicator	Maintenance Recommendation	Date	Description of Maintenance Conducted
Leaks or other damage to ancillary parts including valves, piping, screens, level indicators, and other accessories Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		
Cistern leaning or unstable, damage to roof, supports, anchors, or foundation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make repairs as appropriate to correct the problem and stabilize the system ☐ Other / Comments:		

ATTACHMENT 4

County of San Diego PDP Structural BMP Verification for Permitted Land Development Projects

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ATTACHMENT 5

Copy of Plan Sheets Showing Permanent Storm Water BMPs, Source Control, and Site Design

See
DMA Exhibit

This is the cover sheet for Attachment 5.

Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

☐ Structural BMP(s) with ID numbers matching Step 6 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 County 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 4 and 5 of the SWQMP. Can be included as a separate exhibit as necessary.

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ATTACHMENT 6

Copy of Project's Drainage Report

This is the cover sheet for Attachment 6.

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

Title: Preliminary Drainage Report
Prepared By: SB&O, Inc.
Date: December 17, 2019

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ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 7.

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

Title: Geotechnical Investigation - 1118 North Anza Street Townhomes - El Cajon, California
Prepared By: Geocon, Inc.
Date: May 10, 2018

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GEOTECHNICAL INVESTIGATION

1118 NORTH ANZA STREET TOWNHOMES EL CAJON, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

HALL LAND COMPANY, INC.
SOLANA BEACH, CALIFORNIA

MAY 10, 2018
PROJECT NO. G2259-32-01

Project No. G2259-32-01
May 10, 2018

Hall Land Company, Inc.
740 Lomas Santa Fe Drive, Suite 204
Solana Beach, California, 92057

Attention: Mr. Sean Santa Cruz

Subject: GEOTECHNICAL INVESTIGATION
1118 NORTH ANZA STREET TOWNHOMES
EL CAJON, CALIFORNIA

Dear Mr. Santa Cruz:

In accordance with your request, and our Proposal No. LG-18099 dated March 6, 2018, we have performed a geotechnical investigation on the subject property in El Cajon, California. The accompanying report presents our conclusions and recommendations pertaining to the geotechnical aspects of project development. The results of our study indicate that the site can be developed as planned, provided the recommendations of this report are followed.

If there are 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

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GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed *1118 North Anza Street* residential development located in El Cajon, California (see *Vicinity Map,* Figure 1). The purpose of this study was to evaluate the soil and geologic conditions on the site and provide specific geotechnical recommendations pertaining to the development of the property as proposed based on the conditions encountered.

The scope of our study consisted of the following:

- Reviewing satellite imagery, previous geotechnical reports and readily available published and unpublished geologic literature.
- Excavating nine exploratory trenches to evaluate the general extent and condition of surficial deposits across the site (see Appendix A for trench logs).
- Drilling 5 hollow-stem auger borings to evaluate the general extent and condition of surficial deposits and granitic rock across the site (see Appendix A for boring logs).
- Coring the surrounding roadways to evaluate the existing pavement sections on North Anza Street and Denver Lane. A total of 3 cores were drilled and backfilled with asphalt cold patch.
- Performing laboratory tests on selected soil samples collected to evaluate their physical properties (see Appendix B).
- Providing a storm water infiltration investigation to assist in evaluating feasibility of infiltrating storm water on-site in accordance with the 2016 storm water standards (see Appendix C). Three Aardvark constant head permeameter tests were performed to evaluate the permeability characteristics of the underlying soils.
- Preparing this report presenting our exploratory information and our conclusions and recommendations regarding the geotechnical aspects of developing the site as presently proposed. The approximate locations of the subsurface excavations are shown on the *Geologic Map*, Figure 2.

2. SITE AND PROJECT DESCRIPTION

The property consists of approximately 3 acres of land located north of Broadway, east of North Mollison Avenue, and south of East Bradley Avenue (see Vicinity Map, Figure 1). The site is currently occupied by four single family houses.

Topographically, the site is characterized as relatively flat with an elevation of approximately 446 to 451 feet above Mean Sea Level (MSL). The property is relatively void of vegetation. Several isolated trees and some sparse vegetation is present.

It is our understanding that the proposed development will consist of grading the property to accommodate a two-story, 39-unit development with associated underground utilities and landscaping improvements. Grading plans were not available, however, we understand that existing grades will be raised approximately 10 feet across the property. Maximum cut and fill depths are expected to be on the order of approximately 3 to 13 feet, respectively.

The descriptions contained herein are based upon the site reconnaissance and our understanding of the project. If project details vary significantly from those outlined herein, Geocon Incorporated should be notified for review and possible revisions to this report prior to final design submittal.

3. SOIL AND GEOLOGIC CONDITIONS

One surficial soil type and one geologic formation was encountered during the field investigation. The surficial deposit consists of colluvium and the formational unit consists of granitic rock. Each of the geologic units is described below in order of increasing age. The approximate extent of the deposits are shown on the *Geologic Map*.

3.1 Colluvium (Qcol)

Colluvium was observed in all of the exploratory excavations across the property. The colluvium overlies the granitic rock, varies in thickness from approximately 5 to 12 feet, and is generally comprised of loose to dense, dry to moist, silty/clayey sand and stiff, moist, sandy clay. The upper approximately 3 feet of these deposits will require remedial grading in areas of proposed improvements.

3.2 Granitic Rock (Kgr)

Cretaceous-age granitic rock of the Southern California Batholith underlies the site beneath the surficial deposits. Granitic rock was encountered between approximately 5 and 12 feet below the ground surface. The Granitic rock excavates as a brown to dark gray, silty/clayey, fine to coarse sand. Generally, the granitic rock is completely to highly weathered; however, hard core-stones may also be present. Fractures and/or joints within the rock may contribute to the propagation of groundwater or seepage. Excavations within this unit can typically be accomplished with conventional heavy-duty grading and trenching equipment with heavy to very heavy effort and possible refusal. The granitic rock is considered suitable for the support of the proposed development, however, is not expected to

be encountered, except for underground excavations greater than approximately 5 feet below existing grades.

4. GROUNDWATER

Groundwater was not encountered during the field investigation, however, minor to moderate seepage was observed along the granitic rock contact. The seepage is not anticipated to significantly impact project development as presently proposed. Proper surface drainage of irrigation and rainwater will be important to future performance of the project.

5. GEOLOGIC HAZARDS

5.1 Faulting

Based on our reconnaissance and a review of published geologic maps and reports, the site is not located on any known "active," "potentially active" or "inactive" fault traces as defined by the California Geological Survey (CGS).

The Newport-Inglewood and Rose Canyon Faults, located approximately 14 miles west of the site, are the closest known active faults. The CGS considers a fault seismically active when evidence suggests seismic activity within roughly the last 11,000 years. The CGS has included portions of the Rose Canyon Fault zone within an Alquist-Priolo Earthquake Fault Zone.

5.2 Seismicity-Deterministic Analysis

We used the computer program *EZ-FRISK* (Version 7.65) to determine the distance of known faults to the site and to estimate ground accelerations at the site for the maximum anticipated seismic event.

According to the results of the computer program *EZ-FRISK* (Version 7.65), 7 known active faults are located within a search radius of 50 miles from the property. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) NGA in our analysis. The nearest known active faults are the Newport-Inglewood and Rose Canyon Fault Zones, located approximately 14 miles west of the site, respectively, and are the dominant sources of potential ground motion. Table 5.2 lists the estimated maximum earthquake magnitudes and PGA's for the most dominant faults for the site location calculated for Site Class D as defined by Table 1613.3.2 of the 2016 California Building Code (CBC).

TABLE 5.2
DETERMINISTIC SPECTRA SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2007 (g)
Newport-Inglewood	14	7.5	0.23	0.17	0.22
Rose Canyon	14	6.9	0.19	0.15	0.16
Coronado Bank	26	7.4	0.16	0.11	0.12
Palos Verdes Connected	26	7.7	0.18	0.12	0.15
Elsinore	29	7.85	0.18	0.12	0.15
Earthquake Valley	33	6.8	0.11	0.07	0.07
San Jacinto	49	7.88	0.12	0.08	0.10

5.3 Seismicity-Probabilistic Analysis

We used the computer program *EZ-FRISK* (version 7.65) to perform a probabilistic seismic hazard analysis. *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the fault slip rate. The program accounts for earthquake magnitude as a function of rupture length. Site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) NGA USGS 2008 in the analysis. Table 5.3 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence for Site Class D.

TABLE 5.3
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.43	0.36	0.41
5% in a 50 Year Period	0.33	0.27	0.30
10% in a 50 Year Period	0.26	0.22	0.23

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the California Building Code (CBC) or City of El Cajon guidelines.

5.4 Landslides

No evidence of ancient landslide deposits was encountered at the site during the geotechnical investigation.

5.5 Liquefaction and Seismically Induced Settlement

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 relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from the earthquake-generated ground accelerations. Seismically induced settlement is settlement that may occur whether the potential for liquefaction exists or not. The potential for liquefaction and seismically induced settlement occurring within the site soils is considered to be “very low” due to the geologic conditions encountered, remedial grading recommended, and absence of groundwater.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 No soil or geologic conditions were encountered that, in the opinion of Geocon Incorporated, would preclude the development of the property as proposed, provided the recommendations of this report are followed.

6.1.2 The site is underlain by approximately 5 to 12 feet of colluvial deposits over granitic rock. Based on our observations and laboratory test results, the upper portions of the colluvial deposits are dry and potentially compressible when subjected to additional loading, and will require remedial grading.

6.1.3 With the exception of possible strong seismic shaking, no geologic hazards were observed or are known to exist based on our study that would adversely affect the proposed project. No special seismic design considerations, other than those recommended herein, are required.

6.1.4 The proposed structures can be supported by conventional continuous and isolated spread foundations supported entirely in compacted fill.

6.1.5 Any existing structures, foundation systems, pavement, utility lines, etc., should be removed and exported from the site prior to grading. Undocumented fills associated with these items and with past underground improvements should also be removed and properly compacted. Geocon Incorporated should observe the underlying geologic conditions and provide testing and observation services during the backfill of the resulting excavations where necessary.

6.2 Excavation and Soil Characteristics

6.2.1 Excavation of the surficial soils should be possible with light to moderate effort using conventional heavy-duty equipment. Excavations within the granitic rock, if any, should be possible with moderate to heavy effort using conventional heavy-duty equipment.

6.2.2 The soils encountered in the field investigation are considered to be "expansive" (expansion index [EI] greater than 20) as defined by 2016 California Building Code (CBC) Section 1803.5.3 based on laboratory testing. Table 6.2 presents soil classifications based on the expansion index.

TABLE 6.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM 4829 Expansion Classification	2016 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

6.3 Corrosion

6.3.1 We performed laboratory tests on a sample of the site materials to evaluate the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate content tests are presented in Appendix B and indicate that the on-site materials at the locations tested possess "S0" to "S2" sulfate exposure and "Not Applicable" to "Severe" sulfate severity to concrete structures as defined by 2016 CBC Section 1904 and ACI 318-14 Chapter 19. 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 6.3 presents a summary of concrete requirements set forth by 2016 CBC Section 1904 and ACI 318.

TABLE 6.3
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Severity	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)
Not Applicable	S0	$SO_4<0.10$	No Type Restriction	n/a	2,500
Moderate	S1	$0.10\leq SO_4<0.20$	II	0.50	4,000
Severe	S2	$0.20\leq SO_4\leq 2.00$	V	0.45	4,500
Very Severe	S3	$SO_4>2.00$	V+Pozzolan or Slag	0.45	4,500

[1] Maximum water to cement ratio limits do not apply to lightweight concrete.

6.3.2 Geocon Incorporated does not practice in the field of corrosion engineering. Therefore, if improvements that could be susceptible to corrosion are planned, it is recommended that further evaluation by a corrosion engineer be performed.

6.4 Grading Recommendations

6.4.1 All grading should be performed in accordance with the attached *Recommended Grading Specifications* (Appendix D). Where the recommendations of this section conflict with Appendix D, the recommendations of this section take precedence. All earthwork should be observed and all fills tested for proper compaction by Geocon Incorporated.

6.4.2 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/or the grading plans can be discussed at that time.

6.4.3 Site preparation should begin with the removal of all deleterious material, asphalt concrete, concrete, and vegetation. The depth of removal should be such that material exposed in cut areas or soils to be used as fill are relatively free of organic matter and construction debris. Material generated during stripping and/or site demolition should be exported from the site.

6.4.4 The upper 3 feet of the surficial soils across the entire site should be removed, moisture conditioned, and properly compacted to provide uniform foundation conditions. The actual extent of unsuitable soil removal will be determined in the field by the geotechnical engineer and/or engineering geologist.

6.4.5 After removal of unsuitable materials is performed, the site should then 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 maximum dry density at or above optimum moisture content, as determined in accordance with ASTM Test Procedure D1557. Fill materials below optimum moisture content will require additional moisture conditioning prior to placing additional fill.

6.4.6 Where practical, the upper 3 feet of the building pads should be comprised of soil with a "very low" to "low" expansion potential. The more highly expansive fill soils should be placed in the deeper fill areas, if present. "Very low" to "low" expansive soils are defined by the 2016 California Building Code (CBC) Section 1803.5.3 as those soils that have an Expansion Index of 50 or less.

6.4.7 Prior to placing fill, the ground surface should be scarified to a depth of 12 inches, moisture conditioned, and compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content, as determined by ASTM Test Method D 1557. Deeper processing and/or removal may be necessary in areas where loose, wet or dry soils are encountered.

6.4.8 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations in order to maintain safety and maintain the stability of adjacent existing improvements.

6.4.9 Import fill should consist of granular materials with a "very low" to "low" expansion potential (EI of 50 or less) free of deleterious material or stones larger than 3 inches, and should be compacted as recommended above. Geocon Incorporated should be notified of the import soil source and should perform laboratory testing of import soil prior to its arrival at the site to determine its suitability as fill material.

6.5 Seismic Design Criteria

6.5.1 We used the computer program *U.S. Seismic Design Maps*, provided by the USGS. Table 6.5.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 seconds. The values presented in Table 6.5.1 are for the risk-targeted maximum considered earthquake (MCE_R). Based on soil conditions and planned grading, the building should be designed using a Site Class D. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10.

TABLE 6.5.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.867g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.336g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.153	Table 1613.3.3(1)
Site Coefficient, F_V	1.728	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.000g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.580g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.666g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.387g	Section 1613.3.4 (Eqn 16-40)

6.5.2 Table 6.5.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 6.5.2
2016 CBC SITE ACCELERATION PARAMETERS

Parameter	Value, Site Class D	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.326g	Figure 22-7
Site Coefficient, F_{PGA}	1.174	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.383g	Section 11.8.3 (Eqn 11.8-1)

6.5.3 Conformance to the criteria for seismic design does not constitute any guarantee or assurance that significant structural damage or ground failure will not occur in the event of a maximum level earthquake. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive.

6.6 Foundation and Concrete Slab-On-Grade Recommendations

6.6.1 The following foundation recommendations 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 6.6.1.

TABLE 6.6.1
FOUNDATION CATEGORY CRITERIA

Foundation Category	Maximum Fill Thickness, T (feet)	Differential Fill Thickness, D (feet)	Expansion Index (EI)
I	T<20	--	EI≤50
II	20≤T<50	10≤D<20	50<EI≤90
III	T≥50	D≥20	90<EI≤130

6.6.2 We will provide the final foundation category for the buildings after finish pad grades have been achieved and laboratory testing of the finish grade soil has been completed. However, we expect Category I foundations due to the planned import of low expansive soil.

6.6.3 Table 6.6.2 presents minimum foundation and interior concrete slab design criteria for conventional foundation systems.

TABLE 6.6.2
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Footing Embedment Depth (inches)	Continuous Footing Reinforcement	Interior Slab Reinforcement
I	12	Two No. 4 bars, one top and one bottom	6 x 6 - 10/10 welded wire mesh at slab mid-point
II	18	Four No. 4 bars, two top and two bottom	No. 3 bars at 24 inches on center, both directions
III	24	Four No. 5 bars, two top and two bottom	No. 3 bars at 18 inches on center, both directions

6.6.4 The embedment depths presented in Table 6.6.2 should be measured from the lowest adjacent pad grade for both interior and exterior footings. The conventional foundations should have a minimum width of 12 inches and 24 inches for continuous and isolated footings, respectively. A typical wall/column footing detail is presented on Figure 3.

6.6.5 The concrete slabs-on-grade should be a minimum of 4 inches thick for Foundation Categories I and II and 5 inches thick for Foundation Category III. The concrete slabs-on-grade should be underlain by 4 inches and 3 inches of clean sand for 4-inch thick and 5-inch-thick slabs, respectively. Slabs expected to receive moisture sensitive floor coverings or used to store moisture sensitive materials should be underlain by a vapor inhibitor covered with at least 2 inches of clean sand or crushed rock. If crushed rock will be used, the thickness of the vapor inhibitor should be at least 10 mil to prevent possible puncturing.

6.6.6 As a substitute, the layer of clean sand (or crushed rock) beneath the vapor inhibitor recommended in the previous section can be omitted if a vapor inhibitor that meets or exceeds the requirements of ASTM E 1745-97 (Class A), and that exhibits permeance not greater than 0.012 perm (measured in accordance with ASTM E 96-95) is used. This vapor inhibitor may be placed directly on properly compacted fill or formational materials. The vapor inhibitor should be installed in general conformance with ASTM E 1643-98 and the manufacturer's recommendations. Two inches of clean sand should then be placed on top of the vapor inhibitor to reduce the potential for differential curing, slab curl, and cracking. Floor coverings should be installed in accordance with the manufacturer's recommendations.

6.6.7 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 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 2016 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 6.6.3 for the particular Foundation Category designated. The parameters presented in Table 6.6.3 are based on the guidelines presented in the PTI DC 10.5 design manual.

TABLE 6.6.3
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI), Third Edition 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

6.6.8 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 2016 CBC. If post-tensioned foundations are planned, an alternative, commonly accepted design method (other than PTI DC 10.5) 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. This foundation category alternative is commonly referred to as CAT 1A.

6.6.9 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).

6.6.10 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.

6.6.11 If the structural engineer proposes a post-tensioned foundation design method other than PTI DC 10.5:

- The deflection criteria presented in Table 6.6.3 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.

6.6.12 Our experience indicates post-tensioned slabs may be susceptible to excessive edge lift, 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.

6.6.13 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless designed by the structural engineer.

6.6.14 Category I, II, or III foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient

6.6.15 Isolated footings, 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.

6.6.16 For Foundation Category III, consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness. 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.

6.6.17 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.

6.6.18 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, building 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.

6.6.19 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein. Slab panels should be a minimum of 4 inches thick and, when in excess of 8 feet square, should be reinforced with 6 x 6 - W2.9/W2.9 (6 x 6 - 6/6) welded wire mesh or No. 3 reinforcing bars at 18 inches on center in both directions to reduce the potential for cracking. In addition, 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 in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be checked prior to placing concrete.

6.6.20 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 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. 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.

6.6.21 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 (ACI) 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.

6.6.22 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

6.7 Retaining Walls and Lateral Loads Recommendations

6.7.1 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid with a density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index $\leq$50. Geocon Incorporated should be consulted for additional recommendations if backfill materials have an EI >50.

6.7.2 Retaining walls shall be designed to ensure stability against overturning sliding, excessive foundation pressure and water uplift. 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.

6.7.3 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf (where H equals the height of the retaining wall portion of the wall in feet) should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 12H where the wall is greater than 8 feet. For retaining walls subject to vehicular loads

within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to two feet of fill soil should be added (total unit weight of soil should be taken as 130 pcf).

6.7.4 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.

6.7.5 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 wall designer should provide appropriate lateral deflection quantities for planned retaining walls structures, if applicable. These lateral values should be considered when planning types of improvements above retaining wall structures.

6.7.6 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI $\leq$50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. A typical retaining wall drainage detail is presented on Figure 4. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

6.7.7 In general, wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within three feet below the base of the wall has an Expansion Index $\leq$ 90. The recommended allowable soil bearing pressure may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable soil bearing pressure of 4,000 psf.

6.7.8 The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated. As a minimum, wall footings should be deepened such that

the bottom outside edge of the footing is at least seven feet from the face of slope when located adjacent and/or at the top of descending slopes.

6.7.9 The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613.3.5 of the 2016 CBC or Section 11.6 of ASCE 7-10. 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 2016 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. A seismic load of 20H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.383g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

6.7.10 For resistance to lateral loads, a passive earth pressure equivalent to a fluid density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed formational materials. The passive pressure assumes a horizontal surface extending away from the base of the wall at least five feet or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance.

6.7.11 An ultimate friction coefficient of 0.35 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the passive earth pressure when determining resistance to lateral loads.

6.7.12 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 12 feet. In the event that walls higher than 12 feet are planned, Geocon Incorporated should be consulted for additional recommendations.

6.8 Mechanically-Stabilized Earth (MSE) Retaining Walls

6.8.1 The geologic conditions in the vicinity of proposed retaining walls are anticipated to consist of compacted fill over formational materials. The formational materials consist of granitic rock. The compacted fill soils in the foundation and retained zones are expected to consist of imported silty sands. Based our experience with similar soil and geologic conditions, we recommend the following geotechnical parameters be used for design of the MSE retaining walls.

TABLE 6.8.1
MSE RETAINING WALL PARAMETERS

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 Weight	125 pcf	125 pcf	125 pcf

6.8.2 The shear strength values used for the reinforced zone assume that predominately granular materials will be stockpiled for use as backfill. Geocon has no way of knowing whether these materials will actually be used as backfill behind the wall during construction. 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 verify 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 geogrid embedment lengths).

6.8.3 Backfill materials within the reinforced zone should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content in accordance with ASTM D 1557. This is applicable to the entire embedment length of the geogrid reinforcement. In addition, the wall designer has maximum particle size (typically 3-inches in size or less) and shape (angular/rounded) requirements for soil-rock fill within the reinforced zone. Typically, wall designers specify that heavy compaction equipment be excluded from within 3 feet of the face of the wall; however, smaller equipment (e.g., walk-behind, self-driven compactors or hand whackers) should 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 geogrid within the uncompacted zone should not be relied upon for reinforcement and overall embedment lengths should be increased to account for the difference.

6.8.4 The wall designer should provide a drainage system sufficient to dissipate hydrostatic pressure behind the wall and to mitigate seepage through and beneath the wall. As such, a subdrain system consisting of a minimum 4-inch diameter, Schedule 40, perforated pvc pipe surrounded by at least 1 cubic foot of ¾-inch open-graded gravel and wrapped in filter fabric (Mirafi 140N or equivalent) should be incorporated into the wall design. In order to prevent soil piping into the open-graded gravel layer behind the wall, we recommend the filter fabric be extended to cover the entire gravel layer. The final segment of the subdrain should outlet into an approved drainage facility, such as storm drain or headwall structure.

The final segment of the drain should consist of solid pvc pipe. At the transition between the solid and perforated pipe, a concrete cut-off wall should be added to direct the subsurface water into the solid pipe.

6.8.5 A peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.383g was calculated from ASCE 7-10 Section 11.8.3. The 2016 CBC seismic design parameters are provided herein.

6.8.6 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), construction, and the type of geosynthetic used. In addition, over time reinforced-earth retaining walls have been known to exhibit creep 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 and should be designed to accommodate this movement.

6.9 Existing Pavements

6.9.1 Table 6.9 presents the existing pavement sections based on a total of 3 cores drilled on the surrounding roadways. The approximate locations of the 6-inch diameter cores are shown on Figure 2.

TABLE 6.9
EXISTING PCC PAVEMENT SECTION

Roadway (sample location)	Core No.	Existing AC Pavement Thickness (inch)	Existing Aggregate Base Thickness (inches)
Denver Street	C-1	2.75	6
North Anza Street	C-2	2.75	5
North Anza Street	C-3	5.25	7

6.10 Site Drainage and Moisture Protection

6.10.1 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 2016 CBC 1804.4 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.

6.10.2 In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

6.10.3 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.

6.11 Grading and Foundation Plan Review

6.11.1 Geocon Incorporated should review the grading and foundation plans for the project prior to final design submittal to determine if additional analysis and/or recommendations are required.

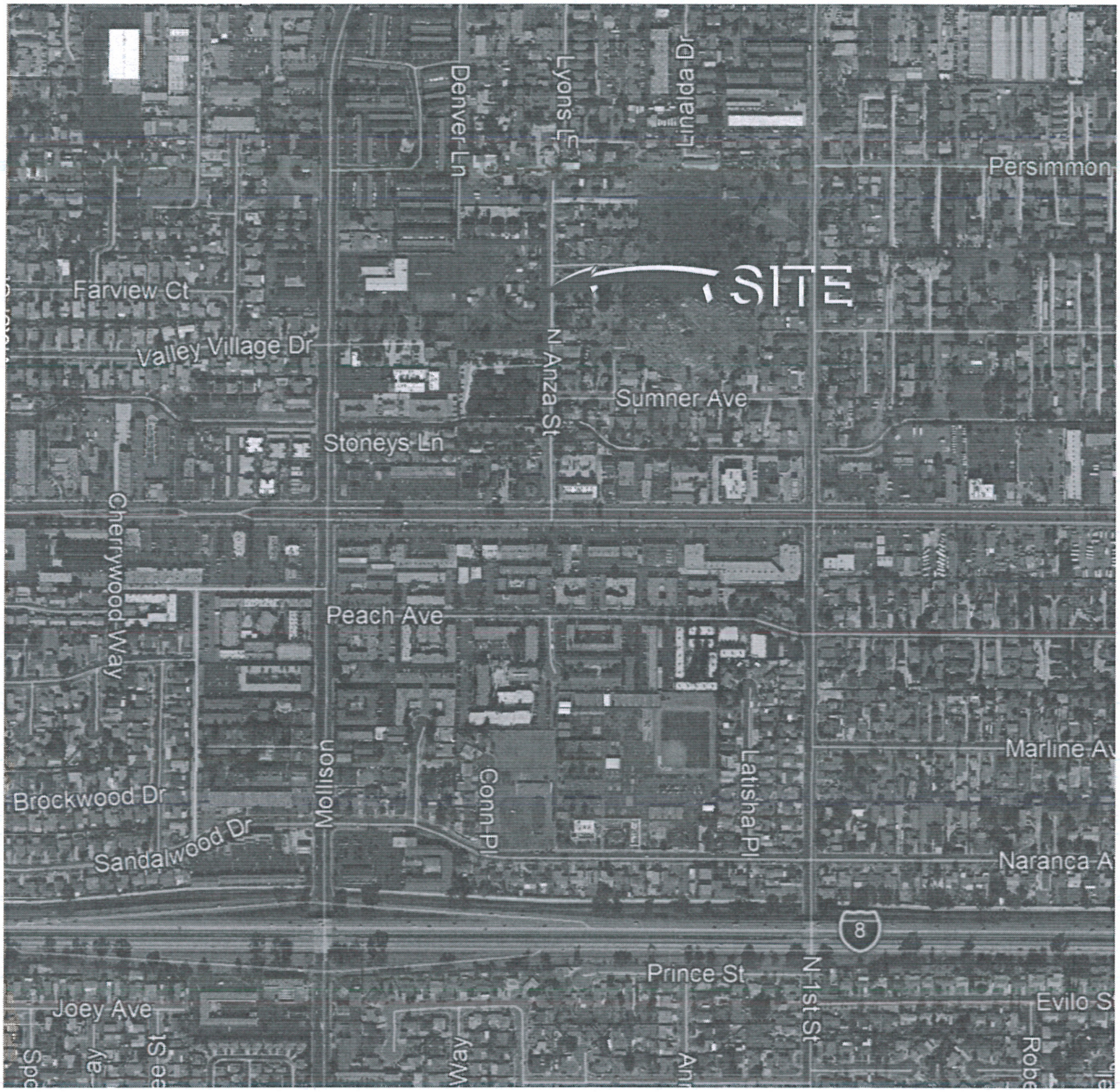
LIMITATIONS AND UNIFORMITY OF CONDITIONS

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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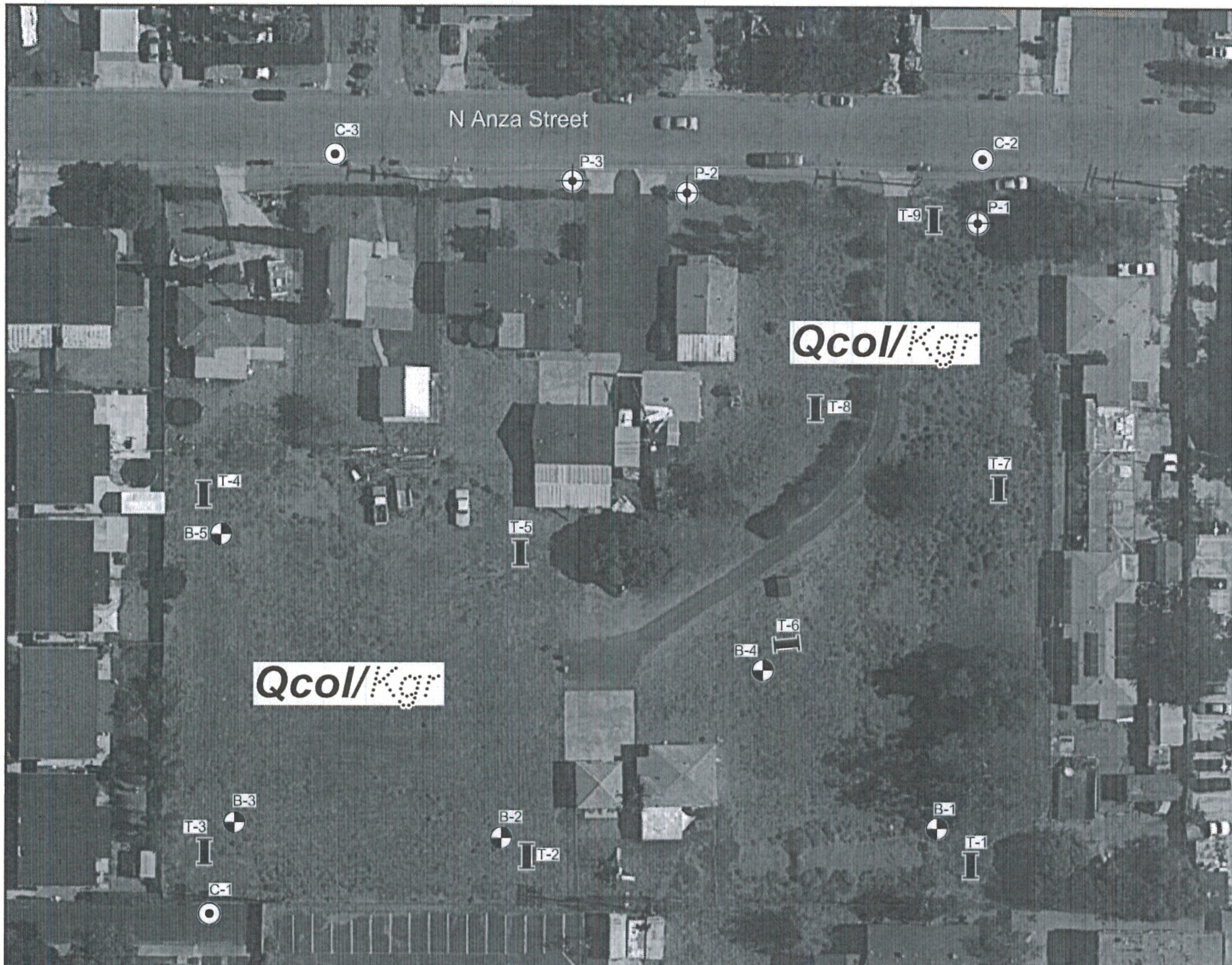
1118 N ANZA STREET TOWNHOMES
EL CAJON, CALIFORNIA

TM / CW		DSK/GTYPD	DATE 05 - 10 - 2018	PROJECT NO. G2259 - 32 - 01	FIG. 1

Plotted:05/10/2018 8:01AM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\G2259-32-01 1118 North Anza Street\DETAILS\G2259-32-01_Vicinity Map.dwg



1118 N ANZA STREET TOWNHOMES
EL CAJON, CALIFORNIA

0' 50' 100'
SCALE 1" = 50' (On 11x17)

GEOCON LEGEND

Qcol ....COLLUVIUM
Kgr ....GRANITIC ROCK (Dotted Where Buried)
B-5 ....APPROX. LOCATION OF GEOTECHNICAL BORING
P-3 ....APPROX. LOCATION OF PERMEABILITY TEST
C-3 ....APPROX. LOCATION OF PAVEMENT CORE
T-8 ....APPROX. LOCATION OF EXPLORATORY TRENCH

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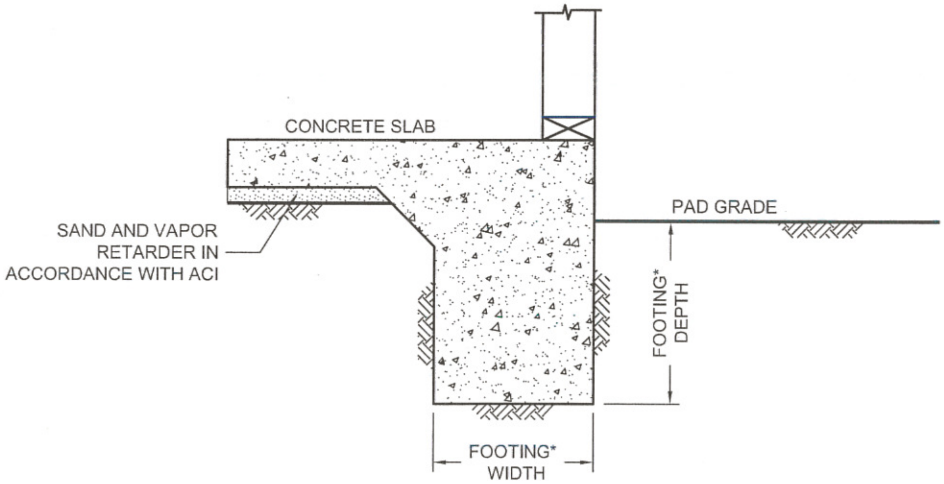
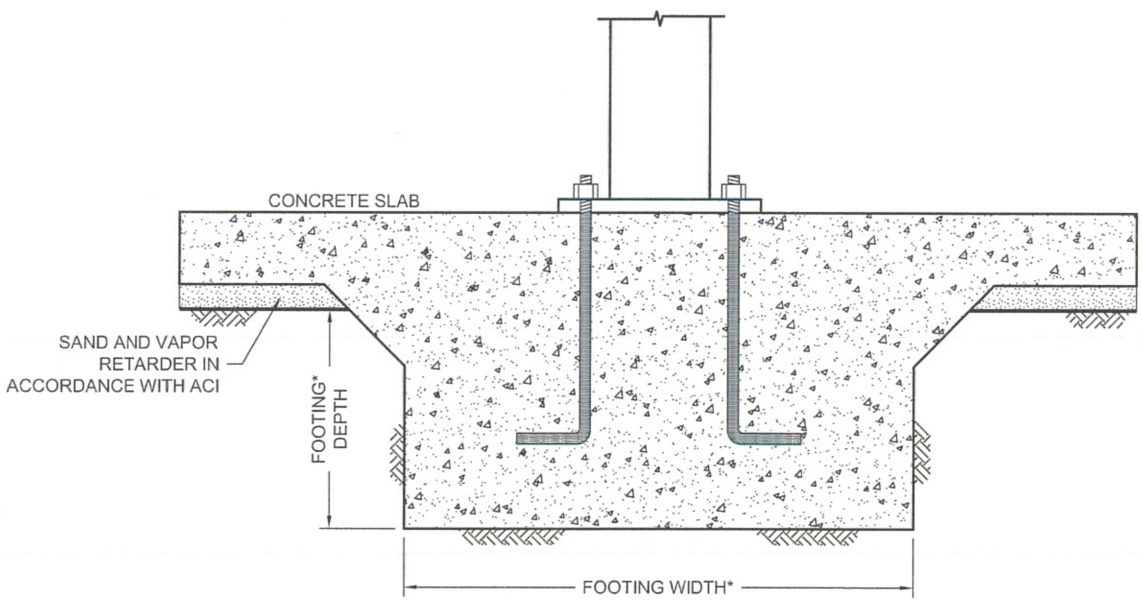
GEOLOGIC MAP
PROJECT NO. G2259 - 32 - 01
FIGURE 2
DATE 05 - 10 - 2018

Plotted:05/10/2018 8:19AM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\G2259-32-01 1118 North Anza Street\SHEETS\G2259-32-01 As-Grd GeoMAP.dwg





*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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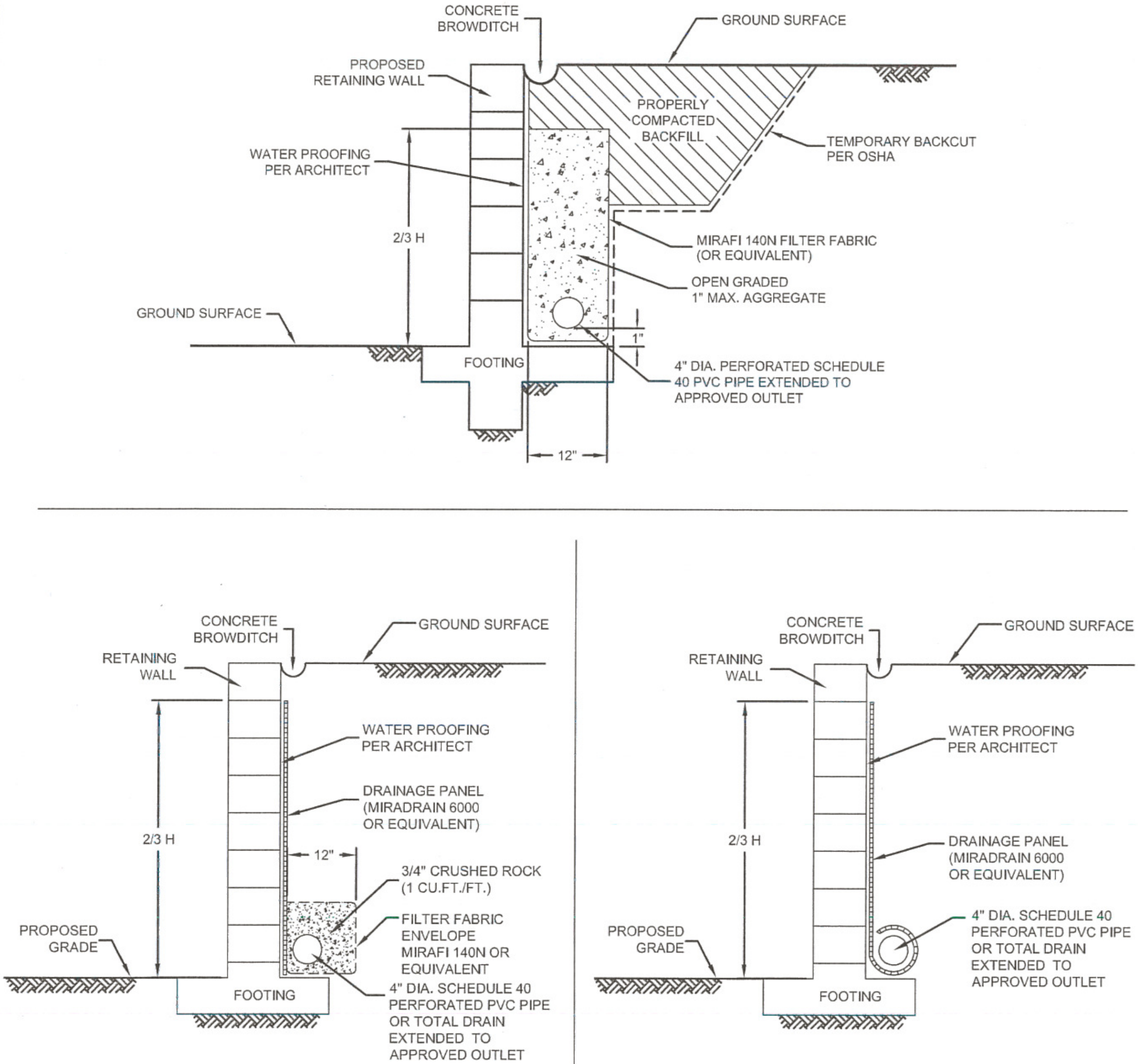
TM / CW		DSK/GTYPD	DATE 05 - 10 - 2018	PROJECT NO. G2259 - 32 - 01	FIG. 3



NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The field investigation was performed on March 19 and March 20, 2018. The field investigation consisted of a visual site reconnaissance and excavating 9 exploratory trenches (Trench Nos. T-1 through T-9) and 5 hollow-stem auger borings (Boring Nos. B-1 through B-5) at various locations across the site. Three permeability tests were conducted on March 19, 2018, to evaluate storm water infiltration feasibility. In addition, 3 pavement cores were drilled to evaluate the existing pavement sections on Denver Lane and North Anza Street. The approximate locations of the trenches, borings, pavement cores, and permeability tests are shown on the *Geologic Map*, Figure 2. The results and discussion of the infiltration testing is discussed in *Appendix C* of this report.

The exploratory trenches performed by Hillside Excavating were advanced to depths of 7 to 17 feet using a JD 410G backhoe equipped with a 24-inch-wide bucket. Bulk samples were obtained for laboratory testing.

The borings were excavated by Scott's Drilling to depths of approximately 9 feet below existing grade using an Ingersoll Rand A-300 truck mounted drill rig. Relatively undisturbed and disturbed bulk samples were obtained from the borings for laboratory testing.

The soils 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 2488).

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 1 ELEV. (MSL.) 446' DATE COMPLETED 03-20-2018 EQUIPMENT INGERSOL RAND 8-300 BY: D. GITHENS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
2								
	B1-1			CL	Stiff, moist, dark brown, Sandy CLAY	44	121.5	12.5
4								
	B1-2				-Becomes hard	56	110.7	17.8
6								
	B1-3					85	114.2	16.2
8					**GRANITIC ROCK (Kgr)** Completely weathered, brownish gray, weak GRANITIC ROCK; excavates as Clayey SAND/Sandy CLAY			
					BORING TERMINATED AT 9 FEET No groundwater encountered			

Figure A-1,
Log of Boring B 1, Page 1 of 1

G2259-32-01.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. G2259-32-01

BORING B 2

ELEV. (MSL.) 447' DATE COMPLETED 03-20-2018

EQUIPMENT INGERSOL RAND 8-300 BY: D. GITHENS

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
2				CL	Hard, moist, brown to dark brown, fine to medium Sandy CLAY			
	B2-1					50/3"	117.7	8.0
4								
	B2-2					50/5"	111.5	18.6
6								
	B2-3			SC	Dense, moist, brown to dark brown, Clayey fine to medium SAND	79	121.4	13.9
8					BORING TERMINATED AT 8 FEET No groundwater encountered			

Figure A-2,
Log of Boring B 2, Page 1 of 1

G2259-32-01.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. G2259-32-01

BORING B 3

ELEV. (MSL.) **447'** DATE COMPLETED **03-20-2018**

EQUIPMENT **INGERSOL RAND 8-300** BY: **D. GITHENS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
				SC	Medium dense, moist, Clayey fine to medium SAND			
2								
	B3-1				-Becomes dense	50/3"	109.8	10.4
4								
	B3-2			CL	Hard, moist, brown to dark brown, Sandy CLAY	78	107.3	21.3
6								
	B3-3					93	105.9	20.0
8					**GRANITIC ROCK (Kgr)** Highly weathered, brownish gray, moderately weak GRANITIC ROCK; excavates as Silty, fine to coarse SAND			
					BORING TERMINATED AT 9 FEET No groundwater encountered			

Figure A-3,
Log of Boring B 3, Page 1 of 1

G2259-32-01.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. G2259-32-01

BORING B 4

ELEV. (MSL.) 448' DATE COMPLETED 03-20-2018

EQUIPMENT INGERSOL RAND 8-300 BY: D. GITHENS

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
2					-Becomes medium dense, moist			
	B4-1			SM-SC	Medium dense, moist, dark brown, Silty/Clayey SAND	41	112.1	3.1
4								
	B4-2					86	128.0	10.8
6					-Becomes dense			
	B4-3				**GRANITIC ROCK (Kgr)** Highly weathered, brownish gray, moderately weak GRANITIC ROCK; excavates as a fine to coarse sand with rock fragments	50/2"	126.2	10.0
8					BORING TERMINATED AT 8 FEET No groundwater encountered			

Figure A-4,
Log of Boring B 4, Page 1 of 1

G2259-32-01.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. G2259-32-01

BORING B 5

ELEV. (MSL.) **450'** DATE COMPLETED **03-20-2018**

EQUIPMENT **INGERSOL RAND 8-300** BY: **D. GITHENS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
				SC	Medium dense, moist, brown Clayey, fine to medium SAND			
2								
	B5-1				-Becomes medium dense, moist	50/1"	112.6	7.0
4				CL	Hard, moist, brown to dark brown, Sandy CLAY			
	B5-2					67	102.8	21.8
6								
	B5-3					82	117.5	16.8
8					BORING TERMINATED AT 8 FEET No groundwater encountered			

Figure A-5,
Log of Boring B 5, Page 1 of 1

G2259-32-01.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 1

ELEV. (MSL.) **446'** DATE COMPLETED **03-19-2018**

EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, moist, reddish brown, Silty, fine SAND			
2								
	T1-1			CL	Stiff, moist, dark brown, Sandy CLAY			
4								
6								
	T1-2							
8					-Becomes light grayish brown			
10			▽		-Slight seepage at contact			
					GRANITIC ROCK (Kgr) Completely weathered, greenish gray, weak, GRANITIC ROCK; excavates to Clayey SAND/Sandy CLAY			
	T1-3							
12								
14					-Becomes moderately weak			
					TRENCH TERMINATED AT 15 FEET Minor seepage at contact			

Figure A-6,
Log of Trench T 1, Page 1 of 1

G2259-32-01.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. G2259-32-01

TRENCH T 2

ELEV. (MSL.) **447'** DATE COMPLETED **03-19-2018**

EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, moist, brown, Silty, fine SAND			
2				CL	Stiff, moist, brown to dark brown, fine to medium Sandy CLAY			
4								
6								
				SC	Medium dense to dense, moist, brown to dark brown, Clayey, fine to medium SAND			
8								
10								
			▽		-Slight seepage at contact			
12					**GRANITIC ROCK (Kgr)** Completely weathered, greenish gray, weak, GRANITIC ROCK; excavates to Clayey SAND/Sandy CLAY			
14								
					-Becomes moderately weathered and moderately weak			
16								
					TRENCH TERMINATED AT 17 FEET Heavy seepage at contact			

Figure A-7,
Log of Trench T 2, Page 1 of 1

G2259-32-01.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. G2259-32-01

TRENCH T 3

ELEV. (MSL.) **447'** DATE COMPLETED **03-19-2018**

EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, moist, brown, Silty, fine SAND			
				SC	Medium dense, Clayey, fine to medium SAND			
2								
4	T3-1			CL	Stiff, moist, brown to dark brown, Sandy CLAY			
6	T3-2							
8				SC	Medium dense to dense, light brown, Clayey SAND			
	T3-3							
10								
					GRANITIC ROCK (Kgr) Completely weathered, greenish gray, weak, GRANITIC ROCK; excavates as Clayey SAND/Sandy CLAY			
12								
14					TRENCH TERMINATED AT 14 FEET Moderate seepage at contact			

Figure A-8,
Log of Trench T 3, Page 1 of 1

G2259-32-01.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. G2259-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 4 ELEV. (MSL.) 450' DATE COMPLETED 03-19-2018 EQUIPMENT JD 410G BACKHOE BY: J. PAGNILLO	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	Loose, moist, brown, Silty, fine SAND			
2				SC	Medium dense, moist, brown, Clayey, fine to medium SAND			
4 6 8				CL	Stiff, moist, brown to dark brown, Sandy CLAY			
10 12					**GRANITIC ROCK (Kgr)** Moderately weak, brownish gray, moderately strong to strong, GRANITIC ROCK; excavates to Silty, fine to coarse SAND			
					TRENCH TERMINATED AT 13 FEET No groundwater encountered			

Figure A-9,
Log of Trench T 4, Page 1 of 1

G2259-32-01.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.) **448'** DATE COMPLETED **03-19-2018**

EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
2					-Medium dense, with rootlets			
4					-Medium dense to dense			
6					**GRANITIC ROCK (Kgr)** Highly weathered, brownish gray, moderately strong, GRANITIC ROCK, excavates to fine to coarse SAND with rock fragments up to 8-inches size			
8	T5-1							
					TRENCH TERMINATED AT 9 FEET Groundwater not encountered			

Figure A-10,
Log of Trench T 5, Page 1 of 1

G2259-32-01.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.

PROJECT NO. G2259-32-01

TRENCH T 6

ELEV. (MSL.) **448'** DATE COMPLETED **03-19-2018**

EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND			
2					-Becomes medium dense, moist, with rootlets			
					Becomes dense below 3 feet, Silty/Clayey SAND			
4				SM-SC				
6								
			▽		-Slight seepage at contact			
8					**GRANITIC ROCK (Kgr)** Highly weathered, brownish gray, moderately weak, GRANITIC ROCK; excavates to fine to coarse SAND with rock fragments up to 5-inches in size			
10								
					TRENCH TERMINATED AT 11 FEET Minor seepage at contact			

Figure A-11,
Log of Trench T 6, Page 1 of 1

G2259-32-01.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. G2259-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 7 ELEV. (MSL.) 447' DATE COMPLETED 03-19-2018 EQUIPMENT JD 410G BACKHOE BY: J. PAGNILLO	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T7-1			SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND with rootlets			
2								
4				CL	Stiff, moist, brown to dark brown, Sandy CLAY			
6					**GRANITIC ROCK (Kgr)** Highly weathered, grayish brown, moderately weak GRANITIC ROCK			
8					-Becomes gray, moderately strong, excavates to fine to coarse SAND with rock fragments up to 4-inch size			
10					TRENCH TERMINATED AT 15 FEET No groundwater encountered			

Figure A-12,
Log of Trench T 7, Page 1 of 1

G2259-32-01.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

GEOCON

PROJECT NO. G2259-32-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 8** ELEV. (MSL.) **449'** DATE COMPLETED **03-19-2018** EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM (Qcol)** Loose, dry, reddish brown, Silty, fine to medium SAND with rootlets			
2								
4				CL	Stiff, moist, brown to dark brown, Sandy CLAY			
6					**GRANITIC ROCK (Kgr)** Highly weathered, brownish gray, moderately weak, GRANITIC ROCK; excavates to fine to coarse SAND with rock fragments up to 6-inch size			
8					TRENCH TERMINATED AT 8 FEET No groundwater encountered			

Figure A-13,
Log of Trench T 8, Page 1 of 1

G2259-32-01.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. G2259-32-01

TRENCH T 9

ELEV. (MSL.)________ DATE COMPLETED **03-19-2018**

EQUIPMENT **JD 410G BACKHOE** BY: **J. PAGNILLO**

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, dry, reddish brown, Clayey SAND			
2				SM	**COLLUVIUM (Qcol)** Medium dense, dry, reddish brown, Silty, fine to medium SAND			
4				CL	Stiff, moist, brown to dark brown, Sandy CLAY			
6					**GRANITIC ROCK (Kgr)** Highly weathered, brownish gray, moderately weak, GRANITIC ROCK; excavates to fine to coarse SAND with rock fragments up to 4-inch size			
					TRENCH TERMINATED AT 7 FEET No groundwater encountered			

Figure A-14,
Log of Trench T 9, Page 1 of 1

G2259-32-01.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected undisturbed and bulk samples were tested for shear strength, expansion potential, water-soluble sulfate content, and consolidation characteristics. The results of our laboratory tests are summarized on Tables B-I through B-III and Figures B-1 through B-6.

TABLE B-I
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

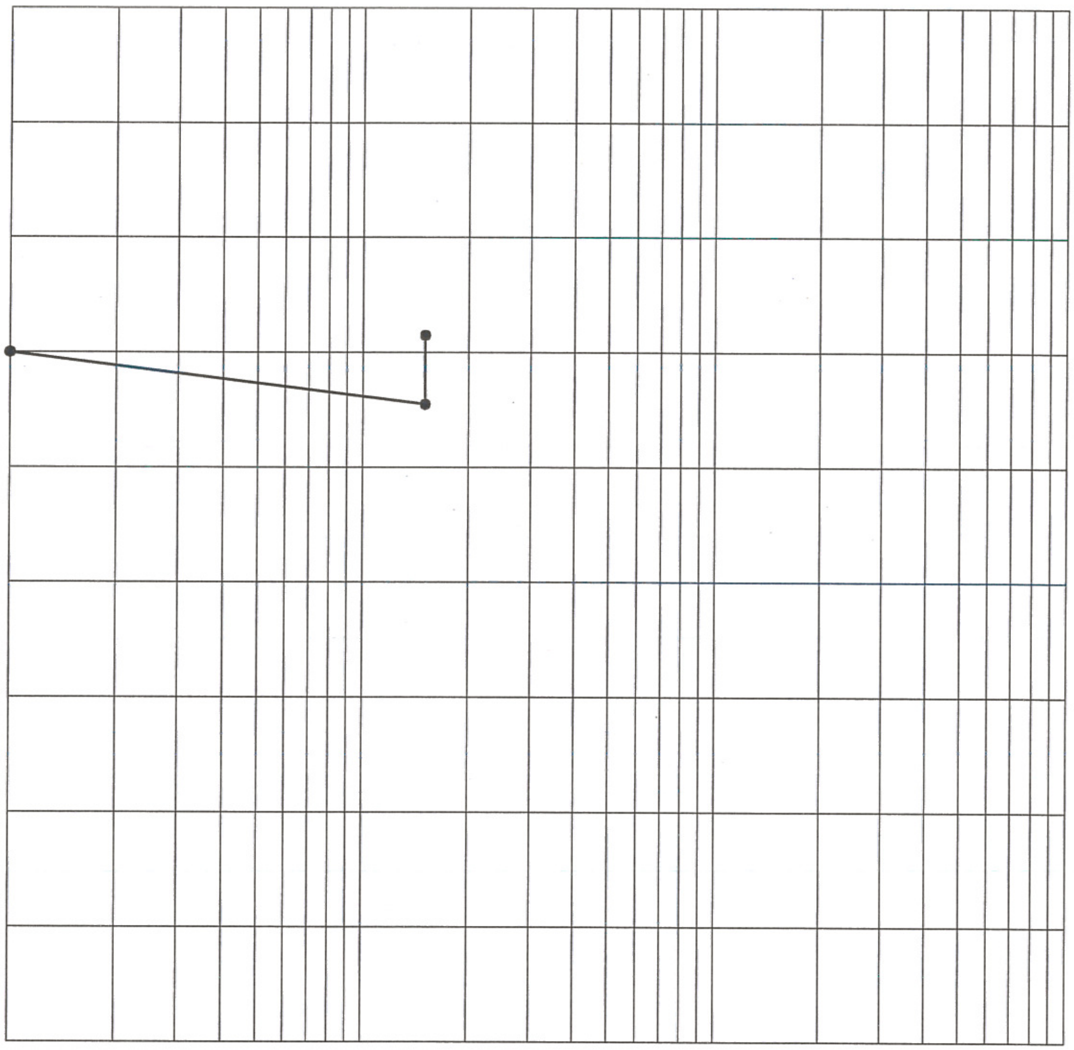
Sample No.	Geologic Unit	Dry Density (pcf)	Moisture Content (%)	Peak [Ultimate] Cohesion (psf)	Peak [Ultimate] Angle of Shear Resistance (degrees)
B4-1	Qcol	112.1	3.1	700 [660]	23 [23]

TABLE B-II
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content		Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
T1-1	12.3	27.4	102.1	63
T7-1	8.9	17.6	112.1	20

TABLE B-III
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

Sample No.	Water-Soluble Sulfate (%)	Sulfate Severity	Sulfate Class
T1-1	0.405	Severe	S2
T7-1	0.001	Not Applicable	S0



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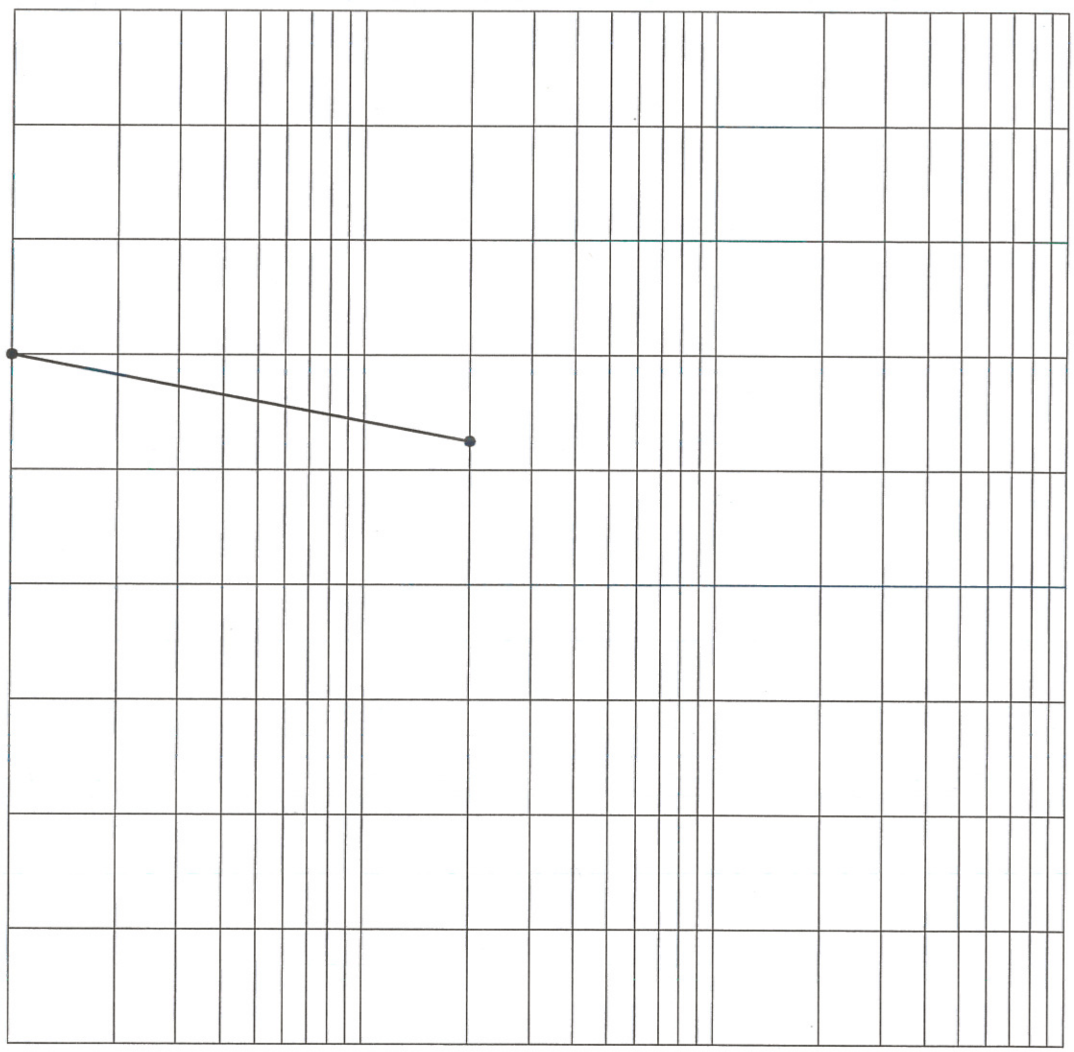

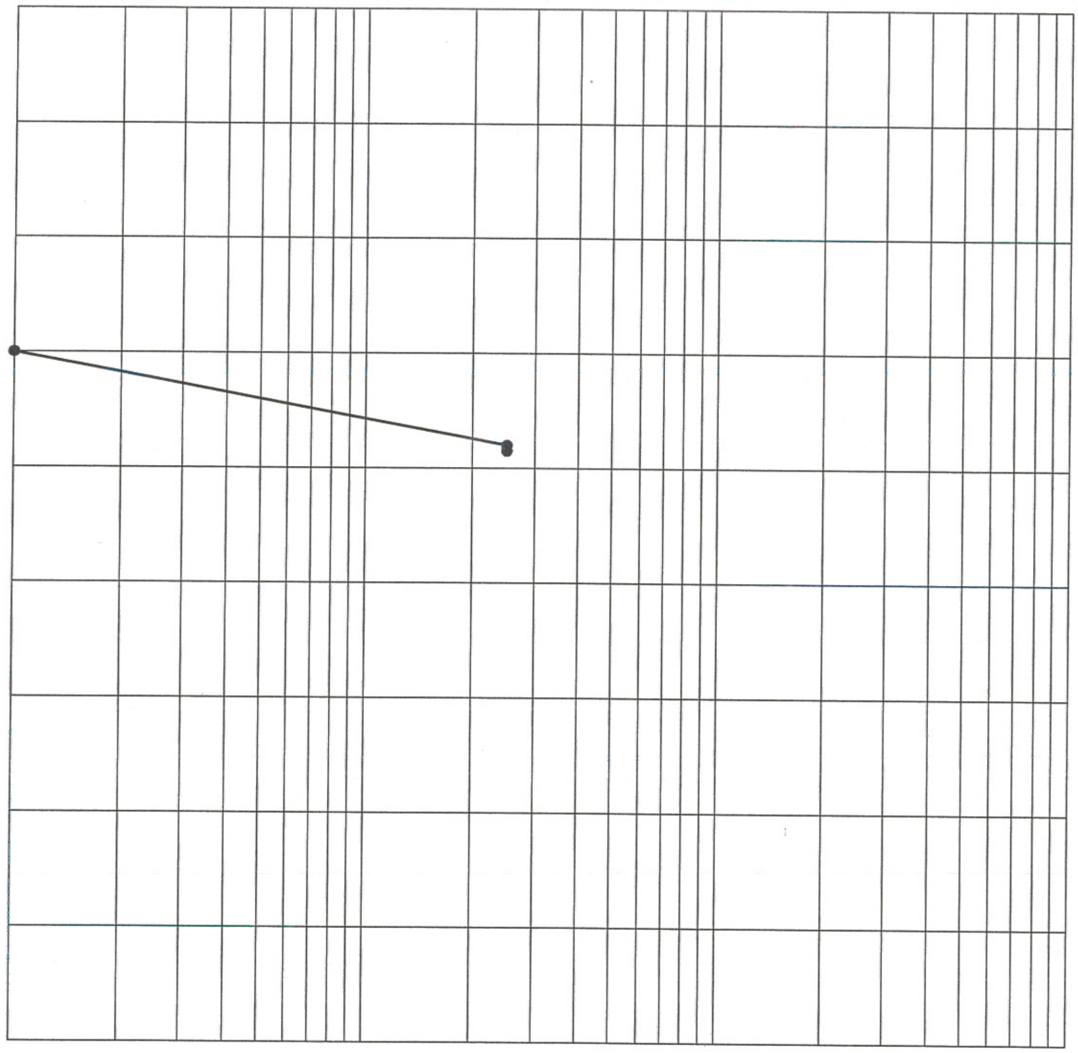

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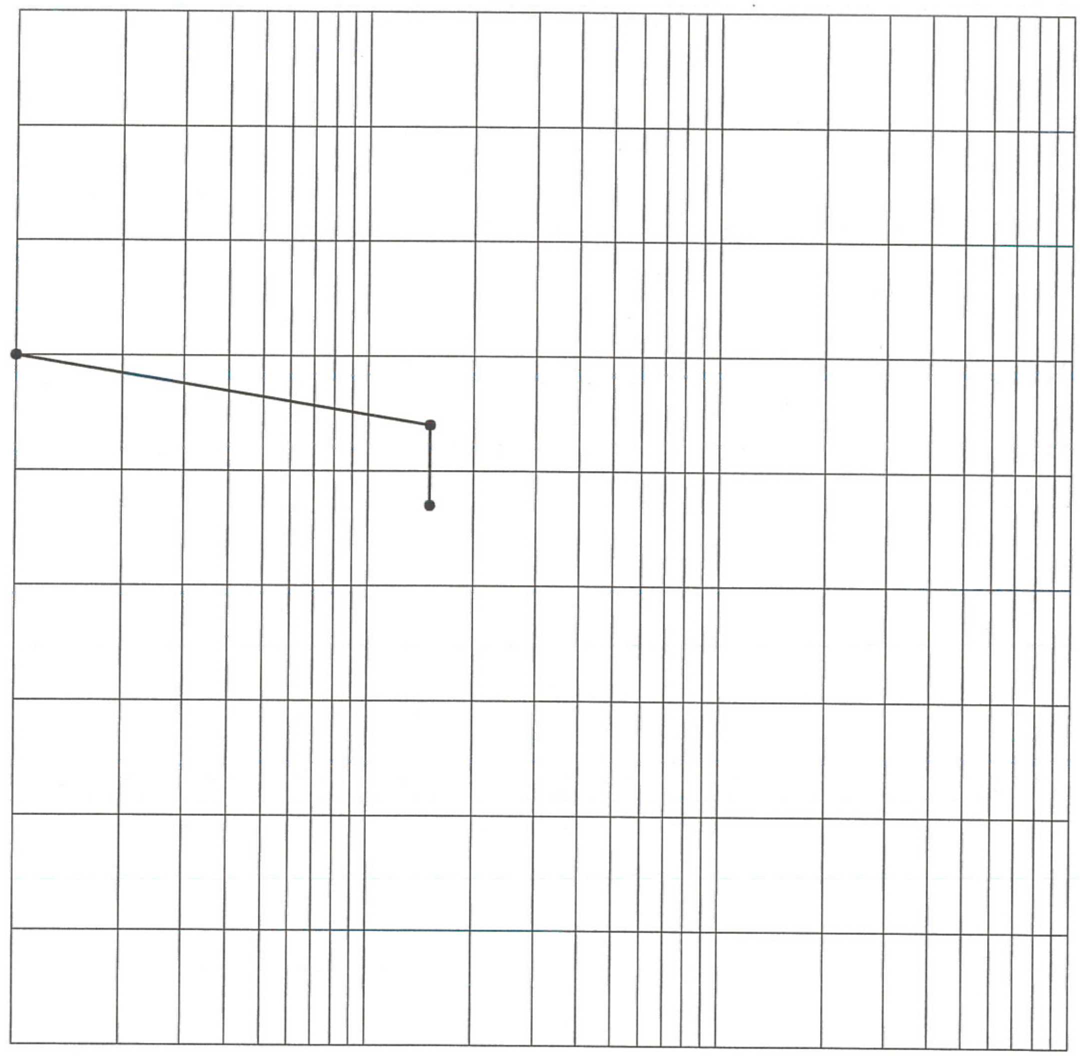

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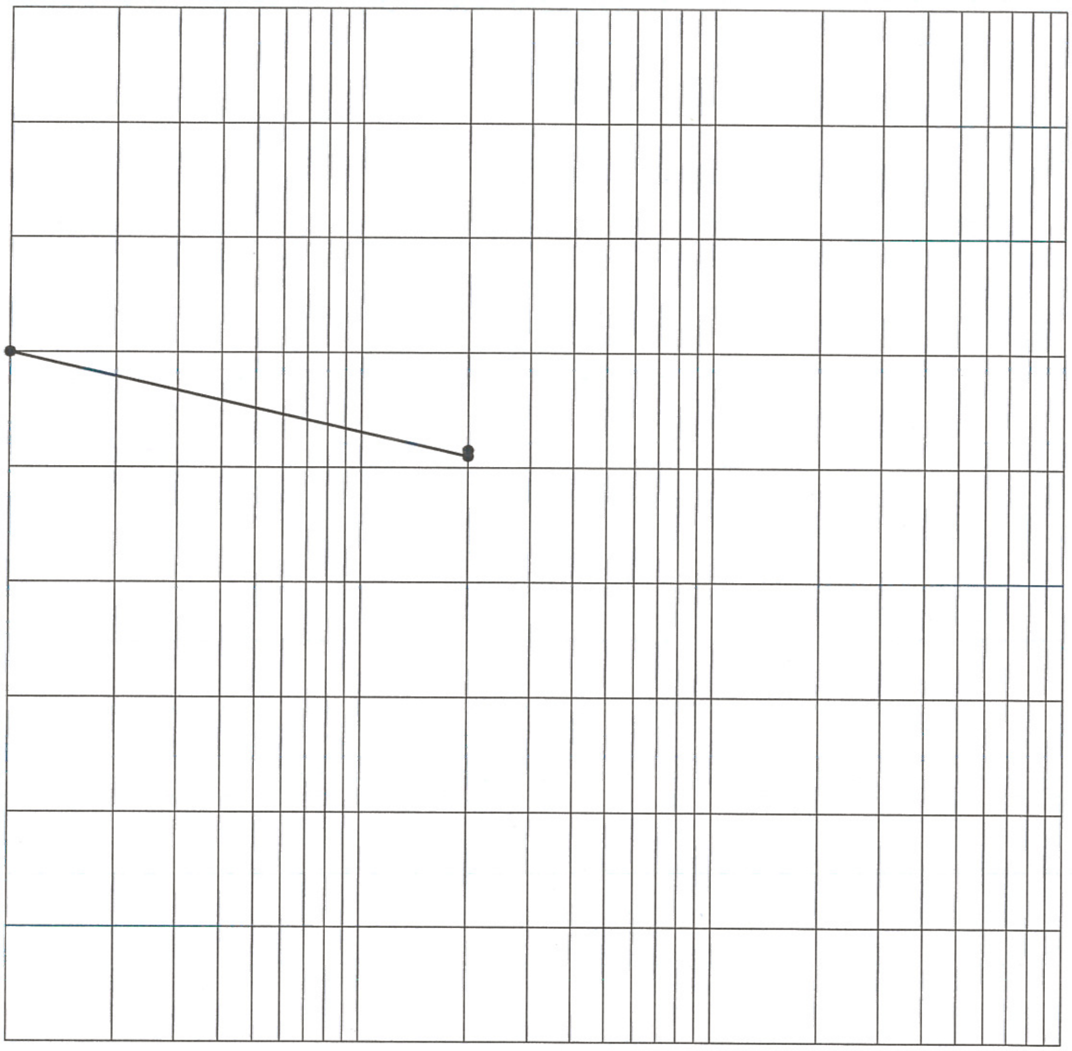

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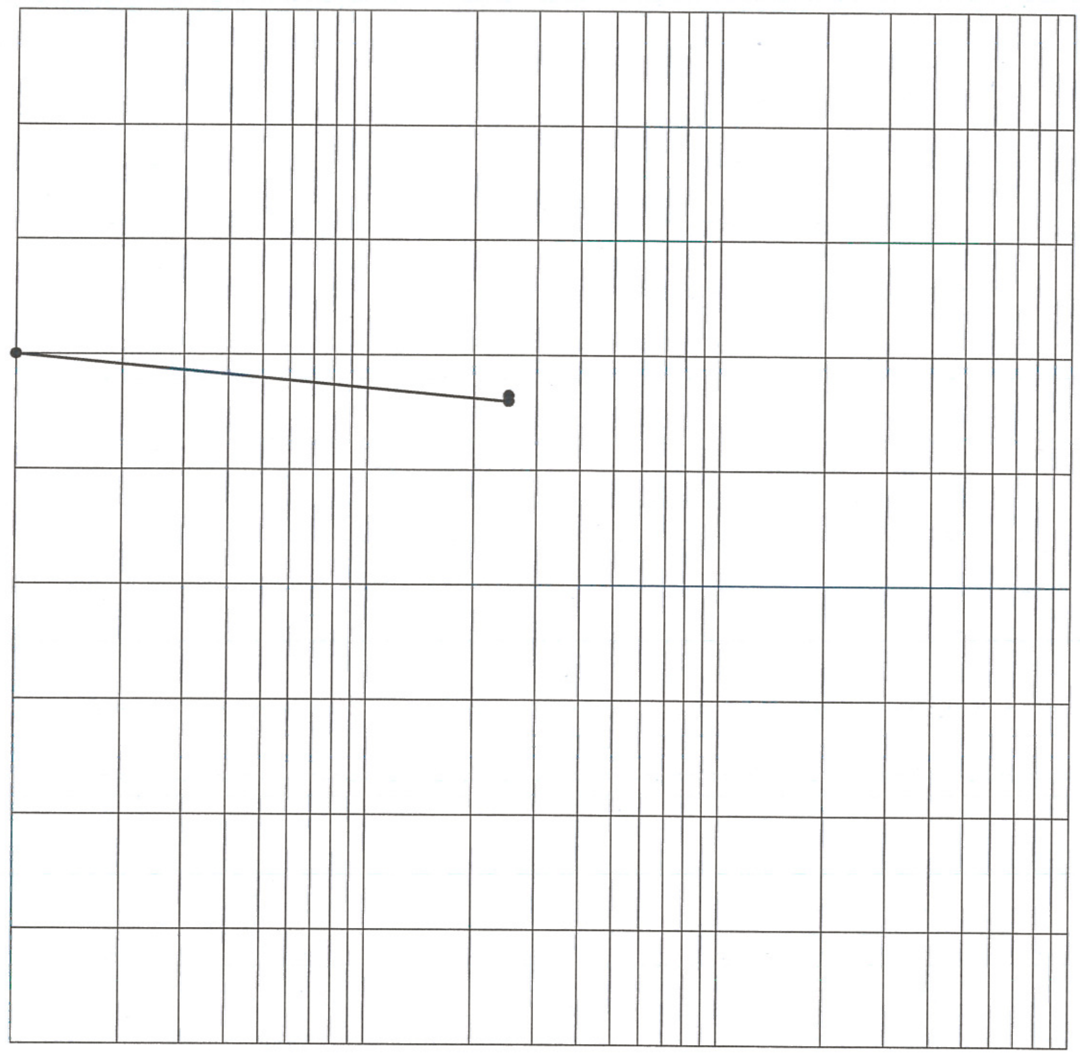

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APPENDIX C

APPENDIX C

STORM WATER MANAGEMENT INVESTIGATION

FOR

1118 NORTH ANZA STREET TOWNHOMES
EL CAJON, CALIFORNIA

PROJECT NO. G2259-32-01

APPENDIX C

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices are being proposed in accordance with the *2016 City of El Cajon 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 property is underlain by two units identified as Placentia sandy loam (PfC) and Vista coarse sandy loam (VsC). The Placentia sandy loam is shown extending across the vast majority of the property and

is classified as Soil Group D. The Vista coarse sandy loam is identified as Soil Group B. Table C-2 presents the information from the USDA website for the subject property.

TABLE C-2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

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	98	D	0.00-0.06
Vista coarse sandy loam	VsC	2	B	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 three, constant head, Aardvark Permeameter Tests, P-1 through P-3, at locations shown on the attached Geologic Map, Figure 2. The test borings were 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 Aardvark Permeameter tests. The field sheets 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 0.008, 0.019, and 0.115 inches per hour after applying a Factor of Safety of 2. Based on a discussion in the County of Riverside *Design Handbook for Low Impact Development Best Management Practices*, the infiltration rate should be considered equal to the saturated hydraulic conductivity rate.

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)
P-1	Qcol	4.0	0.016	0.008
P-2	Qcol	3.2	0.038	0.019
P-3	Qcol	3.3	0.229	0.115

[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 upper 3 feet of soil and replacement as compacted fill. The proposed storm water BMP's will be founded in compacted fill placed above granitic rock. The compacted fill will be comprised of on-site silty/clay sand and sandy clay. 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, 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.* The underlying granitic rock below the compacted fill is expected between 5 to 12 feet below existing grade, or 15 to 22 feet below finish grade after remedial grading is performed and site raised approximately 10 feet. 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 if the infiltration BMP extends below the compacted fill.

- *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 three infiltration rates (including the feasibility factor of safety of 2) obtained within the colluvium were 0.008, 0.019, and 0.115 inches per hour (iph). Based on the results of the infiltration testing, none of the tests meet the minimum threshold for full infiltration; therefore, full infiltration is considered infeasible.

Groundwater Elevations

Groundwater was not encountered during the field investigation. Minor to moderate seepage was observed along the granitic rock contact during the field exploration. Groundwater is not anticipated to significantly impact project development as presently proposed. Proper surface drainage of irrigation and rainwater will be important to future performance of the project.

Soil or Groundwater Contamination

Based on our review of the Geotracker website, no soil or groundwater contamination is suspected.

New or Existing Utilities

Existing utilities are present within right of ways adjacent to the existing streets, generally beneath public sidewalks and roadways. We expect that all on-site utilities will be removed prior to site development. Full infiltration near existing or proposed utilities should be avoided to prevent lateral water migration into the permeable trench backfill materials.

Existing and Planned Structures

Residential developments surround the property. Existing structures are situated in close proximity to the north, west, and southern property boundaries. Anza Street is located immediately to the east. If water is allowed to infiltrate into the soil, the water could migrate laterally and into other properties in the vicinity of the subject site. The water migration may negatively affect other buildings and improvements in the area.

Slopes

The site is relatively flat and significant slopes do not exist adjacent to the site. Infiltration BMP's situated in close proximity to descending fill slopes are not recommended due to the potential for daylight water seepage and lateral water migration.

Recommendations

Due to the relatively low infiltration rates obtained, and close proximity to public and private improvements, foundations, and roadways, full infiltration of storm water is considered geotechnically infeasible. Partial infiltration of storm water may be feasible if the BMP is directed below any compacted fill. Otherwise, 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 3 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. If designing any storm water infiltration BMP's for partial infiltration, side liners and a subdrain are recommended.

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 Form 1-8 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 C-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	2	0.50
Depth to Groundwater/ Impervious Layer	0.25	1	0.25
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.

Categorization of Infiltration Feasibility Condition	Worksheet C.4-1

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: Based on results of permeability testing in 3 locations across the site, the unfactored infiltration rate was measured to be 0.016, 0.038, and 0.229 inches/hour using a constant head borehole permeameter. If applying a feasibility factor of safety of 2.0, the infiltration rates would be 0.008, 0.019 and 0.115 iph, which are less than the required threshold value of 0.5 iph. The USDA web soil survey website indicates the vast 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 Aardvark 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.

Criteria	Screening Question	Yes	No
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 of approximately 10 to 13 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.

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants 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.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: It is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2	No Full Infiltration	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Worksheet C.4-1 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** 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: Based on results of permeability testing in 3 locations across the site, the unfactored infiltration rate was measured to be 0.016, 0.038, and 0.229 inches/hour using a constant head borehole permeameter. If applying a feasibility factor of safety of 2.0, the infiltration rates would be 0.008, 0.019 and 0.115 iph, therefore, 2 of the 3 tests indicated rates below 0.05 iph, which should be considered the low bound threshold for partial infiltration (based on 2016 City of San Diego Storm Water Manual). After grading, the actual BMP's would be situated in compacted fill over granitic rock, and infiltration BMP's founded in compacted fill are not recommended (see discussion in Appendix C of the Geotechnical Investigation).

Criteria	Screening Question	Yes	No
6	**Can Infiltration in any appreciable quantity 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 of approximately 10 to 13 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.

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
8	**Can infiltration be allowed without violating downstream water rights?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: It is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**	No Infiltration	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

GEOCON

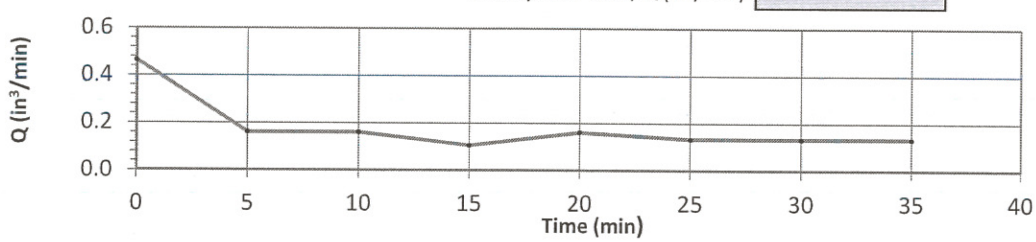
Aardvark Permeameter Data Analysis

Project Name:	1118 North Anza Street	Date:	3/22/2018
Project Number:	G2259-32-01	By:	DEG
Test Number:	P-1		

Borehole Diameter, d (in.):	4.00	Ref. EL (feet, MSL):	0.0
Borehole Depth, **H** (in):	48.00	Bottom EL (feet, MSL):	-4.0
Distance Between Reservoir & Top of Borehole (in.)	25.00		
Estimated Depth to Water Table, **S** (feet):	20.00		
Height APM Raised from Bottom (in.):	2.00		
Pressure Reducer Used:	No		

Distance Between Reservoir and APM Float, **D** (in.):	63.75
Head Height Calculated, **h** (in.):	5.71
Head Height Measured, **h** (in.):	6.00
Distance Between Constant Head and Water Table, **L** (in.):	198.00

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	5.00	0.085	2.35	0.471
3	5.00	0.030	0.83	0.166
4	5.00	0.030	0.83	0.166
5	5.00	0.020	0.55	0.111
6	5.00	0.030	0.83	0.166
7	5.00	0.025	0.69	0.138
8	5.00	0.025	0.69	0.138
9	5.00	0.025	0.69	0.138
			Steady Flow Rate, Q (in^3/min):	0.138



Soil Matric Flux Potential, Φ_m

Φ_m= 0.00269 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 2.75E-04 in/min 0.016 in/hr

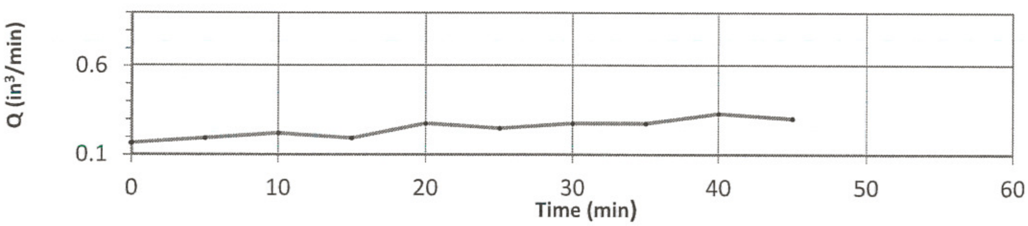
GEOCON

Aardvark Permeameter Data Analysis

Project Name:	1118 North Anza Street	Date:	3/22/2018
Project Number:	G2259-32-01	By:	DEG
Test Number:	P-2	Ref. EL (feet, MSL):	0.0
		Bottom EL (feet, MSL):	-3.3

Borehole Diameter, d (in.):	4.00
Borehole Depth, **H** (in):	39.00
Distance Between Reservoir & Top of Borehole (in.)	27.00
Estimated Depth to Water Table, **S** (feet):	20.00
Height APM Raised from Bottom (in.):	2.00
Pressure Reducer Used:	No
Distance Between Reservoir and APM Float, **D** (in.):	56.75
Head Height Calculated, **h** (in.):	5.69
Head Height Measured, **h** (in.):	6.00
Distance Between Constant Head and Water Table, **L** (in.):	207.00

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	5.00	0.030	0.83	0.166
3	5.00	0.035	0.97	0.194
4	5.00	0.040	1.11	0.222
5	5.00	0.035	0.97	0.194
6	5.00	0.050	1.38	0.277
7	5.00	0.045	1.25	0.249
8	5.00	0.050	1.38	0.277
9	5.00	0.050	1.38	0.277
10	5.00	0.060	1.66	0.332
11	5.00	0.055	1.52	0.305
			Steady Flow Rate, Q (in^3/min):	0.318



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0062 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 6.31E-04 in/min   0.038 in/hr

GEOCON

Aardvark Permeameter Data Analysis

Project Name: 1118 North Anza Street
Project Number: G2259-32-01
Test Number: P-3

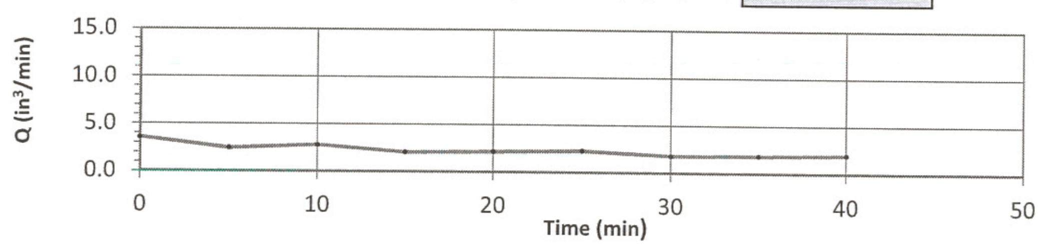
Date: 3/22/2018
By: DEG
Ref. EL (feet, MSL): 0.0
Bottom EL (feet, MSL): -2.9

Borehole Diameter, d (in.):	4.00
Borehole Depth, **H** (in):	35.00
Distance Between Reservoir & Top of Borehole (in.)	27.00
Estimated Depth to Water Table, **S** (feet):	20.00
Height APM Raised from Bottom (in.):	2.00
Pressure Reducer Used:	No

Distance Between Reservoir and APM Float, **D** (in.):	52.75
Head Height Calculated, **h** (in.):	5.68
Head Height Measured, **h** (in.):	6.00
Distance Between Constant Head and Water Table, **L** (in.):	211.00

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	5.00	0.645	17.86	3.572
3	5.00	0.445	12.32	2.465
4	5.00	0.505	13.98	2.797
5	5.00	0.375	10.38	2.077
6	5.00	0.390	10.80	2.160
7	5.00	0.415	11.49	2.298
8	5.00	0.330	9.14	1.828
9	5.00	0.340	9.42	1.883
10	5.00	0.355	9.83	1.966

Steady Flow Rate, Q (in^3/min): 1.925



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0374 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 3.82E-03 in/min   0.229 in/hr

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

April 9, 2018

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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Contents

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

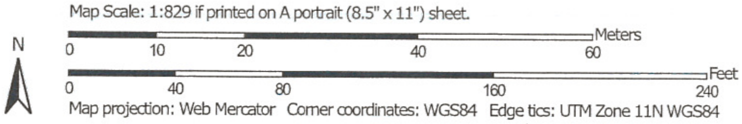
identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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: 1:829 if printed on A portrait (8.5" x 11") sheet.



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 12, Sep 13, 2017

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

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	3.3	97.9%
VsC	Vista coarse sandy loam, 5 to 9 percent slopes	0.1	2.1%
Totals for Area of Interest		**3.3**	**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, sandy clay
H2 - 13 to 34 inches:

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural 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
Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 25.0
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

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