County of San Diego
PRIORITY DEVELOPMENT PROJECT (PDP) SWQMP

Tavern Road Gas Station
Permit No: PDS2018-STP-18-012

1140 Tavern Road
Alpine, CA 91901

ASSESSOR'S PARCEL NUMBER(S):
403-380-42, 45, & 46

ENGINEER OF WORK:

Patric de Boer RCE 83583
Registration Expires 3-31-2021

PREPARED FOR:

Tony Shores
2020 Hillside Road
El Cajon, CA 92019
609-250-1474

PDP SWQMP PREPARED BY:

OMEGA ENGINEERING CONSULTANTS INC.
4340 Viewridge Ave., Suite B
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858-634-8620

DATE OF SWQMP:
10/18/2019

PLANS PREPARED BY:
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619-233-6450

SWQMP APPROVED BY:

APPROVAL DATE:

Table of Contents

Attachments

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: Tavern Road Gas Station
Permit Application Number: PDS2018-STP-18-012

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

Patric de Boer
Print Name

Omega Engineering Consultants Inc.
Company

10/21/2019
Date

Engineer's Seal:

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	03/29/2018	Initial Submittal
2	08/15/2018 4/09/2019	Addressed 1st Plancheck Comments Addressed 2nd Plancheck Comments
3	07/29/2019 9/13/2019	Addressed 3rd Plancheck Comments Addressed 4th Plancheck Comments
4	10/18/2019	Addressed 4th Plancheck Comments

Final Design

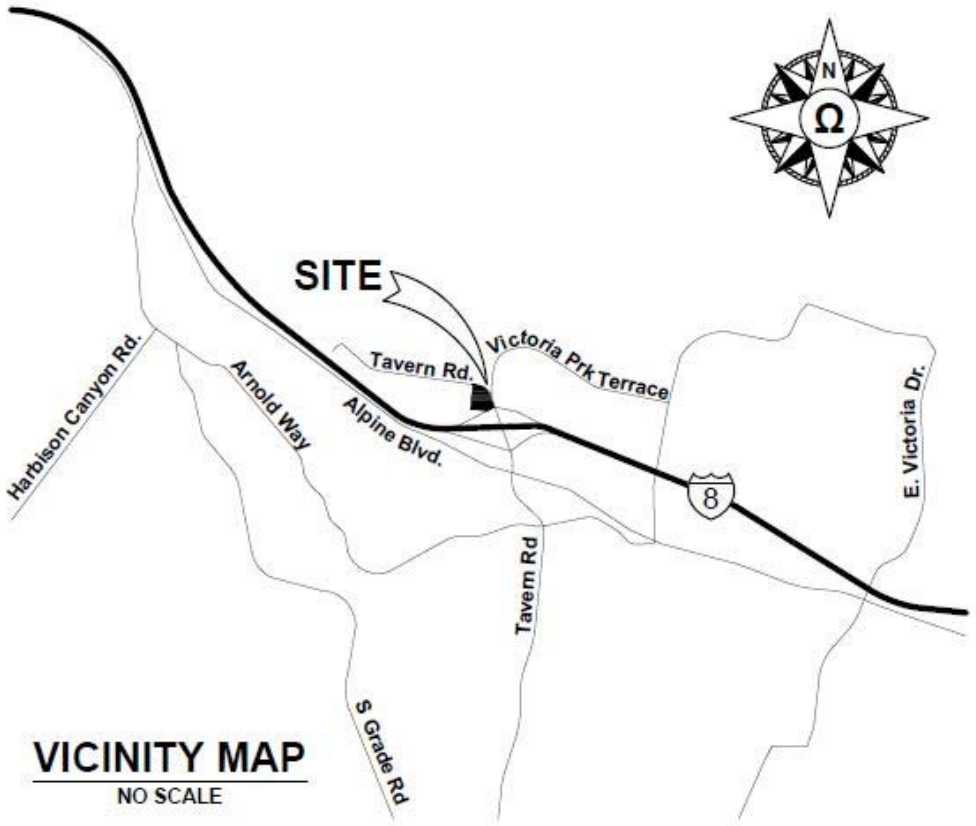
Submittal Number	Date	Summary of Changes
1		Initial Submittal
2		
3		
4		

Plan Changes

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

Project Vicinity Map

Project Name: Tavern Road Gas Station
Record ID: PDS2018-STP-18-012



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:			53,111 ft^2
The total existing (pre-project) impervious area is:			34,422 ft^2
The total area disturbed by the project is:			89,841 ft^2
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: _TBD__			
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 not a Priority Development Project (Standard Project).

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

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

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

The area of existing (pre-project) impervious area at the project site is:	34,422 ft^2 (A)
The total proposed newly created or replaced impervious area is	53,111 ft^2 (B)
Percent impervious surface created or replaced (B/A)*100:	154 %

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:	If so:
☐ 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;	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:
N/A

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	☐	TBD
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	☒	TBD
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	☐	TBD
D. Select sediment control method for all disturbed areas (choose at least one)			
Silt Fence	SC-1	☒	TBD
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	☒	TBD
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	☒	TBD
Spill Prevention and Control	WM-4	☒	
F.2 Waste Management[10]			
Waste Management Concrete Waste Management	WM-8	☒	TBD
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, El Capitan, Alpine 907.33**

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:
The existing is an operating gasoline station with convenience store.

Existing Land Cover Includes (select all that apply and provide each area on site):

☒ Vegetative Cover 1.49 Acres (64,841 Square Feet)
☐ Non-Vegetated Pervious Areas 0 Acres (0 Square Feet)
☒ Impervious Areas 0.79 Acres (34,422 Square Feet)

Description / Additional Information:
The easterly portion of the project site is an operating gas station and the westerly half is an undeveloped natural hillside.

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):

☐ 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:
According to the Biology Report under provided in Appendix 8 the flow from the existing culvert is not considered to be jurisdictional waters.

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:
1. The existing drainage conveyance is urban
2. No offsite runoff conveys through the site
3. The majority of runoff from the easterly portion of the site sheet flows from a northerly high point to an existing ribbon gutter and conveys the runoff to a natural undeveloped slope. There's an existing culvert that drains offsite runoff onto the natural undeveloped slope west of the existing gas station.
4. As shown in the Hydrology Report and exhibits, the northerly portion of the gas station drain north and the southerly half drains south. Both portions drain to a natural undeveloped slope, which conveys runoff to two separate discharge points.

Below is a table of the Rational Method Hydrology data. The areas in the hydrology report do not equal the total areas in this SWQMP because the hydrology report includes downslope, offsite areas tributary to the Hydrology Discharge Point.

Basin #	Area (ac)	Impervious %	C	I (in/hr)	Q100 (cfs)
EX-1	1.99	7%	0.39	8.64	6.69
EX-2	1.94	33%	0.53	8.72	8.98

The peak flowrate at Discharge Point #1 is 6.69 cfs for the 100-yr storm event. The peak flowrate at Discharge Point #2 is 8.98 cfs. See the attached calculations for details.

Step 3.3: Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:
The project proposes to demolition the previous development and expand the pad by pushing the fill slope west. The proposed development will include a new gas station with two restaurants, a convenience store, a private storm drain network with two biofiltration facilities and two tree wells.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):
Two buildings, a parking lot, a driveway & the drive thru area

List/describe proposed pervious features of the project (e.g., landscape areas):
Landscape areas, two biofiltration facilities and two tree wells.

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

Description / Additional Information:
The existing development will be demolished and the existing pad will be expanded by pushing the fill slope west.

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	64,841 sf	48,104 sf	26%
Pervious (non-vegetated)	0	0	0%
Impervious	34,422 sf	53,111 sf	154%

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:

The proposed site is divided into three drainage basins. The most southerly basin sheets flow into a proposed catch basin and into a 12" storm drain. The runoff then continues through the 12" PVC and flows into a biofiltration basin. The runoff from the northerly half sheets flows through a series of gutters and is conveyed to a biofiltration basin with outlet control. To prevent the existing culvert discharging onto the development a proposed private storm drain will be constructed to extend and convey the offsite runoff further downstream along the existing drainage path west of the fill slope. The flow from both biofiltration systems and the extended culvert confluence at a proposed headwall located at the bottom of the fill slope and discharge onto energy dissipaters to prevent excess erosion.

Basin #	Area (ac)	Impervious %	C	Slope	Q100 (cfs)
A-1	0.65	85%	0.82	1%	0.85
A-2	0.77	81%	0.80	2%	2.61
A-3	1.34	0%	0.35	15%	3.09
B-1	1.17	0%	0.35	9%	2.70

The peak flowrate at Discharge Point #1 is **5.38 cfs** for the 100-yr storm event. The peak flowrate at Discharge Point #2 is **2.70 cfs**. See the attached calculations for 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:

1. All on-site storm drain inlets will be marked with the words "No Dumping" or similar
2. Landscape will be drought tolerant and plants will be chosen to require a minimal amount of pesticides.
3. Use dry methods when possible when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
4. Fueling areas will be graded to drain toward a dead-end sump. Runoff from downspouts/roofs will be directed away from fueling areas.
5. Fire sprinkler systems will be drained to sanitary sewer

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):
The runoff from the project flows through a series of unnamed creeks to the northwest into chocolate creek which then enters El Capitan reservoir.

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
El Capitan lake	Color, Manganese & pH	TMDL completion 2019
	Phosphorus & Nitrogen	TMDL completion 2021
San Diego River (Lower)	*Benthic, Cadmium, Nitrogen, Oxygen Dissolved, Phosphorus, TDS*	TMDL completion 2019 & 2021

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	☐	☒	☐
Bacteria & Viruses	☒	☐	☐
Pesticides	☐	☒	☐

[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

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):

N/A

[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. The SWMM analysis of the hydromodification conditions of the project uses a single Point of compliance at a well-defined natural channel that runs down the hillside to the west of the project site. The analysis identifies this point as PRE-POC for predeveloped conditions and PROP-POC for proposed conditions
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)* N/A

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.

There is an existing culvert that is directly underneath the proposed development and discharges west of the existing undeveloped slope. To prevent any interference to the existing drainage pathway a proposed private storm drain will be constructed to extend the discharge point further downstream of the existing drainage course.

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.

N/A

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: N/A			
4.2.2 Storm Drain Stenciling or Signage	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.2 not implemented: N/A			
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: No outdoor storage proposed			
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: No outdoor work areas proposed			

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: N/A			
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. A. All on-site storm drain inlets will be marked with the words “No Dumping” or similar E. Landscape will be drought tolerant and plants will be chosen to require a minimal amount of pesticides G. All food service areas will have a grease trap that will connect to a sewer line O. Fire sprinkler systems will be drained to sanitary sewer All remaining BMPs are marked N/A because it is not applicable to the project.			

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: The existing hydrologic feature shall be maintained by constructing a private storm drain at the discharge point of the existing culvert. The private storm drain attachment shall extend the discharge point further downstream to preserve the existing drainage pathway.			
4.3.2 Conserve Natural Areas, Soils, and Vegetation	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.2 not implemented: Only portions necessary for development will be graded. The rest of the site will remain the same.			
4.3.3 Minimize Impervious Area	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.3 not implemented: The impervious areas will be limited to the gasoline station and the proposed facilities. No unnecessary impervious areas are proposed through the site.			
4.3.4 Minimize Soil Compaction	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.4 not implemented: Soil will only be compacted as necessary.			
4.3.5 Impervious Area Dispersion	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.5 not implemented: Roof drains will be directed to landscape area, if possible. Otherwise, runoff from impervious areas will be directed to biofiltration basins.			

Site Design Requirement	Applied?		
4.3.6 Runoff Collection	☐Yes	☐No	☒N/A
Discussion / justification if 4.3.6 not implemented: No appreciable benefit to storm water quality would be gained by using runoff collection in addition to the already two proposed structural BMPs.			
4.3.7 Landscaping with Native or Drought Tolerant Species	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.7 not implemented: Landscaping will use native and drought tolerant species.			
4.3.8 Harvesting and Using Precipitation	☐Yes	☒No	☐N/A
Discussion / justification if 4.3.8 not implemented: Total Demand- 31.7 cubic feet & Total DCV 1,808 cubic feet. The 36 hour demand less than 0.25DCV.			

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.

The steps of the BMP design manual were followed to select and design the appropriate pollutant control BMPs.

Step 1) The Drainage Management Areas were delineated based on the proposed site design resulting in 7 separate DMAs. The westerly basin is referred to as DMA-1, the most northerly drainage basin is referred to as DMA-2, and the most easterly basin is DMA-3 which is considered to be Self-Mitigating. DMA-4 is located along the northwest portion of the site. It drains to two 20' trees that have been sized with a DCV multiplier of 2.9 applied to the rainfall depth. This negates the need to include DMA-4 in hydromodification calculations. DMAs 5, 6 & 7 are De Minimis Areas, and do not require treatment or inclusion in hydromodification calculations.

Step 2) In order to offset the Design Capture Volume generated by all drainage basins, Harvest and Reuse Method was considered. Using the a feasibility screening analysis it was determined that the Harvest and Reuse Method is infeasible due to the demand being less than a quarter of the total DCV while using all of the disturbed pervious area as low water landscape area.

Step 3) As the underlying soil is Type D and the development is on a steep hillside it was concluded that storm water infiltration is deemed to be infeasible. Storm water infiltration was assumed to be infeasible since there is a concern that the infiltrated water would laterally migrate causing the site to become a geotechnical hazard. Therefore all proposed structural BMPs will be fully-lined to prevent storm water infiltration. This assumption is supported by the geotechnical report titled "Geotechnical Investigation-Shell Station Expansion" dated December 21, 2017.

Step 4) The Design Capture Volume (DCV) for DMA-1 and DMA-2 was calculated using the method in Appendix B of the BMP design manual. For DMA-1 it generated a DCV of 956 cubic feet and DMA-2 generated 1,090 cubic feet. For DMA-3 it does not generate any DCV as the drainage basin is considered to be Self-Mitigating.

Step 5) Two fully-lined biofiltration facilities are proposed. Both of the biofiltration facilities were properly sized and spec'd using the County of San Diego BMP Design Manual. DMA-4 will drain to two 20' mature canopy tree well were determined using B.2.2.1 Tree Wells credit volume table.

(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)

Step 6.2: Structural BMP Checklist

(Copy this page as needed to provide information for each individual proposed structural BMP)	
Structural BMP ID No. BMP-1 & BMP-2	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ 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)	Andrew J Kann 858-634-8620
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.	The Structural BMPs are recognized as Category 2. Refer to attachment 3 for the appropriate maintenance agreement.
Discussion (as needed): N/A *(Continue on subsequent pages as necessary)*	

Step 6.3: Offsite Alternative Compliance Participation Form

PDP INFORMATION	
Record ID:	
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)

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA-1	DMA-2	DMA-4								unitless
	2	85th Percentile 24-hr Storm Depth	0.52	0.52	1.51								inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	24,106	27,053	2,110								sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	4,184	6,497	7,072								sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	Yes	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A			2								#
	19	Average Mature Tree Canopy Diameter			20								ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	28,290	33,550	9,182	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.78	0.75	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	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
	25	Initial Weighted Runoff Factor	0.78	0.75	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	956	1,090	324	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	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
	30	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
	31	Runoff Factor After Dispersion Techniques	0.78	0.75	0.28	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	956	1,090	324	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	360	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.78	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	22,066	25,163	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	360	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	956	1,090	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Basic Analysis	1	Drainage Basin ID or Name	DMA-1	DMA-2	DMA-4	-	-	-	-	-	-	-	unitless
	2	85th Percentile Rainfall Depth	0.52	0.52	1.51	-	-	-	-	-	-	-	inches
	3	Predominant NRCS Soil Type Within BMP Location	D	D	D								unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted	Restricted	Restricted								unitless
	5	Nature of Restriction	Slopes	Slopes	Slopes								unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes	Yes	Yes								yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No	No	No								yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	Yes	Yes	Yes								yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000								in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	0.000	0.000	-	-	-	-	-	-	-	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	4.5%	4.5%	1.5%	-	-	-	-	-	-	-	percentage
	12	Fraction of DCV Requiring Retention	0.02	0.02	0.01	-	-	-	-	-	-	-	ratio
	13	Required Retention Volume	19	22	0	-	-	-	-	-	-	-	cubic-feet

No Warning Messages

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
BMP Inputs	1	Drainage Basin ID or Name	DMA-1	DMA-2	DMA-4	-	-	-	-	-	-	-	sq-ft
	2	Design Infiltration Rate Recommended	0.000	0.000	0.000	-	-	-	-	-	-	-	in/hr
	3	Design Capture Volume Tributary to BMP	956	1,090	0	-	-	-	-	-	-	-	cubic-feet
	4	Is BMP Vegetated or Unvegetated?	Vegetated	Vegetated									unitless
	5	Is BMP Impermeably Lined or Unlined?	Lined	Lined									unitless
	6	Does BMP Have an Underdrain?	Underdrain	Underdrain									unitless
	7	Does BMP Utilize Standard or Specialized Media?	Standard	Standard									unitless
	8	Provided Surface Area	700	1,090									sq-ft
	9	Provided Surface Ponding Depth	12	12									inches
	10	Provided Soil Media Thickness	18	18									inches
	11	Provided Gravel Thickness (Total Thickness)	24	24									inches
	12	Underdrain Offset	3	3									inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	0.56	0.56									inches
	14	Specialized Soil Media Filtration Rate											in/hr
	15	Specialized Soil Media Pore Space for Retention											unitless
	16	Specialized Soil Media Pore Space for Biofiltration											unitless
	17	Specialized Gravel Media Pore Space											unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	19	Ponding Pore Space Available for Retention	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	23	Effective Retention Depth	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.13	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	120	120	0	0	0	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.15	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	144	219	0	0	0	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	812	871	0	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.0171	0.0171	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	1.05	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	1.05	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	6.33	4.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	37	Effective Depth of Biofiltration Storage	24.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	11	18	0	0	0	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	23	35	0	0	0	0	0	0	0	0	hours
	40	Total Depth Biofiltered	30.33	28.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	1,218	1,306	0	0	0	0	0	0	0	0	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	1,218	1,306	0	0	0	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	609	653	0	0	0	0	0	0	0	0	cubic-feet
	44	Option 2 - Provided Storage Volume	609	653	0	0	0	0	0	0	0	0	cubic-feet
	45	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	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	Yes	-	-	-	-	-	-	-	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	**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

No Warning Messages

Categorization of Infiltration Feasibility Condition — Form I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

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

Note that it is not necessary to investigate each and every criterion in the worksheet if infiltration is precluded. Instead a letter of justification from a geotechnical professional familiar with the local conditions substantiating any geotechnical issues will be required.

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

Provide basis:

Site soil is Type-D, located in compacted fill conditions and on a slope. Infiltration at a rate 0f 0.5 inches per hour or greater are not anticipated to be feasible.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2.		

Provide basis:

Infiltration precluded by Criterion 1

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Form I-8 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 must be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Infiltration precluded by Criterion 1 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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 must be based on a comprehensive evaluation of the factors presented in Appendix C.3.	N/A	N/A
Provide basis: Infiltration precluded by Criterion 1 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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 INFILTRATION

Form I-8 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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		x

Provide basis:

Site soil is Type-D, located in compacted fill conditions and on a slope. Infiltration of any appreciable volume is not anticipated to be feasible.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2.		

Provide basis:

Partial infiltration precluded by Criterion 5

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

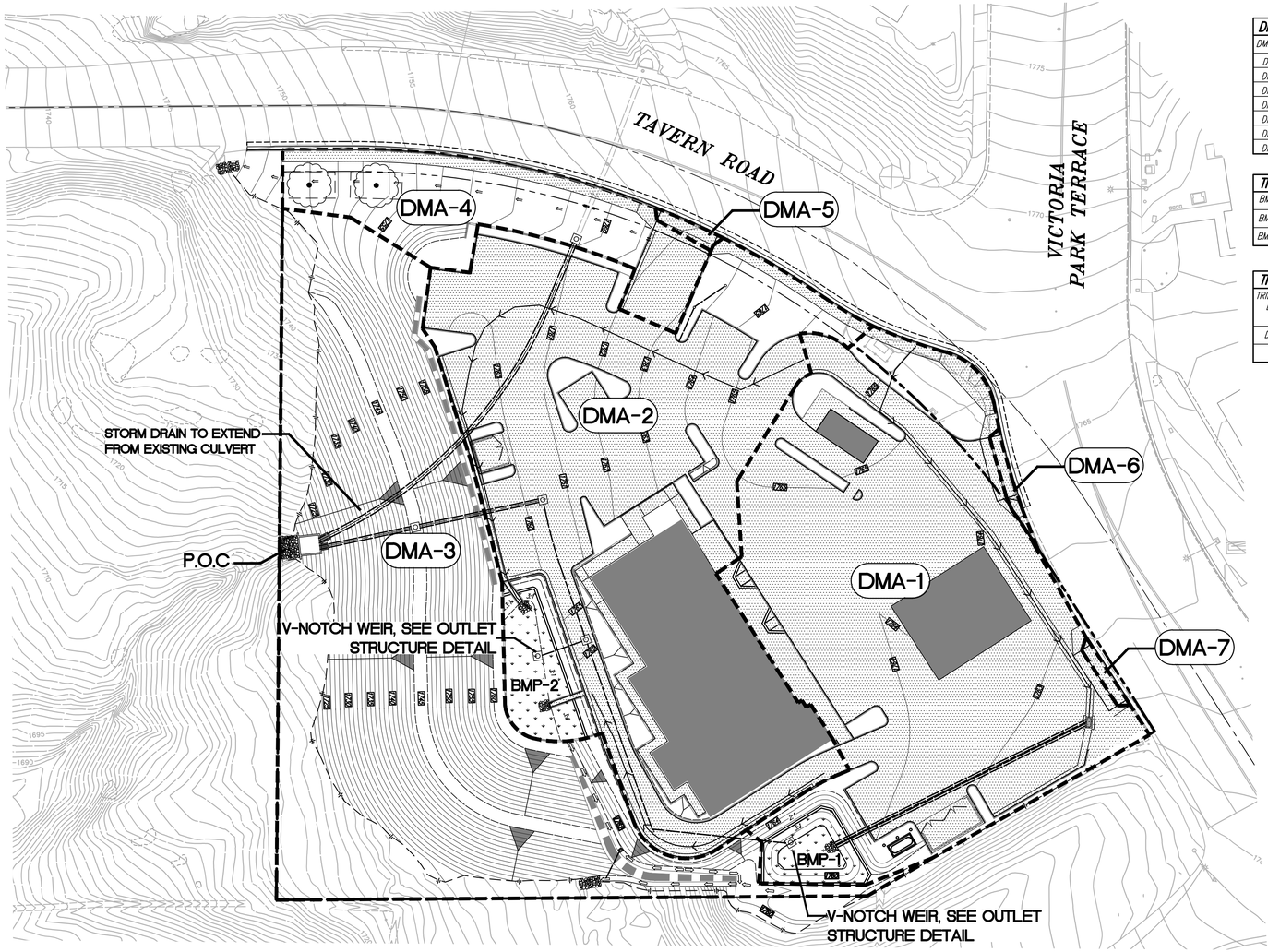
Form I-8 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question must be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Partial infiltration precluded by Criterion 5 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question must be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Partial infiltration precluded by Criterion 5 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
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 Agency/Jurisdictions to substantiate findings

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)



DMA DATA TABLE				
DMA-NO.	TOT. AREA	IMPERVIOUS %	DESIGN DCV	TYPE/TREATED BY
DMA-1	0.671 AC	83%	956 CF	DRAINS TO BMP-1
DMA-2	0.771 AC	78%	1,090 CF	DRAINS TO BMP-2
DMA-3	0.765 AC	0%	0 CF	SELF-MITIGATING
DMA-4	0.162 AC	30%	303 CF	STREET TREE
DMA-5	0.004 AC	100%	0 CF	DE MINIMIS AREA
DMA-6	0.005 AC	100%	0 CF	DE MINIMIS AREA
DMA-7	0.004 AC	100%	0 CF	DE MINIMIS AREA

TREATMENT BMP DATA TABLE			
BMP-#	TREATING	PROPOSED FOOTPRINT	DESCRIPTION
BMP-1	DMA-1	700 SF	BIOFILTRATION BASIN
BMP-2	DMA-2	1,039 SF	BIOFILTRATION BASIN

TREE WELL DATA TABLE					
TRIBUTARY BASIN	TOTAL DCV REDUCTION	STRUCTURAL SOIL DEPTH	STRUCTURAL SOIL VOLUME PER TREE	# OF TREES	DIAMETER
DMA-4	360 CF	2.5 FT	628 CF	2	20 FT
–	–	–	–	–	–

GRAPHICAL SCALE: 1" = 30'

0 15 30 60 90

BIOFILTRATION SOIL MEDIA NOTES

1. LONG-TERM PERCOLATION RATE OF 5.0 IN/HR MIN. & MAXIMUM RATE OF 10 IN/HR.
2. SOIL MEDIA SHALL BE LOOSELY PLACED (<80% COMPACTION)
3. CONTRACTOR SHALL SUBMIT BIO-MEDIA BLEND MATERIAL CUT-SHEETS AND INFILTRATION INFORMATION FOR REVIEW AND APPROVAL PRIOR TO ORDERING AND PLACEMENT.
4. BIORETENTION SOIL MEDIA COMPOSITION BY VOLUME:
   - 85% SAND (PER APPENDIX G.1, COUNTY OF SAN DIEGO LID MANUAL)
   - 5% SILT (PER APPENDIX G.1, COUNTY OF SAN DIEGO LID MANUAL)
   - 5% CLAY (PER APPENDIX G.1, COUNTY OF SAN DIEGO LID MANUAL)
   - 15% ORGANIC MATTER

BIOFILTRATION INSPECTION NOTES

CONTRACTOR MUST CONTACT ENGINEER FOR INSPECTION OF BMPS AT THE FOLLOWING STAGES OF CONSTRUCTION:

- PRIOR TO START OF CONSTRUCTION OF BIOFILTRATION AREA
- PRIOR TO CONSTRUCTION OF OUTLET STRUCTURES
- AFTER GRADING OF THE BASIN AREA FOR CERTIFICATION
- AFTER PLACEMENT OF IMPERMEABLE LINER (W/ EXTRA LENGTH FOR EMBEDMENT)
- AFTER PLACEMENT OF SUB-DRAIN
- AFTER THE PLACEMENT OF GRAVEL DRAINAGE LAYER
- AFTER PLACEMENT OF TREATMENT SOIL
- AFTER IRRIGATION AND LANDSCAPING ACTIVITIES

*SURVEY STAKES SHALL BE AVAILABLE FOR EACH AND EVERY INSPECTION

LEGEND:

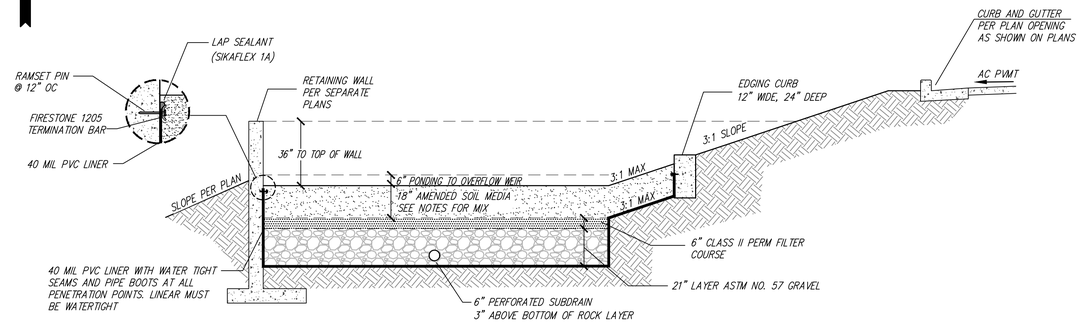
- DMA BOUNDARY
- DRAINAGE ARROWS
- DRAINAGE MANAGEMENT AREA NO. — DMA-3
- POINT OF COMPLIANCE — P.O.C-#
- STRUCTURAL BEST MANAGEMENT PRACTICE — BMP-#
- BUILDING AREA
- IMPERVIOUS AREA
- PERIOUS AREA
- TREE WELLS

IMPERMEABLE LINER NOTES

LINER SHALL BE A 40 MIL PVC LINER WITH WATERTIGHT SEAMS. WHEN INSTALLING LINER, CONTRACTOR SHALL LEAVE PROPER LENGTH AROUND TOP EDGE FOR ATTACHMENT TO WALLS.

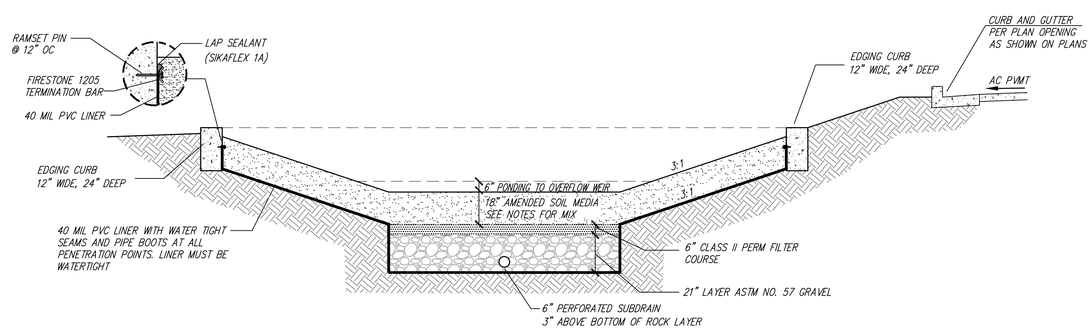
ALL PIPE PENETRATIONS SHALL BE WATER TIGHT WITH A GLUED PIPE BOOT AND STAINLESS STEEL HOSE CLAMP.

WHERE LINER ABUTS CONCRETE, IT SHALL BE AFFIXED TO THE CONCRETE WITH TERMINATION BARS RAMSET PINS, AND SIKAFLEX 1A ELASTOMERIC SEALANT PER DETAIL



BMP-2 SECTION

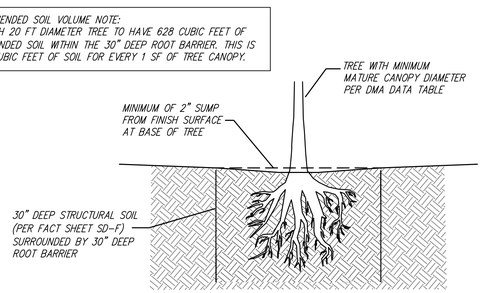
NOT TO SCALE



BMP-2 SECTION

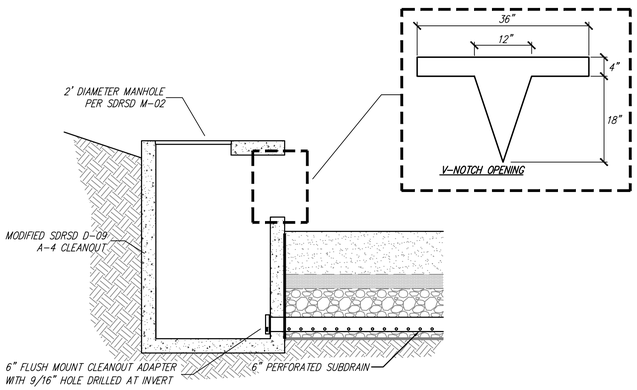
NOT TO SCALE

AMMENDED SOIL VOLUME NOTE:
EACH 20 FT DIAMETER TREE TO HAVE 628 CUBIC FEET OF AMENDED SOIL WITHIN THE 30" DEEP ROOT BARRIER. THIS IS 2 CUBIC FEET OF SOIL FOR EVERY 1 SF OF TREE CANOPY.



TREE-WELL (TYPICAL)

NOT TO SCALE



OUTLET STRUCTURE DETAIL

NOT TO SCALE

TAVERN ROAD GAS STATION

ALPINE, CALIFORNIA

ANDREW J. KANN R.C.E. 50940 — DATE

REGISTERED PROFESSIONAL ENGINEER — ANDREW J. KANN — No. 50940 — CIVIL — STATE OF CALIFORNIA

OMEGA ENGINEERING CONSULTANTS
4340 VIEWRIDGE AVE. SUITE B
SAN DIEGO, CA 92123
PH:(858) 634-8620 FAX:(858)-634-8627

NOTE:
ZAAP, INC. HAS PREPARED THIS SITE PLAN BASED ON INFORMATION PROVIDED BY THE PROPERTY OWNER. ZAAP, INC. ASSUMES NO LIABILITY FOR DIMENSIONAL ACCURACY OR THE EXISTENCE OF ANY IMPROVEMENT NOT READILY VISIBLE. THIS DRAWING IS NOT INTENDED AS A SUBSTITUTE FOR AN ALTA SURVEY.

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PROJECT NO. PDS2018-STP-18-012
ENVIRONMENTAL LOG NO. PDS2018-ER-18-14-003

ZAAP — ZIEBARTH ASSOCIATES ARCHITECTURE + PLANNING

PROJECT NO:	17010		
DATE:	10/21/2019		
REVISION #:	DATE:	REVISION #:	DATE:
1		5	
2		6	
3		7	
4		8	
PROJECT NAME:			
TAVERN ROAD GAS STATION			SHT #

0440-DMA Map.dwg

ATTACHMENT 2

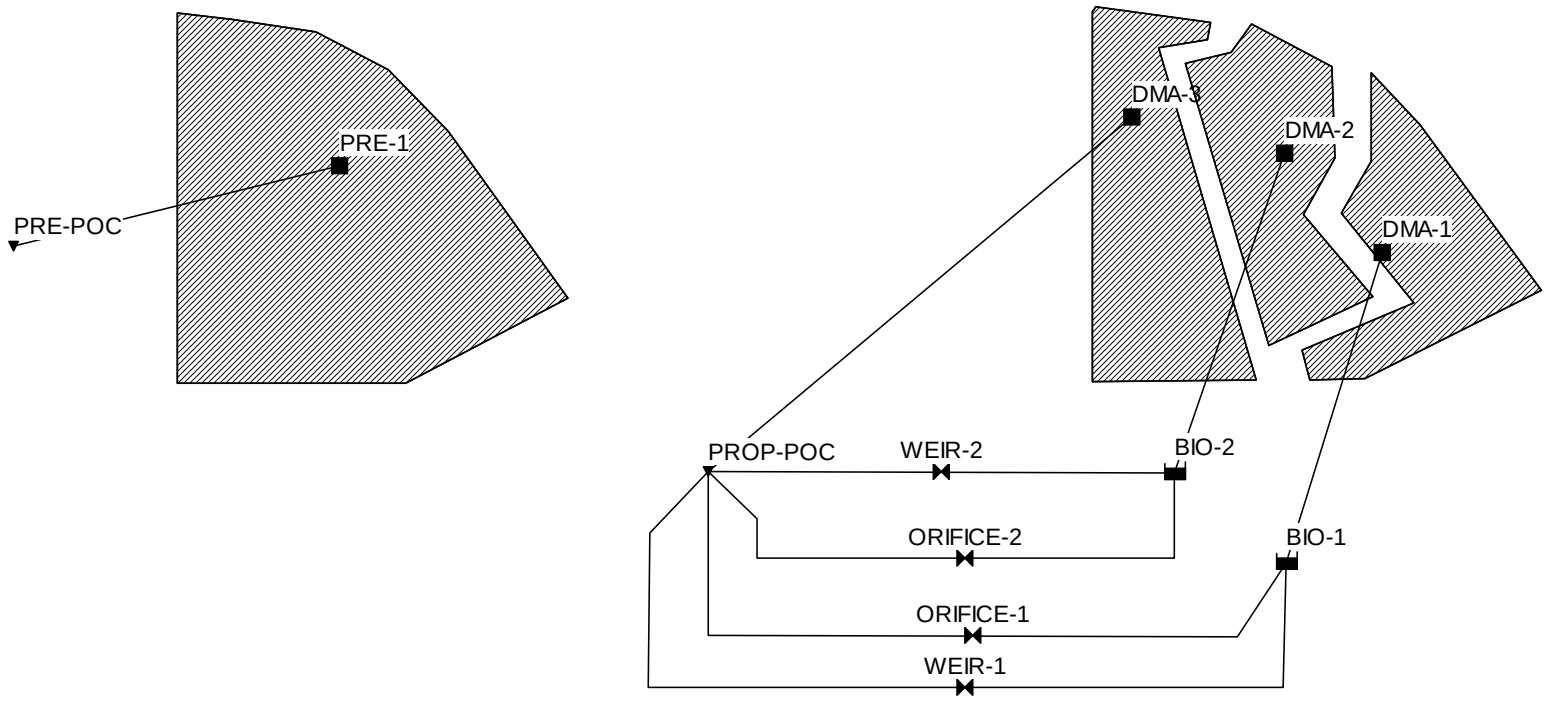
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

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

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	Contents	Checklist
Attachment 2a	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary (Required) See Chapter 6 and Appendix G of the BMP Design Manual	☒ Included ☐ Submitted as separate stand-alone document
Attachment 2b	Hydromodification Management Exhibit (Required)	☒ Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2c	Management of Critical Coarse Sediment Yield Areas See Section 6.2 and Appendix H of the BMP Design Manual.	☐ 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


PRE-1
PRE-POC
DMA-3
DMA-2
DMA-1
PROP-POC
WEIR-2
BIO-2
ORIFICE-2
BIO-1
ORIFICE-1
WEIR-1

Pre-project Flow Frequency - Long-term Simulation

Statistics - Node pre-poc Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	2/19/1980	45	2.273	0.33	46
2	1/25/1995	13	1.512	0.66	23
3	10/19/2004	48	1.379	0.99	15.33
4	2/6/1969	10	1.296	1.32	11.5
5	11/30/2007	4	1.293	1.64	9.2
6	11/22/1965	18	1.26	1.97	7.67
7	3/3/1980	7	1.253	2.3	6.57
8	2/14/1995	12	1.236	2.63	5.75
9	1/31/1979	15	1.156	2.96	5.11
10	2/8/1998	19	1.094	3.29	4.6
11	1/9/2005	20	1.074	3.62	4.18
12	1/14/1969	12	1.067	3.95	3.83
13	3/1/1983	62	1.046	4.28	3.54
14	12/23/1995	1	1.042	4.61	3.29
15	3/13/1996	7	1.016	4.93	3.07
16	2/8/1993	1	1.008	5.26	2.88
17	11/20/1983	10	0.986	5.59	2.71
18	2/3/1998	7	0.983	5.92	2.56
19	3/24/1983	3	0.983	6.25	2.42
20	2/27/1978	61	0.967	6.58	2.3
21	2/22/2004	18	0.966	6.91	2.19
22	1/28/1980	49	0.939	7.24	2.09
23	1/3/1977	4	0.904	7.57	2
24	1/6/1993	46	0.899	7.89	1.92
25	1/29/1983	4	0.897	8.22	1.84
26	3/17/1983	29	0.881	8.55	1.77
27	4/1/1982	4	0.853	8.88	1.7
28	2/27/1991	33	0.848	9.21	1.64
29	2/16/1980	41	0.833	9.54	1.59
30	3/4/1978	25	0.831	9.87	1.53
31	2/10/1978	8	0.826	10.2	1.48
32	2/13/1973	5	0.826	10.53	1.44
33	2/25/1996	2	0.818	10.86	1.39
34	1/12/1993	33	0.812	11.18	1.35
35	2/14/1998	4	0.808	11.51	1.31
36	11/29/1970	5	0.807	11.84	1.28
37	1/9/1980	1	0.799	12.17	1.24
38	11/11/1985	27	0.789	12.5	1.21
39	12/18/1967	6	0.784	12.83	1.18
40	4/28/2005	1	0.768	13.16	1.15
41	12/28/1977	6	0.765	13.49	1.12
42	1/4/1995	11	0.761	13.82	1.1
43	3/8/1973	4	0.73	14.14	1.07
44	2/21/2005	12	0.703	14.47	1.05
45	10/31/1987	5	0.702	14.8	1.02
46	3/31/1992	1	0.699	15.13	1
47	3/14/1982	7	0.694	15.46	0.98
48	1/31/1996	9	0.691	15.79	0.96
49	3/16/1986	14	0.683	16.12	0.94
50	11/30/1982	7	0.68	16.45	0.92
51	1/26/2008	17	0.673	16.78	0.9
52	10/28/1974	24	0.666	17.11	0.88
53	1/18/1979	12	0.651	17.43	0.87
54	9/10/1976	14	0.646	17.76	0.85
55	2/15/1986	11	0.637	18.09	0.84
56	10/26/1991	4	0.632	18.42	0.82
57	11/14/1993	4	0.63	18.75	0.81
58	5/7/1971	5	0.621	19.08	0.79
59	12/25/1988	4	0.614	19.41	0.78
60	3/18/2002	1	0.612	19.74	0.77
61	8/17/1977	3	0.61	20.07	0.75
62	3/10/2001	4	0.601	20.39	0.74
63	2/19/1993	5	0.589	20.72	0.73
64	2/10/1982	7	0.588	21.05	0.72
65	2/19/2007	7	0.586	21.38	0.71
66	3/31/1965	7	0.584	21.71	0.7
67	12/27/1984	23	0.583	22.04	0.69
68	2/18/1969	32	0.582	22.37	0.68
69	2/22/1969	7	0.582	22.7	0.67
70	1/9/1978	26	0.576	23.03	0.66
71	3/1/1981	21	0.573	23.36	0.65
72	11/15/1965	2	0.573	23.68	0.64
73	10/27/2004	5	0.571	24.01	0.63
74	3/5/1995	15	0.569	24.34	0.62
75	4/22/1967	5	0.568	24.67	0.61
76	2/20/2000	51	0.559	25	0.61
77	2/15/1992	3	0.557	25.33	0.6
78	1/18/1993	16	0.554	25.66	0.59
79	3/23/1995	1	0.552	25.99	0.58
80	3/11/1978	4	0.544	26.32	0.57
81	1/20/1964	23	0.539	26.64	0.57
82	2/17/1998	5	0.536	26.97	0.56
83	9/3/1976	1	0.529	27.3	0.55
84	2/25/2003	1	0.518	27.63	0.55
85	1/17/1988	15	0.518	27.96	0.54
86	1/28/2005	3	0.517	28.29	0.53
87	1/12/1997	1	0.517	28.62	0.53
88	3/24/1994	17	0.516	28.95	0.52
89	3/5/1970	11	0.514	29.28	0.52
90	3/21/1983	1	0.511	29.61	0.51
91	2/26/2004	15	0.507	29.93	0.51
92	2/26/1987	1	0.5	30.26	0.5
93	2/6/1966	7	0.498	30.59	0.49
94	3/15/2003	25	0.495	30.92	0.49
95	4/13/1976	3	0.493	31.25	0.48
96	1/3/2005	23	0.489	31.58	0.48
97	3/6/1975	3	0.488	31.91	0.47
98	12/6/1998	1	0.487	32.24	0.47
99	12/21/1970	6	0.486	32.57	0.46
100	3/16/1982	34	0.485	32.89	0.46
101	10/10/1986	2	0.481	33.22	0.46
102	11/10/1964	1	0.476	33.55	0.45
103	11/7/1966	3	0.471	33.88	0.45
104	12/9/1996	3	0.47	34.21	0.44
105	2/28/2006	12	0.466	34.54	0.44

10-year Q: 1.294 cfs (Adjust Column "I" to interpolate from Table)
5-year Q: 1.220 cfs
2-year Q: 0.904 cfs

Lower Flow Threshold: 10%

0.1xQ2 (Pre): 0.090 cfs

106	11/25/1985	19	0.464	34.87	0.43
107	2/13/2001	1	0.464	35.2	0.43
108	1/15/1993	35	0.464	35.53	0.43
109	1/17/1990	1	0.459	35.86	0.42
110	2/13/1980	25	0.459	36.18	0.42
111	4/7/1999	1	0.454	36.51	0.41
112	4/14/2003	1	0.45	36.84	0.41
113	2/8/1976	12	0.447	37.17	0.41
114	2/23/1998	27	0.445	37.5	0.4
115	12/18/1978	7	0.444	37.83	0.4
116	3/11/1973	4	0.442	38.16	0.4
117	12/14/1965	6	0.44	38.49	0.39
118	2/23/1979	1	0.435	38.82	0.39
119	2/12/1992	10	0.429	39.14	0.39
120	12/7/1992	6	0.429	39.47	0.38
121	1/14/1978	15	0.428	39.8	0.38
122	11/16/1972	4	0.428	40.13	0.38
123	2/11/1973	14	0.425	40.46	0.37
124	12/5/1966	44	0.423	40.79	0.37
125	1/24/1969	53	0.423	41.12	0.37
126	1/22/1967	7	0.421	41.45	0.37
127	1/4/1974	16	0.417	41.78	0.36
128	3/25/1998	26	0.416	42.11	0.36
129	5/8/1977	3	0.416	42.43	0.36
130	1/5/1992	16	0.413	42.76	0.35
131	1/10/1995	21	0.41	43.09	0.35
132	3/20/1992	1	0.405	43.42	0.35
133	12/4/1987	2	0.403	43.75	0.35
134	1/12/2001	1	0.402	44.08	0.34
135	12/16/2002	4	0.401	44.41	0.34
136	11/8/2002	25	0.397	44.74	0.34
137	2/26/2001	27	0.396	45.07	0.34
138	2/28/1970	40	0.394	45.39	0.33
139	3/5/1981	1	0.391	45.72	0.33
140	2/17/1997	1	0.39	46.05	0.33
141	2/14/2008	3	0.387	46.38	0.33
142	4/2/1965	23	0.385	46.71	0.32
143	2/26/1983	35	0.38	47.04	0.32
144	2/8/1994	12	0.378	47.37	0.32
145	1/11/2001	7	0.375	47.7	0.32
146	2/8/1983	4	0.37	48.03	0.32
147	1/4/1987	1	0.369	48.36	0.31
149	3/6/2001	2	0.368	49.01	0.31
149	3/28/1998	25	0.368	49.01	0.31
150	1/11/2005	8	0.368	49.34	0.31
151	1/7/1974	18	0.366	49.67	0.3
152	1/19/1980	2	0.363	50	0.3
153	3/23/1964	28	0.363	50.33	0.3
154	11/7/1963	1	0.361	50.66	0.3
155	11/25/1965	4	0.358	50.99	0.3
156	10/30/1996	3	0.358	51.32	0.29
157	3/10/1975	27	0.358	51.64	0.29
158	3/11/2006	11	0.356	51.97	0.29
159	12/19/1970	4	0.355	52.3	0.29
160	4/20/1988	40	0.354	52.63	0.29
161	3/10/1986	17	0.354	52.96	0.29
162	3/19/1981	4	0.347	53.29	0.28
163	1/14/1990	2	0.347	53.62	0.28
164	4/9/1965	28	0.346	53.95	0.28
165	1/21/1969	2	0.345	54.28	0.28
166	11/26/1967	2	0.344	54.61	0.28
167	1/26/1997	6	0.341	54.93	0.28
168	2/18/1994	1	0.341	55.26	0.27
169	11/24/1984	5	0.335	55.59	0.27
170	1/6/1979	4	0.335	55.92	0.27
171	3/31/1967	11	0.333	56.25	0.27
172	11/11/1964	1	0.333	56.58	0.27
173	3/28/1979	1	0.333	56.91	0.27
174	11/10/1969	2	0.332	57.24	0.26
175	12/18/1984	40	0.332	57.57	0.26
176	3/6/1980	10	0.331	57.89	0.26
177	4/11/1998	2	0.33	58.22	0.26
178	2/22/2008	2	0.33	58.55	0.26
179	3/1/1979	1	0.329	58.88	0.26
180	4/4/2006	14	0.327	59.21	0.26
181	5/12/1998	2	0.327	59.54	0.25
182	3/5/2000	1	0.323	59.87	0.25
183	11/24/1978	13	0.323	60.2	0.25
184	3/11/1995	22	0.321	60.53	0.25
185	11/4/1987	14	0.318	60.86	0.25
186	11/21/1967	14	0.318	61.18	0.25
187	2/6/1965	2	0.317	61.51	0.25
189	2/12/2000	3	0.316	62.17	0.24
189	2/17/2000	3	0.316	62.17	0.24
190	1/16/1978	21	0.312	62.5	0.24
191	4/8/1965	5	0.311	62.83	0.24
192	4/11/1967	7	0.309	63.16	0.24
193	4/12/1999	1	0.308	63.49	0.24
194	2/17/1994	3	0.307	63.82	0.24
195	1/27/1994	2	0.303	64.14	0.24
196	4/15/1998	2	0.302	64.47	0.23
197	11/12/2003	1	0.302	64.8	0.23
198	4/18/1995	5	0.3	65.13	0.23
199	12/8/1984	1	0.297	65.46	0.23
200	12/25/1971	5	0.294	65.79	0.23
201	11/22/1996	2	0.293	66.12	0.23
202	10/20/1979	3	0.293	66.45	0.23
203	12/27/1971	22	0.292	66.78	0.23
204	1/16/1979	1	0.284	67.11	0.23
205	11/23/1973	5	0.279	67.43	0.22
206	2/9/1981	3	0.274	67.76	0.22
207	12/23/1982	1	0.274	68.09	0.22
208	2/24/2000	2	0.273	68.42	0.22
209	11/11/1972	1	0.271	68.75	0.22
210	2/11/2005	31	0.268	69.08	0.22
211	2/13/1978	27	0.268	69.41	0.22
212	11/20/1967	1	0.267	69.74	0.22
213	12/4/1972	3	0.264	70.07	0.22
214	2/5/1978	4	0.262	70.39	0.21
215	3/1/1976	2	0.26	70.72	0.21
216	1/6/1977	4	0.25	71.05	0.21
217	1/25/1999	34	0.247	71.38	0.21
218	3/10/1970	1	0.247	71.71	0.21

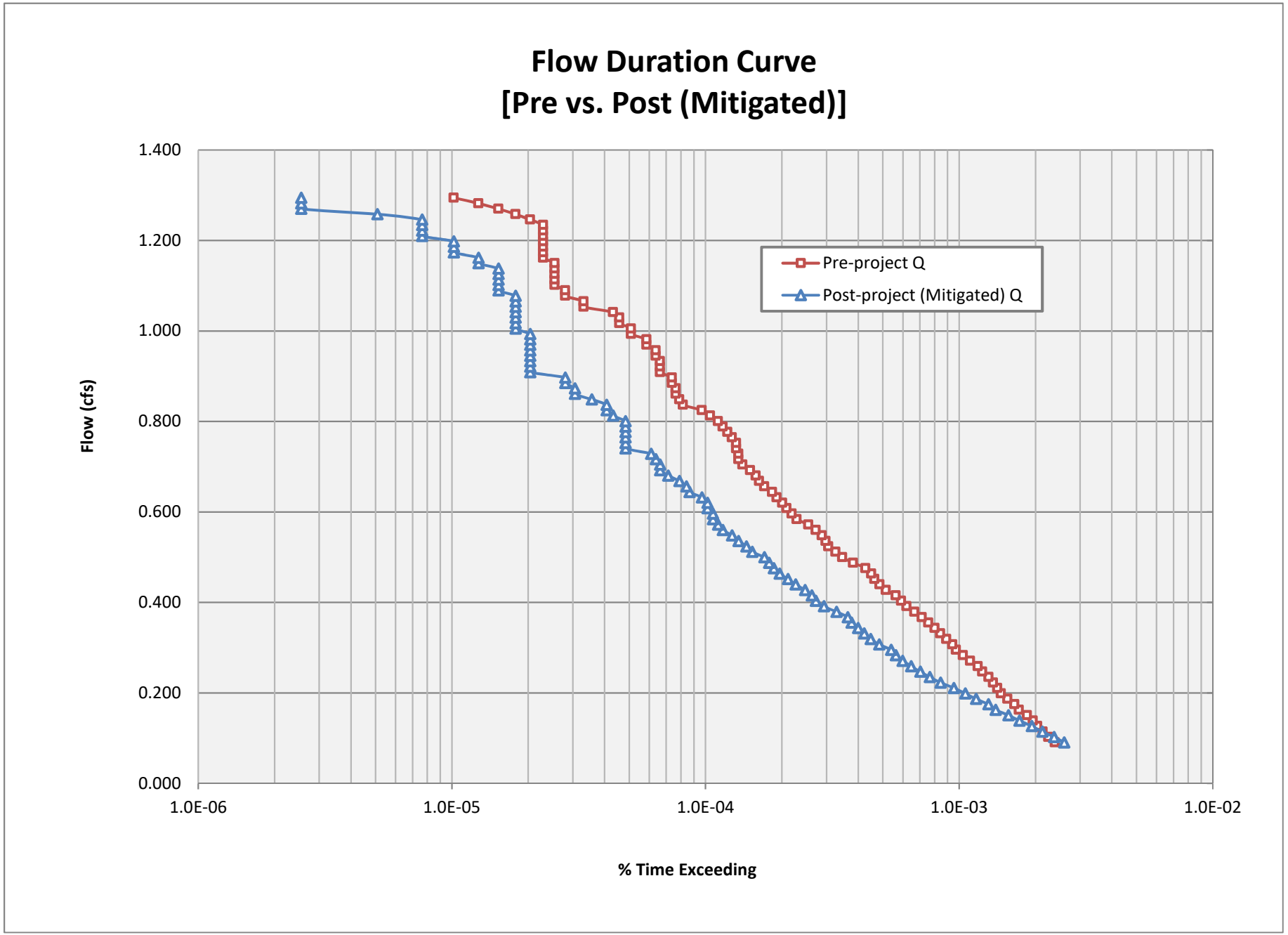
219	5/11/1989	1	0.243	72.04	0.21
220	4/18/2000	1	0.243	72.37	0.21
221	12/29/1991	9	0.242	72.7	0.21
222	12/10/1982	1	0.242	73.03	0.21
223	2/6/1976	27	0.24	73.36	0.21
224	2/22/2005	13	0.238	73.68	0.21
225	10/10/1966	1	0.234	74.01	0.2
226	2/18/2005	3	0.224	74.34	0.2
227	1/11/1980	8	0.221	74.67	0.2
228	2/6/1992	3	0.219	75	0.2
229	1/1/1966	1	0.218	75.33	0.2
230	1/26/2001	1	0.214	75.66	0.2
231	2/7/1978	4	0.212	75.99	0.2
232	3/29/2006	1	0.207	76.32	0.2
233	2/25/1969	7	0.202	76.64	0.2
234	3/4/2005	6	0.2	76.97	0.2
235	3/31/1998	1	0.198	77.3	0.2
236	12/8/1972	2	0.194	77.63	0.19
237	9/18/1963	15	0.188	77.96	0.19
238	12/10/1985	19	0.187	78.29	0.19
239	3/10/1980	3	0.184	78.62	0.19
241	12/21/1997	1	0.183	79.28	0.19
241	12/3/2001	1	0.183	79.28	0.19
242	2/29/1964	2	0.179	79.61	0.19
243	3/28/1982	1	0.179	79.93	0.19
244	3/10/1969	4	0.177	80.26	0.19
245	3/12/2006	3	0.176	80.59	0.19
246	4/1/1968	1	0.172	80.92	0.19
247	3/28/1973	1	0.171	81.25	0.19
248	11/29/2002	1	0.169	81.58	0.19
249	2/24/1987	1	0.168	81.91	0.18
250	3/31/1978	1	0.164	82.24	0.18
251	12/29/1965	3	0.163	82.57	0.18
252	12/6/1997	1	0.157	82.89	0.18
253	3/23/2005	1	0.156	83.22	0.18
254	12/8/2007	1	0.155	83.55	0.18
255	1/29/1981	2	0.15	83.88	0.18
256	1/30/1966	1	0.149	84.21	0.18
257	12/26/1977	5	0.149	84.54	0.18
258	3/17/1979	2	0.147	84.87	0.18
259	11/17/1964	3	0.146	85.2	0.18
260	11/16/1965	6	0.14	85.53	0.18
261	1/19/1973	3	0.139	85.86	0.18
262	11/20/1963	22	0.137	86.18	0.18
263	3/23/1992	1	0.135	86.51	0.17
264	12/16/1965	2	0.133	86.84	0.17
265	1/31/1986	1	0.129	87.17	0.17
266	12/17/1987	1	0.118	87.5	0.17
267	3/8/1975	2	0.113	87.83	0.17
269	2/6/1998	1	0.111	88.49	0.17
269	2/21/2001	1	0.111	88.49	0.17
270	4/8/1975	2	0.11	88.82	0.17
271	4/7/1978	1	0.109	89.14	0.17
272	2/2/1983	1	0.107	89.47	0.17
273	3/3/1976	1	0.106	89.8	0.17
274	3/8/1974	4	0.105	90.13	0.17
275	3/14/1967	2	0.098	90.46	0.17
276	3/5/1996	1	0.096	90.79	0.17
277	3/7/1994	5	0.094	91.12	0.17
278	3/20/1973	2	0.094	91.45	0.17
279	11/25/1983	1	0.089	91.78	0.16
280	3/12/1986	2	0.088	92.11	0.16
281	12/11/1984	3	0.081	92.43	0.16
282	12/28/1992	1	0.081	92.76	0.16
283	2/5/1976	1	0.079	93.09	0.16
284	1/25/1967	1	0.076	93.42	0.16
285	11/13/1964	3	0.067	93.75	0.16
286	2/12/2003	1	0.064	94.08	0.16
287	3/7/1973	1	0.064	94.41	0.16
288	12/19/1987	1	0.058	94.74	0.16
289	4/2/1974	1	0.056	95.07	0.16
290	2/27/2003	1	0.046	95.39	0.16
291	1/5/1978	1	0.04	95.72	0.16
292	10/16/1971	1	0.04	96.05	0.16
293	8/16/1983	1	0.033	96.38	0.16
294	11/29/1985	1	0.031	96.71	0.16
295	4/2/1981	2	0.027	97.04	0.16
296	4/15/1976	1	0.025	97.37	0.16
297	3/14/1975	2	0.021	97.7	0.15
298	4/1/1999	1	0.019	98.03	0.15
299	12/1/1998	1	0.017	98.36	0.15
300	1/16/1970	1	0.014	98.68	0.15
301	3/22/1983	1	0.009	99.01	0.15
302	11/14/1978	1	0.008	99.34	0.15
303	3/27/1981	1	0.005	99.67	0.15

Low-flow Threshold:	10%	
0.1xQ2 (Pre):	0.090	cfs
Q10 (Pre):	1.294	cfs
Ordinate #:	100	
Incremental Q (Pre):	0.01204	64
Total Hourly Data:	392652	hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	0.090	938	2.39E-03	1020	2.60E-03	109%	Pass
1	0.102	884	2.25E-03	930	2.37E-03	105%	Pass
2	0.114	839	2.14E-03	836	2.13E-03	100%	Pass
3	0.127	800	2.04E-03	760	1.94E-03	95%	Pass
4	0.139	767	1.95E-03	679	1.73E-03	89%	Pass
5	0.151	728	1.85E-03	614	1.56E-03	84%	Pass
6	0.163	676	1.72E-03	547	1.39E-03	81%	Pass
7	0.175	649	1.65E-03	512	1.30E-03	79%	Pass
8	0.187	610	1.55E-03	458	1.17E-03	75%	Pass
9	0.199	574	1.46E-03	415	1.06E-03	72%	Pass
10	0.211	556	1.42E-03	374	9.52E-04	67%	Pass
11	0.223	535	1.36E-03	332	8.46E-04	62%	Pass
12	0.235	514	1.31E-03	301	7.67E-04	59%	Pass
13	0.247	485	1.24E-03	276	7.03E-04	57%	Pass
14	0.259	466	1.19E-03	254	6.47E-04	55%	Pass
15	0.271	434	1.11E-03	235	5.98E-04	54%	Pass
16	0.283	407	1.04E-03	221	5.63E-04	54%	Pass
17	0.295	382	9.73E-04	212	5.40E-04	55%	Pass
18	0.307	370	9.42E-04	190	4.84E-04	51%	Pass
19	0.319	350	8.91E-04	176	4.48E-04	50%	Pass
20	0.331	331	8.43E-04	166	4.23E-04	50%	Pass
21	0.343	315	8.02E-04	157	4.00E-04	50%	Pass
22	0.355	297	7.56E-04	148	3.77E-04	50%	Pass
23	0.367	280	7.13E-04	143	3.64E-04	51%	Pass
24	0.379	262	6.67E-04	129	3.29E-04	49%	Pass
25	0.391	244	6.21E-04	115	2.93E-04	47%	Pass
26	0.403	232	5.91E-04	107	2.73E-04	46%	Pass
27	0.415	221	5.63E-04	103	2.62E-04	47%	Pass
28	0.427	202	5.14E-04	97	2.47E-04	48%	Pass
29	0.439	191	4.86E-04	89	2.27E-04	47%	Pass
30	0.451	182	4.64E-04	83	2.11E-04	46%	Pass
31	0.464	177	4.51E-04	77	1.96E-04	44%	Pass
32	0.476	168	4.28E-04	73	1.86E-04	43%	Pass
33	0.488	150	3.82E-04	70	1.78E-04	47%	Pass
34	0.500	136	3.46E-04	67	1.71E-04	49%	Pass
35	0.512	128	3.26E-04	60	1.53E-04	47%	Pass
36	0.524	120	3.06E-04	57	1.45E-04	48%	Pass
37	0.536	117	2.98E-04	53	1.35E-04	45%	Pass
38	0.548	113	2.88E-04	50	1.27E-04	44%	Pass
39	0.560	107	2.73E-04	46	1.17E-04	43%	Pass
40	0.572	100	2.55E-04	44	1.12E-04	44%	Pass
41	0.584	90	2.29E-04	42	1.07E-04	47%	Pass
42	0.596	86	2.19E-04	42	1.07E-04	49%	Pass
43	0.608	82	2.09E-04	40	1.02E-04	49%	Pass
44	0.620	79	2.01E-04	40	1.02E-04	51%	Pass
45	0.632	75	1.91E-04	38	9.68E-05	51%	Pass
46	0.644	72	1.83E-04	34	8.66E-05	47%	Pass
47	0.656	67	1.71E-04	33	8.40E-05	49%	Pass
48	0.668	64	1.63E-04	31	7.90E-05	48%	Pass
49	0.680	62	1.58E-04	28	7.13E-05	45%	Pass
50	0.692	59	1.50E-04	26	6.62E-05	44%	Pass
51	0.704	55	1.40E-04	26	6.62E-05	47%	Pass
52	0.716	53	1.35E-04	25	6.37E-05	47%	Pass
53	0.728	53	1.35E-04	24	6.11E-05	45%	Pass
54	0.740	52	1.32E-04	19	4.84E-05	37%	Pass

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
55	0.752	52	1.32E-04	19	4.84E-05	37%	Pass
56	0.764	50	1.27E-04	19	4.84E-05	38%	Pass
57	0.776	48	1.22E-04	19	4.84E-05	40%	Pass
58	0.789	46	1.17E-04	19	4.84E-05	41%	Pass
59	0.801	44	1.12E-04	19	4.84E-05	43%	Pass
60	0.813	41	1.04E-04	17	4.33E-05	41%	Pass
61	0.825	38	9.68E-05	16	4.07E-05	42%	Pass
62	0.837	32	8.15E-05	16	4.07E-05	50%	Pass
63	0.849	31	7.90E-05	14	3.57E-05	45%	Pass
64	0.861	30	7.64E-05	12	3.06E-05	40%	Pass
65	0.873	30	7.64E-05	12	3.06E-05	40%	Pass
66	0.885	29	7.39E-05	11	2.80E-05	38%	Pass
67	0.897	29	7.39E-05	11	2.80E-05	38%	Pass
68	0.909	26	6.62E-05	8	2.04E-05	31%	Pass
69	0.921	26	6.62E-05	8	2.04E-05	31%	Pass
70	0.933	26	6.62E-05	8	2.04E-05	31%	Pass
71	0.945	25	6.37E-05	8	2.04E-05	32%	Pass
72	0.957	25	6.37E-05	8	2.04E-05	32%	Pass
73	0.969	23	5.86E-05	8	2.04E-05	35%	Pass
74	0.981	23	5.86E-05	8	2.04E-05	35%	Pass
75	0.993	20	5.09E-05	8	2.04E-05	40%	Pass
76	1.005	20	5.09E-05	7	1.78E-05	35%	Pass
77	1.017	18	4.58E-05	7	1.78E-05	39%	Pass
78	1.029	18	4.58E-05	7	1.78E-05	39%	Pass
79	1.041	17	4.33E-05	7	1.78E-05	41%	Pass
80	1.053	13	3.31E-05	7	1.78E-05	54%	Pass
81	1.065	13	3.31E-05	7	1.78E-05	54%	Pass
82	1.077	11	2.80E-05	7	1.78E-05	64%	Pass
83	1.089	11	2.80E-05	6	1.53E-05	55%	Pass
84	1.101	10	2.55E-05	6	1.53E-05	60%	Pass
85	1.113	10	2.55E-05	6	1.53E-05	60%	Pass
86	1.126	10	2.55E-05	6	1.53E-05	60%	Pass
87	1.138	10	2.55E-05	6	1.53E-05	60%	Pass
88	1.150	10	2.55E-05	5	1.27E-05	50%	Pass
89	1.162	9	2.29E-05	5	1.27E-05	56%	Pass
90	1.174	9	2.29E-05	4	1.02E-05	44%	Pass
91	1.186	9	2.29E-05	4	1.02E-05	44%	Pass
92	1.198	9	2.29E-05	4	1.02E-05	44%	Pass
93	1.210	9	2.29E-05	3	7.64E-06	33%	Pass
94	1.222	9	2.29E-05	3	7.64E-06	33%	Pass
95	1.234	9	2.29E-05	3	7.64E-06	33%	Pass
96	1.246	8	2.04E-05	3	7.64E-06	38%	Pass
97	1.258	7	1.78E-05	2	5.09E-06	29%	Pass
98	1.270	6	1.53E-05	1	2.55E-06	17%	Pass
99	1.282	5	1.27E-05	1	2.55E-06	20%	Pass
100	1.294	4	1.02E-05	1	2.55E-06	25%	Pass

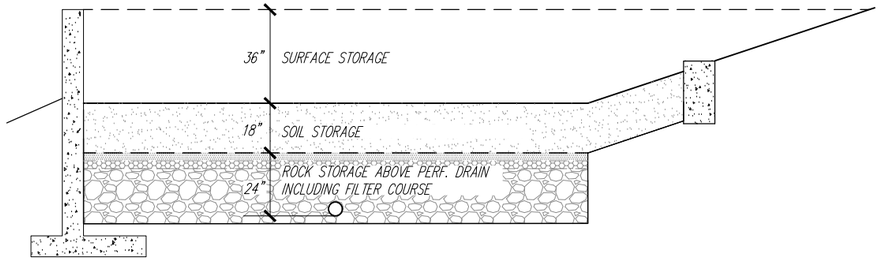

Flow Duration Curve
[Pre vs. Post (Mitigated)]
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Flow (cfs)
Pre-project Q
Post-project (Mitigated) Q
1.0E-06
1.0E-05
1.0E-04
1.0E-03
1.0E-02
% Time Exceeding

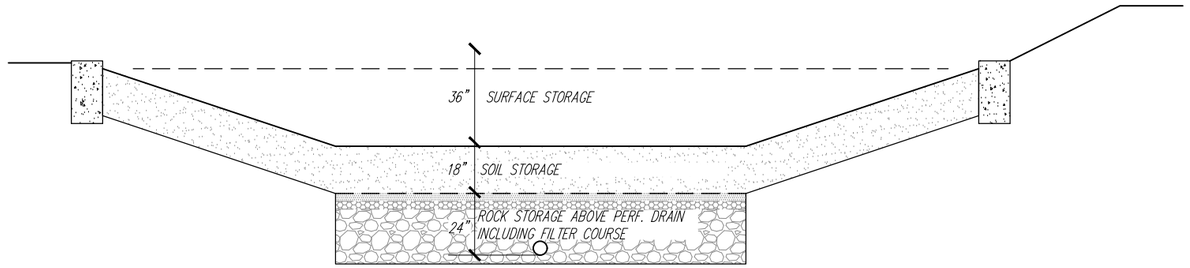
```
[TITLE]
;;Project Title/Notes

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

START_DATE           08/08/1963
START_TIME           06:00:00
REPORT_START_DATE    08/08/1963
REPORT_START_TIME    06:00:00
END_DATE             05/23/2008
END_TIME             18:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.070  0.100  0.130  0.170  0.190  0.220  0.240  0.220  0.190  0.130  0.090  0.060
DRY_ONLY         NO

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
PRE-1            FLINN_SPRINGS    PRE-POC          2.21     0.0      232      25       0
DMA-3            FLINN_SPRINGS    PROP-POC         0.77     0        288      50       0
```

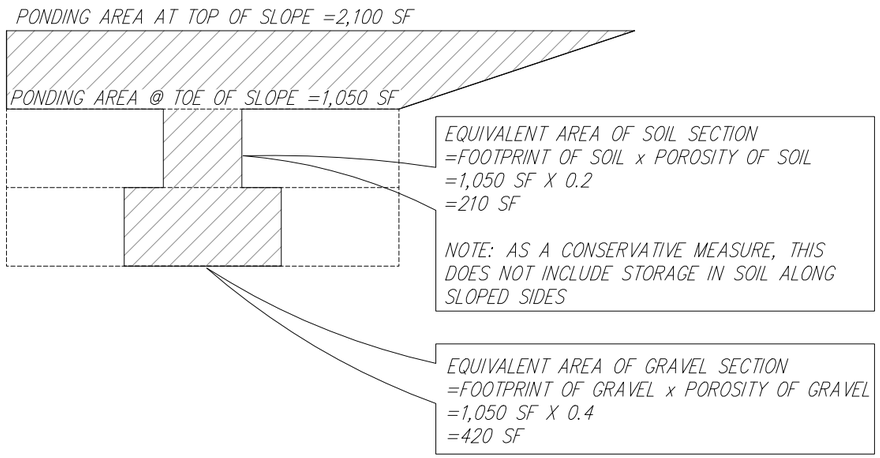
```
DMA-2            FLINN_SPRINGS    BIO-2            0.77     78       134      2.0      0
DMA-1            FLINN_SPRINGS    BIO-1            0.67     83       92       1        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
PRE-1            0.011      0.03       0.05       0.10       25         OUTLET
DMA-3            0.011      0.04       0.05       0.10       25         PERVIOUS   100
DMA-2            0.011      0.06       0.05       0.10       25         PERVIOUS   100
DMA-1            0.011      0.06       0.05       0.10       25         PERVIOUS   100

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
PRE-1            9.0        0.025      0.33
DMA-3            9.0        0.025      0.33
DMA-2            9.0        0.025      0.33
DMA-1            9.0        0.025      0.33

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

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------          -------- --------
BIO-1            0        6.0        0          TABULAR    BIO-1                          0        0
BIO-2            0        6.0        0          TABULAR    BIO-2                          0        0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
ORIFICE-1        BIO-1            PROP-POC         SIDE         0          0.65       NO       0
ORIFICE-2        BIO-2            PROP-POC         SIDE         0          0.65       NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff     Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- -------- ---------- ---------- ---------- ----------
WEIR-1           BIO-1            PROP-POC         V-NOTCH      4.0        3.33       NO       0        0          YES
WEIR-2           BIO-2            PROP-POC         V-NOTCH      4.0        3.33       NO       0        0          YES

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
ORIFICE-1        CIRCULAR     0.046875         0          0          0
ORIFICE-2        CIRCULAR     0.046875         0          0          0
WEIR-1           TRIANGULAR   1.5              1          1.0        1.0
WEIR-2           TRIANGULAR   1.5              1          1          1

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
BIO-2            Storage    0          420
BIO-2                       2.0        420
```

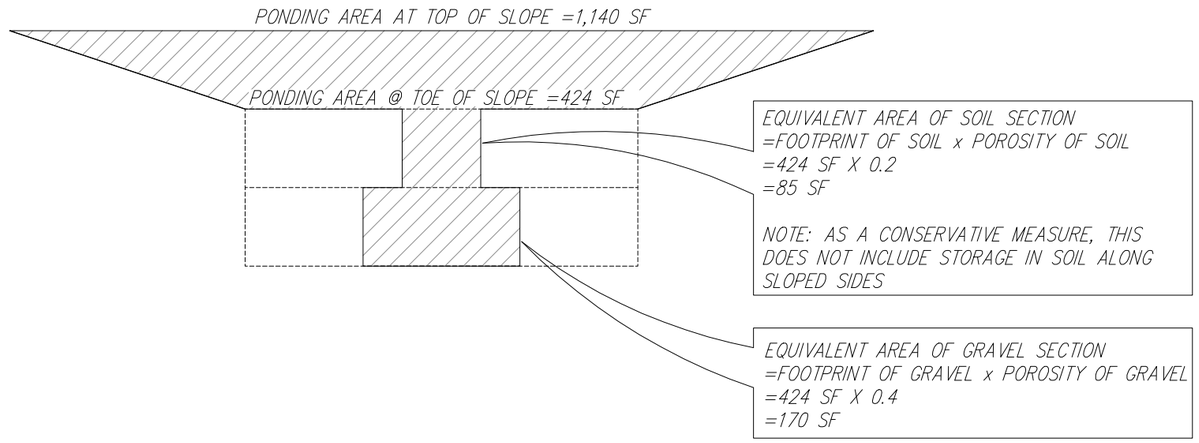
```
BIO-2                    2.01       210
BIO-2                    3.5        210
BIO-2                    3.51       1050
BIO-2                    6.0        2100
;
BIO-1            Storage 0          170
BIO-1                    2.0        170
BIO-1                    2.01       85
BIO-1                    3.5        85
BIO-1                    3.51       424
BIO-1                    6.0        1140

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
FLINN_SPRINGS    8/8/1963   6:00       0.01
FLINN_SPRINGS    8/8/1963   7:00       0.01
FLINN_SPRINGS    9/4/1963   1:00       0.02
FLINN_SPRINGS    9/4/1963   2:00       0.01
FLINN_SPRINGS    9/4/1963   4:00       0.01
FLINN_SPRINGS    9/4/1963   5:00       0.04
FLINN_SPRINGS    9/4/1963   6:00       0.06
FLINN_SPRINGS    9/4/1963   7:00       0.12
FLINN_SPRINGS    9/4/1963   8:00       0.08
FLINN_SPRINGS    9/4/1963   9:00       0.14
FLINN_SPRINGS    9/4/1963   10:00      0.18
FLINN_SPRINGS    9/4/1963   11:00      0.06
FLINN_SPRINGS    9/17/1963  2:00       0.02
FLINN_SPRINGS    9/17/1963  3:00       0.03
FLINN_SPRINGS    9/17/1963  4:00       0.02
FLINN_SPRINGS    9/17/1963  6:00       0.05
FLINN_SPRINGS    9/17/1963  7:00       0.04
FLINN_SPRINGS    9/17/1963  8:00       0.03
FLINN_SPRINGS    9/17/1963  15:00      0.01
FLINN_SPRINGS    9/17/1963  16:00      0.06
FLINN_SPRINGS    9/17/1963  17:00      0.05
FLINN_SPRINGS    9/17/1963  18:00      0.06
FLINN_SPRINGS    9/17/1963  19:00      0.11
FLINN_SPRINGS    9/17/1963  20:00      0.17
FLINN_SPRINGS    9/17/1963  21:00      0.14
FLINN_SPRINGS    9/17/1963  22:00      0.08
FLINN_SPRINGS    9/17/1963  23:00      0.17
FLINN_SPRINGS    9/17/1963  24:00      0.02
FLINN_SPRINGS    9/18/1963  2:00       0.01
FLINN_SPRINGS    9/18/1963  3:00       0.02
FLINN_SPRINGS    9/18/1963  4:00       0.05
FLINN_SPRINGS    9/18/1963  5:00       0.01
FLINN_SPRINGS    9/18/1963  6:00       0.02
FLINN_SPRINGS    9/18/1963  7:00       0.01
FLINN_SPRINGS    9/18/1963  8:00       0.06
FLINN_SPRINGS    9/18/1963  9:00       0.03
FLINN_SPRINGS    9/18/1963  10:00      0.01
FLINN_SPRINGS    9/18/1963  11:00      0.02
FLINN_SPRINGS    9/18/1963  12:00      0.15
FLINN_SPRINGS    9/18/1963  13:00      0.09
FLINN_SPRINGS    9/19/1963  7:00       0.07
```

Rain gauge data has been appended, as the full set is 100+ pages long. The full data set is included in the USB thumb drive included in this submittal.









STORAGE CURVE TABLE		
STAGE (FT)	PONDING AREA (SF)	STORAGE MATERIAL
6.5	2,100	SURFACE PONDING
3.51	1,050	SURFACE PONDING
3.5	210	SOIL
2.01	210	SOIL
2.00	420	GRAVEL
0.00	420	GRAVEL

NOTE:
AT STAGES WHERE SECTION MATERIAL CHANGES (GRAVEL TO SOIL, SOIL TO SURFACE) IT IS NECESSARY TO HAVE A SMALL STAGE INCREMENT OVER WHICH THE CHANGE TAKES PLACE. THIS IS BECAUSE THE CALCULATIONS DO NOT ALLOW FOR TWO PONDING AREA VALUES AT THE SAME STAGE.

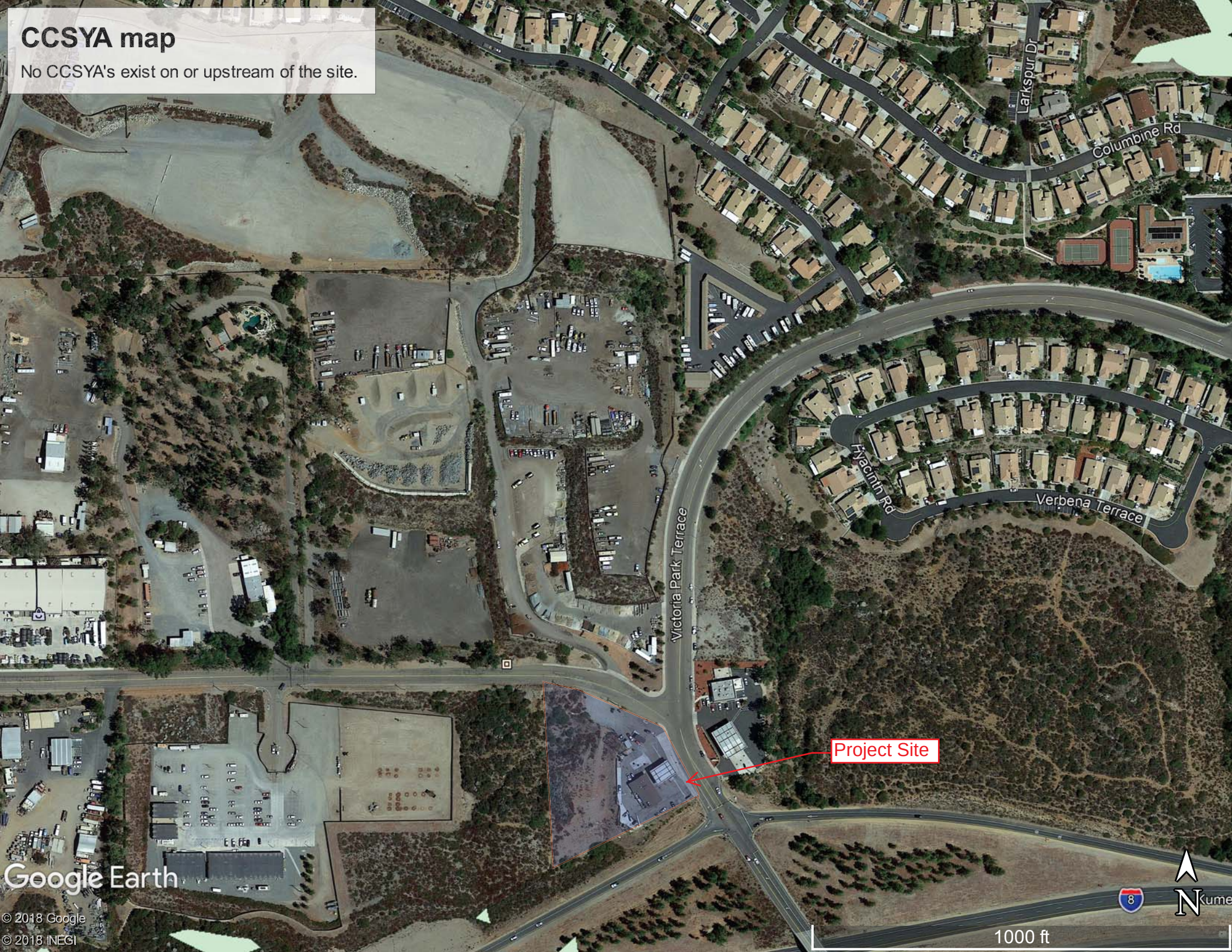
STORAGE CURVE TABLE		
STAGE (FT)	PONDING AREA (SF)	STORAGE MATERIAL
6.5	1,140	SURFACE PONDING
3.51	424	SURFACE PONDING
3.5	85	SOIL
2.01	85	SOIL
2.00	170	GRAVEL
0.00	170	GRAVEL

BMP-2, STORAGE CURVE EQUIVALENT AREA DETAILS

NOT TO SCALE

BMP-1, STORAGE CURVE EQUIVALENT AREA DETAILS

NOT TO SCALE


CCSYA map
No CCSYA's exist on or upstream of the site.
Larkspur Dr
Columbine Rd
Victoria Park Terrace
Hyacinth Rd
Verbena Terrace
Project Site
Google Earth
© 2018 Google
© 2018 INEGI
N
1000 ft

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)

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

Maintenance Plan to be included in ministerial submittals.

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.

ATTACHMENT 4

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

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County of San Diego BMP Design Manual Verification Form	
Project Summary Information	
Project Name	Tavern Road Gas Station
Record ID (e.g., grading/improvement plan number)	PDS2018-STP-18-012
Project Address	1140 Tavern Road, Alpine, CA 91901
Assessor's Parcel Number(s) (APN(s))	403-380-42, 45, & 46
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	The site is located in the Alpine Hydrologic subarea (907.33) on the southeasterly edge of the El Capitan Hydrologic area on the southeasterly border of the San Diego Hydrologic Unit.
Responsible Party for Construction Phase	
Developer's Name	Tony Shores
Address	2020 Hillside Road, El Cajon, CA 92019
Email Address	
Phone Number	609-250-1474
Engineer of Work	Andrew J Kann
Engineer's Phone Number	858-634-8620
Responsible Party for Ongoing Maintenance	
Owner's Name(s)*	TBD
Address	
Email Address	
Phone Number	
*Note: If a corporation or LLC, provide information for principal partner or Agent for Service of Process. If an HOA, provide information for the Board or property manager at time of project closeout.	

County of San Diego BMP Design Manual Verification Form Page 2 of 4					
Stormwater Structural Pollutant Control & Hydromodification Control BMPs* (List all from SWQMP)					
Description/Type of Structural BMP	**Plan Sheet #**	**STRUCT-URAL BMP ID#**	**Maint-enance Category**	**Maintenance Agreement Recorded Doc #**	**Revisions**
Biofiltration Basin	TBD	BMP-1	TBD		
Biofiltration Basin	TBD	BMP-2	TBD		
Tree Well	TBD	BMP-2	TBD		
Tree Well	TBD	BMP-4	TBD		
*All Priority Development Projects (PDPs) require a Structural BMP					

Note: If this is a partial verification of Structural BMPs, provide a list and map denoting Structural BMPs that have already been submitted, those for this submission, and those anticipated in future submissions.

County of San Diego BMP Design Manual Verification Form Page 3 of 4

Checklist for Applicant to submit to PDCI:

- ☐ Copy of the final accepted SWQMP and any accepted addendum.
- ☐ Copy of the most current plan showing the Stormwater Structural BMP Table, plans/cross-section sheets of the Structural BMPs and the location of each verified as-built Structural BMP.
- ☐ Photograph of each Structural BMP.
- ☐ Photograph(s) of each Structural BMP during the construction process to illustrate proper construction.
- ☐ Copy of the approved Structural BMP maintenance agreement and associated security

By signing below, I certify that the Structural BMP(s) for this project have been constructed and all BMPs are in substantial conformance with the approved plans and applicable regulations. I understand the County reserves the right to inspect the above BMPs to verify compliance with the approved plans and Watershed Protection Ordinance (WPO). Should it be determined that the BMPs were not constructed to plan or code, corrective actions may be necessary before permits can be closed.

Please sign your name and seal.

Professional Engineer's Printed Name:

Patric de Boer, PE

Professional Engineer's Signed Name:

[SEAL]

Date:

County of San Diego BMP Design Manual Verification Form Page 4 of 4

COUNTY - OFFICIAL USE ONLY:

For PDCI: Verification Package #: _____

PDCI Inspector: _____

Date Project has/expects to close: _____

Date verification received from EOW: _____

By signing below, PDCI Inspector concurs that every noted Structural BMP has been installed per plan.

PDCI Inspector's Signature: _____ Date: _____

FOR WPP:

Date Received from PDCI: _____

WPP Submittal Reviewer: _____

WPP Reviewer concurs that the information provided for the following Structural BMPs is acceptable to enter into the Structural BMP Maintenance verification inventory:

List **acceptable** Structural BMPs:

WPP Reviewer's Signature: _____ Date: _____

ATTACHMENT 5

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

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: CEQA Drainage Study- Tavern Road Gas Station
Prepared By: Omega Engineering Consultants, Inc
Date: August 15, 2018

Preliminary Drainage Study
Tavern Road Gas Station
1040 Tavern Road
Alpine, CA 91901

Project ID:
PDS2018-STP-18-012

Date Prepared:
April 9th, 2019

Prepared for:
Ziebarth Associates
Architecture + Planning
2900 4th Ave, #204
San Diego, CA 92103
Ph: (619) 233-6450

Prepared By:
Omega Engineering Consultants
4340 Viewridge Ave, Suite B
San Diego, CA 92123
Ph: (858) 634-8620

Declaration of Responsible Charge:
I hereby declare that I am the engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards. I understand that the check of the project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as an engineer of work, of my responsibilities for project design.

_____

Patric T. de Boer RCE 83583
Registration Expires 3-31-2019

Table of Contents

Appendices

Site & Project Description

This drainage study has been prepared as part of the grading plans for the proposed commercial redevelopment at the intersection Tavern Road and Victoria Park Terrace. The redevelopment includes a gas station and several restaurants. The project will be constructed with a fueling area, parking spaces and landscaped biofiltration basins to treat stormwater before it is discharged from the site.

The project is subject to hydromodification requirements and will be constructed with outlet control facilities. See Figure 2 for the existing drainage limits. See Figure 3 for the proposed drainage limits. There will be no work over waterways and the project will not involve dredged material, thus this project does not require approval under Clean Water Acts 401 or 404.

Methodology

This drainage report has been prepared in accordance with current County of San Diego regulations and procedures. The Modified Rational Method was used to compute the anticipated peak runoff flowrates for the existing and proposed conditions. RatHydro was used to generated hydrographs based on the Rational Method results. These hydrographs were routed through storage elements in the SWMM model of the site that was generated for hydromodification compliance. The resulting peak flowrates from each storage element was input back into the Rational Method calculations and confluenced with according to the hydrology manual. See the attached calculations for particulars.

Rational Method

Q=CIA

Where:

Q=peak discharge, in cubic feet per second (cfs)
C=runoff coefficient, proportion of the rainfall that runs off the surface (no units)
=(0.90*(% impervious)+Cp*(1-% Impervious)) page 5, County Hydrology Manual
I =average rainfall intensity for a duration equal to the Tc for the area, (in/hr)
= 7.44*P6*Tc-0.645
A = drainage area contributing to the design location, in acres
Cp= Pervious Coefficient Runoff Value, County Hydrology Manual minimum of 0.35
Tc= Ti +Tt
Ti = Initial Time of Concentration (From table 3-2, County Hydrology Manual
Tt= Travel time of concentrated flow to Discharge Point
S= Slope of drainage course*

The following references have been used in preparation of this report:

(1) Handbook of Hydraulics, E.F. Brater & H.W. King, 6th Ed., 1976.
(2) Modern Sewer Design, American Iron & Steel Institute, 1st Ed., 1980.
(3) County of San Diego Hydrology Manual, 2003

Existing Conditions

The existing site is an operating gas station located at the easterly side of the site. The westerly half is a fill slope and undeveloped natural hillside with existing culvert stubbing out from the hillside. The existing impervious improvements consist of building rooftop and paving. The developed portion of the site drains in two directions, with the north portion of the gas station draining to the north and the south portion draining to the south. Both portions drain to natural, unhardened slopes, which convey runoff to the two separate discharge points.

A culvert north of the site collects runoff from a 13.74 ac offsite basin that includes residential areas, public roads and industrial equipment yards. This culvert flows under Tavern Road, under a portion of the site and daylights at a headwall on the steep slope west of the gas station. The flow from this culvert is included in the confluenced flow at Discharge Pt. 1 for the existing conditions.

Proposed Conditions

The proposed project will construct a gas station with two restaurants. The improvements will be built where the existing gas station is located. The pad will be expanded by pushing the fill slope to the west. A private storm drain system will be constructed to convey runoff to two biofiltration facilities. Both of these will have outlet control structures to store and attenuate discharge for hydromodification and flood control purposes.

The biofiltration basins will drain via an 18" storm drain to a concrete energy dissipater at the toe of the proposed fill slope west of the development.

The existing culvert for offsite flow that was described in the existing conditions will no longer daylight at the northwest end of the site, as the existing headwall will be covered with fill dirt. The pipe will be extended with new 24" RCP to the previously mentioned concrete energy disapater.

The biofiltration areas will serve as storage for flow attenuation for the 100-year storm as well as flow mitigation for hydromodification purposes. The excess volume generated by the peak of the 100 year storm will be stored in the biofiltration basin and released at an attenuated rate.

Existing Runoff Analysis

For the existing condition calculations, the area of analysis was broken into three drainage catchments, EX-1, EX-2 & OFF-1. EX-1 contains the northerly half of the area of analysis. EX-2 contains the southerly portion of the area of analysis. OFF-1 is the offsite area that drains to the culvert under Tavern Rd. The Rational Method was used to determine the peak flow generated by each catchment. These peak flows were confluence according to the Junction Equations in the County Hydrology Manual.

Runoff coefficients were calculated by taking a weighted average of the surface types for each basin. A value of 0.90 was used for impervious surfaces and 0.35 was used for pervious surfaces.

Basin #	Area (ac)	Impervious %	C	I (in/hr)	Q_{100} (cfs)
EX-1	1.99	7%	0.39	8.64	6.69
EX-2	1.94	33%	0.53	8.72	8.98
OFF-1	13.74	11%	0.41	4.51	25.30

The peak flowrate at Discharge Point #1 is **28.79 cfs** for the 100-yr storm event. This includes flow from EX-1 & OFF-1 . The peak flowrate at Discharge Point #2 is **8.98 cfs.** This includes flow from only EX-2. See the attached calculations for details.

Proposed Runoff Analysis

For the proposed conditions calculations, the area of analysis was broken into five drainage catchments. P-1, P-2, P-3 and OFF-1 drain to Discharge Point #1. Basin P-4 drains to Discharge Point #2.

P-1, P-2 & P-3 contain the majority of the site and proposed improvements including two biofiltration basins that will be used for 100-yr flow attenuation. P-4 contains a portion of the fill slope and other offsite areas.

RatHydro was used to generate hydrographs based on the Rational Method Calculations for basins P-1 and P-2. These hydrographs were input as a time series into the SWMM model that was built for the HMP calculations. The hydrograph was then run through the modeled biofiltration systems. The outflow from the biofiltration basins was confluenced with flow from the remaining portions of the area of analysis. The confluenced flow at both discharge points were determined to be less than the existing conditions.

Runoff coefficients were calculated by taking a weighted average of the surface types for each basin. A value of 0.9 was used for impervious surfaces and 0.35 was used for pervious surfaces.

Below is a summary of the basin input data:

Basin #	Area (ac)	Impervious %	C	Slope	Q_{100} (cfs)	Mitigated Q_{100} (cfs)
P-1	0.65	85%	0.82	1%	4.76	*0.85
P-2	0.77	81%	0.80	2%	5.49	*2.61
P-3	1.34	0%	0.35	15%	3.09	3.09
P-4	1.17	0%	0.35	9%	2.70	2.70
OFF-1	13.74	11%	0.41	5%	25.30	25.30

The peak flowrate with mitigation at Discharge Point #1 is **27.94 cfs** and Discharge Point #2 is **2.70 cfs** for 100-year storm event**.** See the attached calculations for details.

Results and Conclusions

The redevelopment of the site will decrease the peak flowrate generated, despite an increase in impervious area compared to the existing condition. This is due to flattening of the average slope of the disturbed area of the site, as well as the flow attenuation that is accomplished by storage in the biofiltration basin and controlled release. The biofiltration facilities were designed to discharge the runoff at a flowrate less than the existing drainage condition. It was concluded that the redevelopment will result in a 0.85 cfs decrease in peak flow at Discharge Point #1 and a decrease of 6.27 cfs at Discharge Point #2.

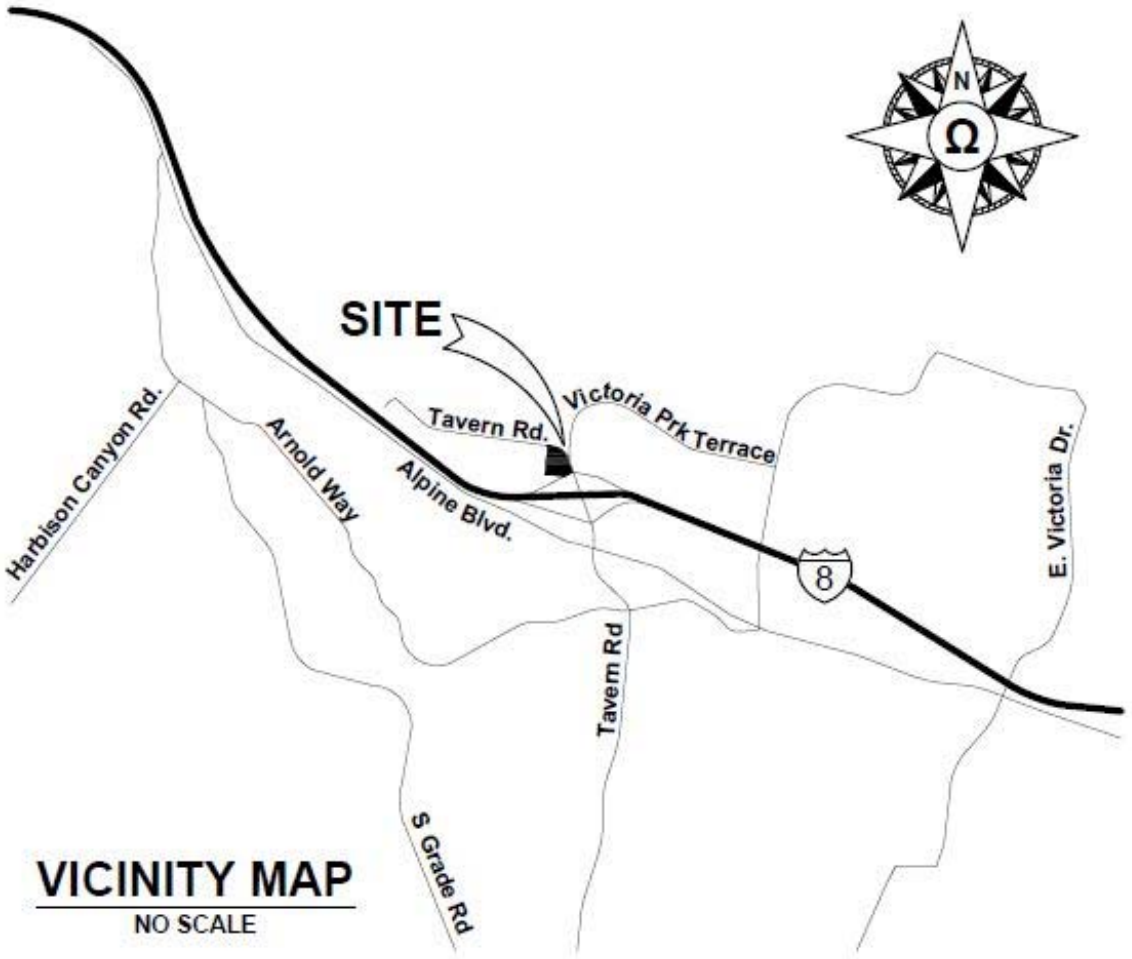
The county has indicated that it considers a reduction in flow to be a flow diversion. We do not consider this to be a flow diversion, as it does not increase flow to any offsite area by diverting flow. Additionally there are no hydrologic features such as wetlands or marshes in the vicintity of the site that would be negatively impacted by the reduced flowrate. The reduction in flow brings the downstream drainage conditions closer to predeveloped flow conditions.

Project will not place structures or housing in 100 year flood hazard area as the project is not located in a flood hazard area. The project will not expose people or structures to the risk of loss, injury or death involving flooding as a result of the failure of a levee or dam.

Project does not propose to discharge fill or dredged materials to the Waters of the State, therefore CWA 401 or 404 permits are not required. It is the opinion of Omega Engineering Consultants that the project will not cause adverse effects to the downstream facilities or receiving waters as a result of increased stormwater flowrates.

A separate Storm Water Quality Management Plan (SWQMP) has been prepared to discuss the water quality impacts for the proposed development.

Due to the measures taken to attenuate stormwater peak flow rates, it is the opinion of Omega Engineering Consultants that the project will not cause adverse effects to downstream conveyances and waterways that would be the result of increased or decreased stormwater flowrates.



VICINITY MAP

NO SCALE

GRAPHICAL SCALE: 1" = 60'

0 30 60 120

EX-2

SEE SEPARATE EXHIBIT FOR FULL EXTENTS

EX. CONF. PT-1
EX. 24" HEADWALL

EX-1

EX-2

VICTORIA PARK TERRACE

TAVERN ROAD

DISCHARGE PT #1
Q_{100}=28.79 cfs

DISCHARGE PT #2
Q_{100}=8.98 cfs

LEGEND

- BASIN NUMBER — EX-#
- ONSITE DRAINAGE BASIN LIMITS
- OFFSITE DRAINAGE BASIN LIMITS
- SURFACE DRAINAGE DIRECTION
- BUILDING AREA
- PAVEMENT AREA
- PERVIOUS AREA

DRAINAGE BASIN DATA

BASIN #	AREA (AC)	C VALUE	T_C (MINS)	I_{100} (IN/HR)	Q_{100} (CFS)
EX-1	1.99	0.77	5.3	8.46	6.69
EX-2	1.94	0.53	5.2	8.72	8.98
OFF-1	13.74	0.41	31.68	2.72	25.3

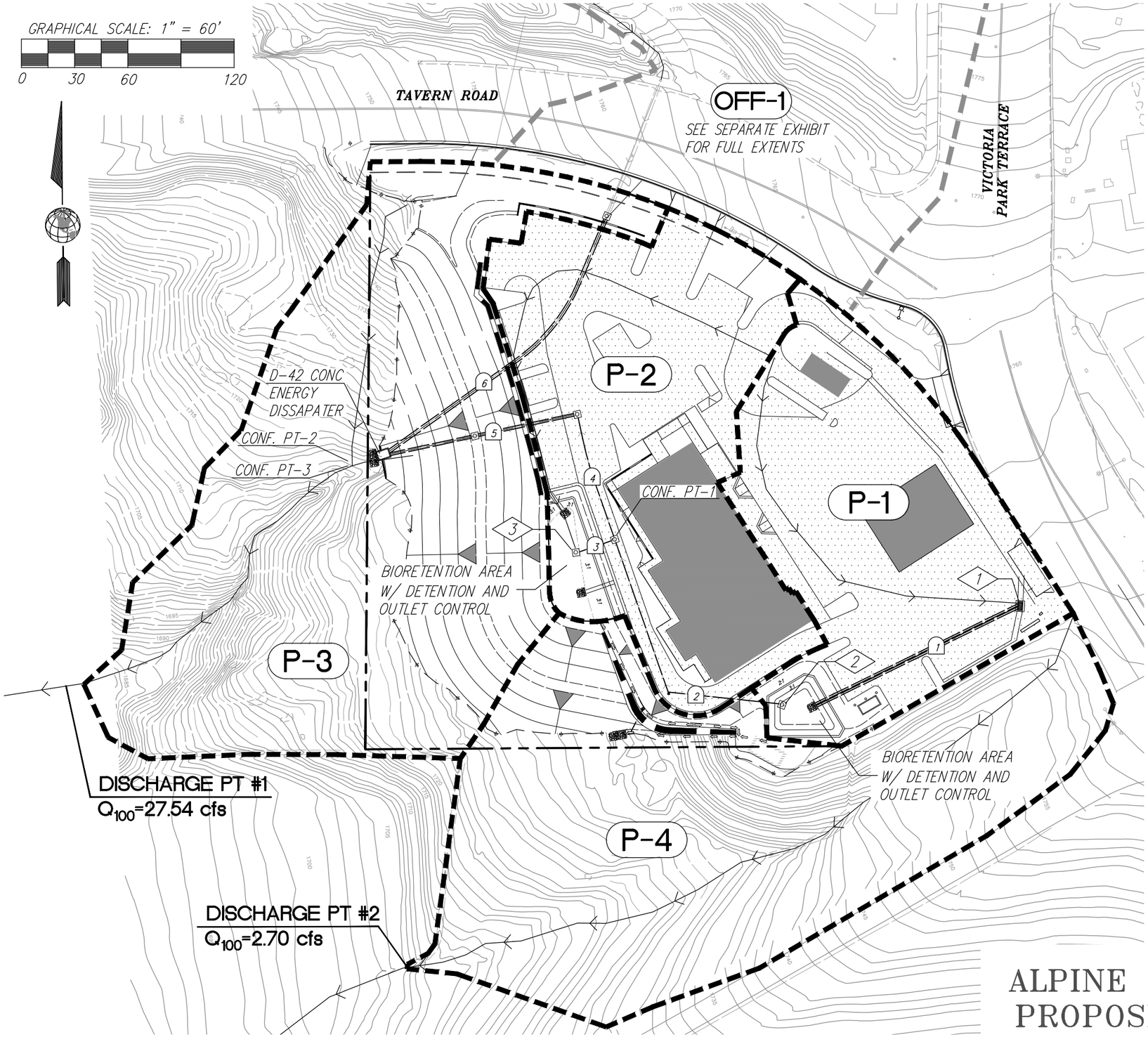
ALPINE SHELL STATION
EXISTING HYDROLOGY

OMEGA

EX. HYDROLOGY EXHIBIT

GRAPHICAL SCALE: 1" = 60'

0 30 60 120



LEGEND

BASIN NUMBER ..... P-#

ONSITE DRAINAGE BASIN LIMITS .....

OFFSITE DRAINAGE BASIN LIMITS .....

SURFACE DRAINAGE DIRECTION .....

PIPE DRAINAGE DIRECTION .....

BUILDING AREA .....

PAVEMENT AREA .....

PERVIOUS AREA .....

DRAINAGE BASIN DATA

BASIN #	AREA (AC)	C VALUE	T_C (MINS)	I_{100} (IN/HR)	Q_{100} (CFS)	Q_{100} MITIGATED (CFS)
P-1	0.65	0.82	5.0	8.96	4.76	0.85
P-2	0.80	0.80	5.0	8.96	5.49	2.61
P-3	0.35	0.35	8.1	6.58	3.09	3.09
P-4	0.35	0.35	8.0	6.62	2.70	2.70
OFF-1	13.74	0.41	14.5	4.51	25.3	25.30

STORM DRAIN INLETS

◇1	INLET DESCRIPTION	Q_{100} (CFS)
#1	SDRSD G-2 INLET	4.76
#2	V-NOTCH WEIR	4.76
#3	V-NOTCH WEIR	5.49

DRAINAGE CONVEYANCES

◇X	CONVEYANCE DESCRIPTION	DEPTH/ DIAMETER	Q_{100} (CFS)	V_{100} (FPS)
#1	2-12" PIPES @ 0.5% MIN	0.77	2.38	3.67
#2	18" DIA. PIPE @ 1% MIN	0.47	4.76	5.83
#3	18" DIA. PIPE @ 1% MIN	0.51	5.49	6.05
#4	18" DIA. PIPE @ 1% MIN	0.79	10.24	6.83
#5	18" DIA. PIPE @ 18% MIN	0.32	10.27	21.00
#6	24" DIA. PIPE @ 18% MIN	0.49	25.30	25.82

ALPINE SHELL STATION
PROPOSED HYDROLOGY

OMEGA

PROP. HYDROLOGY EXHIBIT

LEGEND:

AREA LIMITS

DRAINAGE DIRECTION ARROW

PAVEMENT AREA

PERVIOUS AREA

BASIN DATA

BASIN	AREA (ac)	C	T_C (mins)	I (in/hr)	Q_{100}(cfs)
OFF-1	13.74	0.41	14.5	4.51	25.30

GRAPHICAL SCALE: 1" = 150'

0 75 150 350 450

ALPINE SHELL STATION
OFFSITE BASIN

OMEGA

OFFSITE BASIN

ALPINE HEIGHTS SUBDIVISION
HYDROLOGY AND HYDRAULICS CALCS (Table No. 1)

4/9/2019

BASIN	AREA (SF)	AREA (AC)	% Imp	"C" Value
EXISTING BASINS				
EX-1	86,809	1.99	7.0%	0.39
EX-2	84,364	1.94	33.0%	0.53
EX. TOTAL	**171,173**	**3.93**	20.1%	0.46
PROPOSED BASINS				
P-1	28,290	0.65	85.0%	0.82
P-2	33,550	0.77	81.0%	0.80
P-3	58,557	1.34	0.0%	0.35
P-4	50,776	1.17	0.0%	0.35
PROP TOTAL	**171,173**	**3.93**	29.9%	0.51
OFFSITE BASINS				
OFF-1	598,526	13.74	10.6%	0.41

Basin Confluence	Symbol
EX-1	ECP#1
(A-1 & A-2)	CP#1
(CP#1 & A-3)	CP#2

(A) CP # - Proposed Confluence Point

(B) C value for bare ground is 0.35 (Table 3-1 County Hydrology Manual) (Type 'D' soil)

(C.) C value for impervious surfaces is 0.9
Basins with mixed surface type use a weighted average of these 2 values. (impervious % x 0.9)+(pervious % x 0.35)

ALPINE SHELL STATION 4/9/2019

HYDROLOGY AND HYDRAULICS CALCS (Table No. 2)

Sub-Basin	AREA Ac.	"C"	CA	Overland flow length	Concentrated Flow Length, (ft)	S(%) (avg.)	Ti mins	Tt mins	T_c mins	I in/hr	Q cfs	Q tot cfs	NOTES 85th % Storm
EX-1	1.99	0.39	0.77	60.0	530.0	14%	3.2	2.1	5.3	0.20	0.15	0.15	
OFF-1	13.74	0.41	5.61	100.0	1843.0	5%	6.4	8.1	14.5	0.20	1.12	1.12	
									14.5	0.20		1.28	Ex. Confluence Pt-1
												1.28	**Discharge Pt. 1**
EX-2	1.94	0.53	1.03	60.0	515.0	10%	3.2	2.0	5.2	0.20	0.21	0.21	
												0.21	**Discharge Pt. 2**
P-1	0.65	0.82	0.53	70.0	250.0	1%	2.7	1.4	5.0	0.20	0.11	0.11	
P-2	0.77	0.80	0.61	80.0	200.0	2%	2.6	1.1	5.0	0.20	0.12	0.12	
									5.0	0.20	0.11	0.23	Confluence Pt. 1
P-3	1.34	0.35	0.47	100.0	400.0	15%	6.9	1.2	8.1	0.20	0.09	0.09	
									8.1	0.20	0.00	0.24	Confluence Pt. 2
OFF-1	13.74	0.41	5.61	100.0	1843.0	5%	6.4	8.1	14.5	0.20	1.12	1.12	
									14.5	0.20	0.00	1.36	Confluence Pt. 3
												1.36	**Discharge Pt. 1**
P-4	1.17	0.35	0.41	100.0	320.0	9%	6.9	1.1	8.0	0.20	0.08	0.08	
												0.08	**Discharge Pt. 2**

ALPINE SHELL STATION 4/9/2019

HYDROLOGY AND HYDRAULICS CALCS (Table No. 3)

Sub-Basin	AREA Ac.	"C"	CA	Overland flow length	Concentrated Flow Length, (ft)	S(%) (avg.)	Ti mins	Tt mins	T_c mins	I in/hr	Q cfs	Q tot cfs	NOTES 100-Year Storm
													P(6)= 3.4
EX-1	1.99	0.39	0.77	60.0	530.0	14%	3.2	2.1	5.3	8.64	6.69	6.69	
OFF-1	13.74	0.41	5.61	100.0	1843.0	5%	6.4	8.1	14.5	4.51	25.30	25.30	
									14.5	4.51		28.79	Ex. Confluence Pt-1
												28.79	**Discharge Pt. 1**
EX-2	1.94	0.53	1.03	60.0	515.0	10%	3.2	2.0	5.2	8.72	8.98	8.98	
												8.98	**Discharge Pt. 2**
P-1	0.65	0.82	0.53	70.0	250.0	1%	2.7	1.4	5.0	8.96	4.76	4.76	
P-2	0.77	0.80	0.61	80.0	200.0	2%	2.6	1.1	5.0	8.96	5.49	5.49	
									5.0	8.96	4.76	10.24	Confluence Pt. 1
P-3	1.34	0.35	0.47	100.0	400.0	15%	6.9	1.2	8.1	6.58	3.09	3.09	
									8.1	8.96	0.00	9.44	Confluence Pt. 2
OFF-1	13.74	0.41	5.61	100.0	1843.0	5%	6.4	8.1	14.5	4.51	25.30	25.30	
									14.5	8.96	0.00	30.05	Confluence Pt. 3
												30.05	**Discharge Pt. 1**
P-4	1.17	0.35	0.41	100.0	320.0	9%	6.9	1.1	8.0	6.62	2.70	2.70	
												2.70	**Discharge Pt. 2**

ALPINE SHELL STATION 4/9/2019

HYDROLOGY AND HYDRAULICS CALCS (Table No. 4)

Sub-Basin	AREA Ac.	"C"	CA	Overland flow length	Concentrated Flow Length, (ft)	S(%) (avg.)	Ti mins	Tt mins	T_c mins	I in/hr	Q cfs	Q tot cfs	NOTES 100-Year Storm (mitigated)
													P(6)= 3.4
EX-1	1.99	0.39	0.77	60.0	530.0	14%	3.2	2.1	5.3	8.64	6.69	6.69	
OFF-1	13.74	0.41	5.61	100.0	1843.0	5%	6.4	8.1	14.5	4.51	25.30	25.30	
									14.5	4.51		28.79	Ex. Confluence Pt-1
												28.79	**Discharge Pt. 1**
EX-2	1.94	0.53	1.03	60.0	515.0	10%	3.2	2.0	5.2	8.72	8.98	8.98	
												8.98	**Discharge Pt. 2**
P-1	0.65	0.82	0.53	70.0	250.0	1%	2.7	1.4	5.0	8.96	4.76	0.85	**Mitigated flowrates**
P-2	0.77	0.80	0.61	80.0	200.0	2%	2.6	1.1	5.0	8.96	5.49	2.61	**Mitigated flowrates**
									5.0	8.96	4.76	3.46	Confluence Pt. 1
P-3	1.34	0.35	0.47	100.0	400.0	15%	6.9	1.2	8.1	6.58	3.09	3.09	
									8.1	8.96	0.00	5.24	Confluence Pt. 2
OFF-1	13.74	0.41	5.61	100.0	1843.0	5%	6.4	8.1	14.5	4.51	25.30	25.30	
									14.5	8.96	0.00	27.94	Confluence Pt. 3
												27.94	**Discharge Pt. 1**
P-4	1.17	0.35	0.41	100.0	320.0	9%	6.9	1.1	8.0	6.62	2.70	2.70	
												2.70	**Discharge Pt. 2**

CONDUIT SIZING CALCULATIONS

The following chart details the sizing parameters and for conduits that convey runoff on the site.
Flow parameters from *Handbook of Hydraulics, King & Brater* were used, see following page.

K'= Discharge factor	=	$(Q*n)/(d^{8/3}*s^{1/2})$
n= Mannings coefficient	=	0.013 for PVC & HDPE
d=diameter of conduit (ft)	=	per chart
Q= Discharge	=	based off portions of basins tributary to outlet
s=Minimum Pipe Slope (ft/ft)	=	per chart
D=depth of flow	=	From table 7-4 of the *Handbook of Hydraulics, King & Brater* See right
C_a= Flow factor	=	From table 7-14 of the *Handbook of Hydraulics, King & Brater* See right
A=Cross sectional area of flow	=	C_a*d^2
V=Velocity	=	Q/A

Pipe Flow

Pipe	Tributary Areas	Q (cfs)	S (%)	d (in)	K'	D/d	C_a	A (sf)	V (fps)
1	P-1, 2 pipes	2.38	0.5	12	0.4376	0.77	0.649	0.649	3.67
2	P-1	4.76	1	18	0.2099	0.47	0.363	0.816	5.83
3	P-2	5.49	1	18	0.2421	0.51	0.403	0.907	6.05
4	P-1 & P-2	10.24	1	18	0.4515	0.79	0.666	1.499	6.83
5	P-1 & P-2	10.24	18	18	0.1064	0.32	0.217	0.488	21.00
6	Offsite Basin	25.3	18	24	0.1221	0.35	0.245	0.980	25.82

Table 7-4. For Determining the Area a of the Cross Section of a Circular Conduit Flowing Part Full

Let $\frac{\text{depth of water}}{\text{diameter of channel}} = \frac{D}{d}$ and C_a = the tabulated value. Then $a = C_a d^2$.

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0013	.0037	.0069	.0105	.0147	.0192	.0242	.0294	.0350
.1	.0409	.0470	.0534	.0600	.0668	.0739	.0811	.0885	.0961	.1039
.2	.1118	.1199	.1281	.1365	.1449	.1535	.1623	.1711	.1800	.1890
.3	.1982	.2074	.2167	.2260	.2355	.2450	.2546	.2642	.2739	.2836
.4	.2934	.3032	.3130	.3229	.3328	.3428	.3527	.3627	.3727	.3827
.5	.393	.403	.413	.423	.433	.443	.453	.462	.472	.482
.6	.492	.502	.512	.521	.531	.540	.550	.559	.569	.578
.7	.587	.596	.605	.614	.623	.632	.640	.649	.657	.666
.8	.674	.681	.689	.697	.704	.712	.719	.725	.732	.738
.9	.745	.750	.756	.761	.766	.771	.775	.779	.782	.784

Table 7-14. Values of K' for Circular Channels in the Formula

$$Q = \frac{K'}{n} d^{8/3} s^{1/2}$$

D = depth of water d = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0		.00007	.00031	.00074	.00138	.00222	.00328	.00455	.00604	.00775
.1	.00967	.0118	.0142	.0167	.0195	.0225	.0257	.0291	.0327	.0366
.2	.0406	.0448	.0492	.0537	.0585	.0634	.0686	.0738	.0793	.0849
.3	.0907	.0966	.1027	.1089	.1153	.1218	.1284	.1352	.1420	.1490
.4	.1561	.1633	.1705	.1779	.1854	.1929	.2005	.2082	.2160	.2238
.5	.232	.239	.247	.255	.263	.271	.279	.287	.295	.303
.6	.311	.319	.327	.335	.343	.350	.358	.366	.373	.380
.7	.388	.395	.402	.409	.416	.422	.429	.435	.441	.447
.8	.453	.458	.463	.468	.473	.477	.481	.485	.488	.491
.9	.494	.496	.497	.498	.498	.498	.496	.494	.489	.483
1.0	.463									

Inlet Report

Inlet # 1, (G-2 inlet)

Drop Grate Inlet

Location	= Sag
Curb Length (ft)	= -0-
Throat Height (in)	= -0-
Grate Area (sqft)	= 7.68
Grate Width (ft)	= 1.92
Grate Length (ft)	= 4.00

Gutter

Slope, Sw (ft/ft)	= 0.086
Slope, Sx (ft/ft)	= 0.086
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

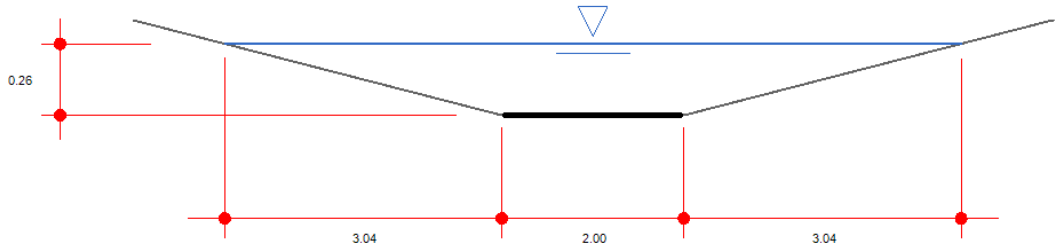
Calculations

Compute by:	Known Q
Q (cfs)	= 4.76

Highlighted

Q Total (cfs)	= 4.76
Q Capt (cfs)	= 4.76
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 3.14
Efficiency (%)	= 100
Gutter Spread (ft)	= 8.09
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Section

Weir Report

Inlet #2 (V-notch Weir)

V-Notch Weir

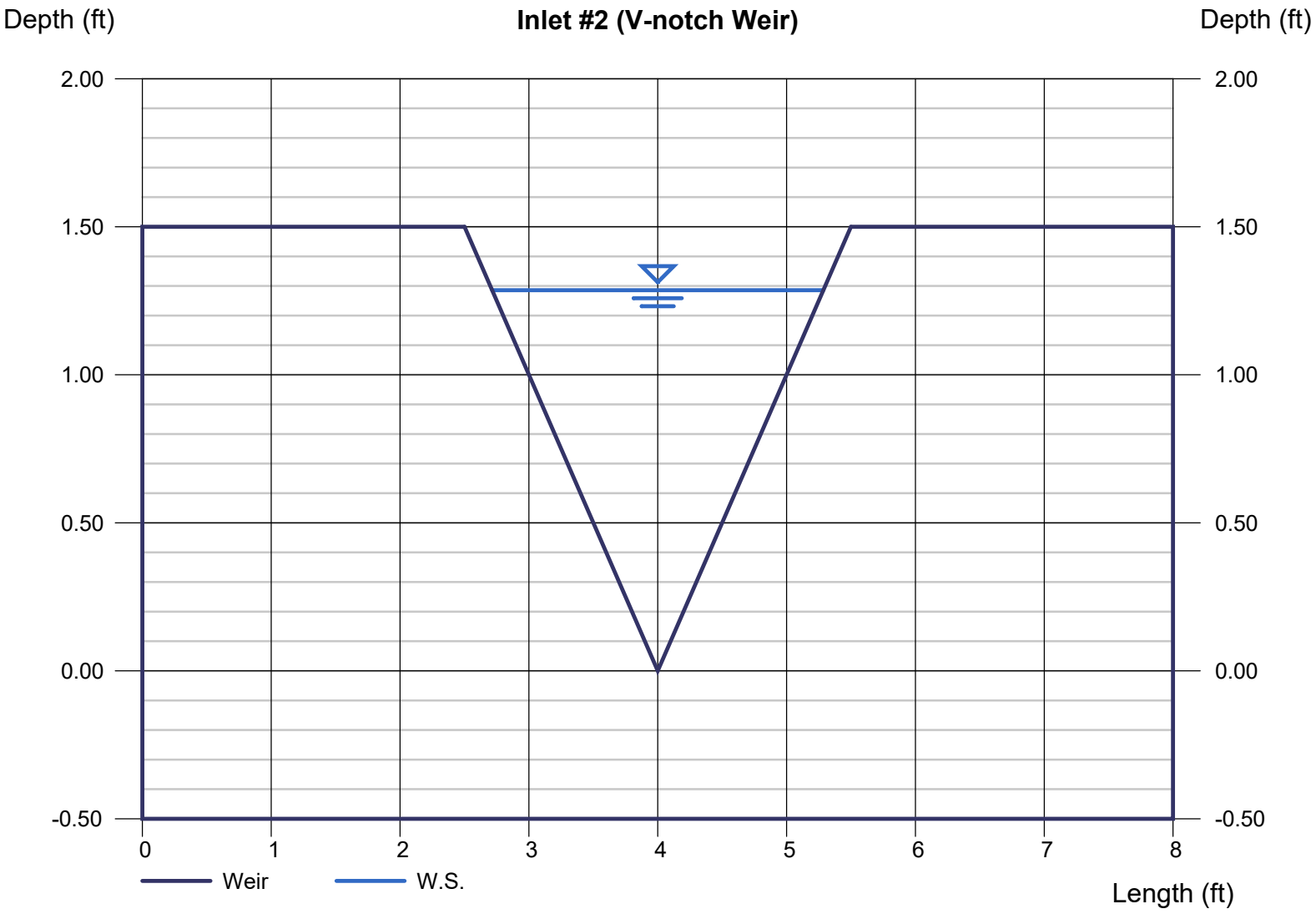
Crest	= Sharp
Angle (Deg)	= 90
Total Depth (ft)	= 1.50

Calculations

Weir Coeff. Cw	= 2.54
Compute by:	Known Q
Known Q (cfs)	= 4.76

Highlighted

Depth (ft)	= 1.29
Q (cfs)	= 4.760
Area (sqft)	= 1.65
Velocity (ft/s)	= 2.88
Top Width (ft)	= 2.57



Weir Report

Inlet #3 (V-notch Weir)

V-Notch Weir

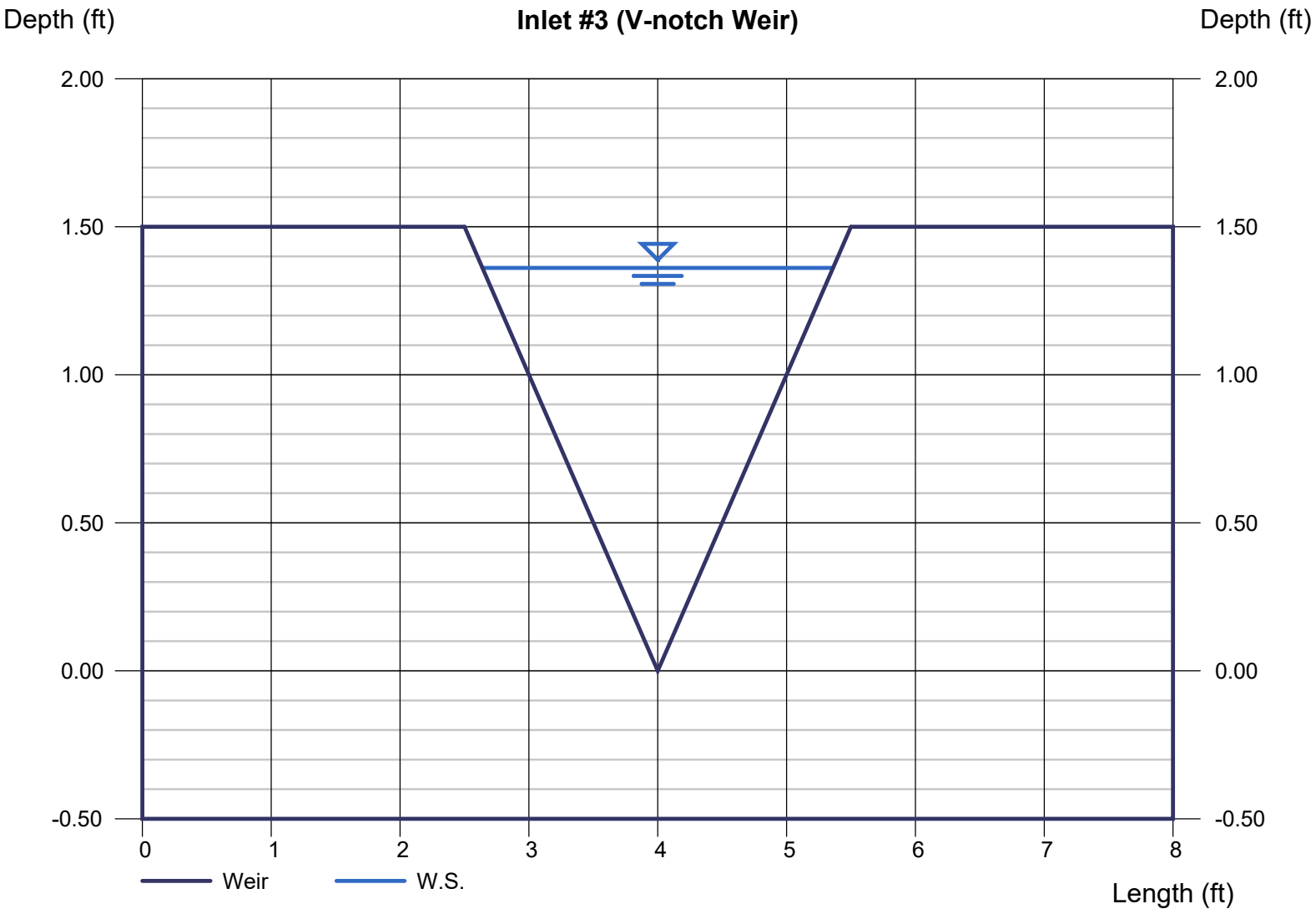
Crest	= Sharp
Angle (Deg)	= 90
Total Depth (ft)	= 1.50

Calculations

Weir Coeff. Cw	= 2.54
Compute by:	Known Q
Known Q (cfs)	= 5.49

Highlighted

Depth (ft)	= 1.36
Q (cfs)	= 5.490
Area (sqft)	= 1.85
Velocity (ft/s)	= 2.96
Top Width (ft)	= 2.72



RATIONAL METHOD HYDROGRAPH PROGRAM

BASIN A-1

RUN DATE 3/28/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3.4 INCHES
BASIN AREA 0.65 ACRES
RUNOFF COEFFICIENT 0.82
PEAK DISCHARGE 4.76 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0.1
TIME (MIN) = 10	DISCHARGE (CFS) = 0.1
TIME (MIN) = 15	DISCHARGE (CFS) = 0.1
TIME (MIN) = 20	DISCHARGE (CFS) = 0.1
TIME (MIN) = 25	DISCHARGE (CFS) = 0.1
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TIME (MIN) = 45	DISCHARGE (CFS) = 0.1
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TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 75	DISCHARGE (CFS) = 0.1
TIME (MIN) = 80	DISCHARGE (CFS) = 0.1
TIME (MIN) = 85	DISCHARGE (CFS) = 0.1
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TIME (MIN) = 100	DISCHARGE (CFS) = 0.1
TIME (MIN) = 105	DISCHARGE (CFS) = 0.2
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TIME (MIN) = 205	DISCHARGE (CFS) = 0.4
TIME (MIN) = 210	DISCHARGE (CFS) = 0.4
TIME (MIN) = 215	DISCHARGE (CFS) = 0.4
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TIME (MIN) = 230	DISCHARGE (CFS) = 0.6
TIME (MIN) = 235	DISCHARGE (CFS) = 0.9
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TIME (MIN) = 250	DISCHARGE (CFS) = 0.8
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TIME (MIN) = 290	DISCHARGE (CFS) = 0.2
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TIME (MIN) = 340	DISCHARGE (CFS) = 0.1
TIME (MIN) = 345	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 355	DISCHARGE (CFS) = 0.1

RATIONAL METHOD HYDROGRAPH PROGRAM

BASIN A-Z

RUN DATE 3/28/2018
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3.4 INCHES
BASIN AREA 0.77 ACRES
RUNOFF COEFFICIENT 0.8
PEAK DISCHARGE 5.49 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
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TIME (MIN) = 15	DISCHARGE (CFS) = 0.1
TIME (MIN) = 20	DISCHARGE (CFS) = 0.1
TIME (MIN) = 25	DISCHARGE (CFS) = 0.1
TIME (MIN) = 30	DISCHARGE (CFS) = 0.1
TIME (MIN) = 35	DISCHARGE (CFS) = 0.1
TIME (MIN) = 40	DISCHARGE (CFS) = 0.1
TIME (MIN) = 45	DISCHARGE (CFS) = 0.1
TIME (MIN) = 50	DISCHARGE (CFS) = 0.1
TIME (MIN) = 55	DISCHARGE (CFS) = 0.1
TIME (MIN) = 60	DISCHARGE (CFS) = 0.1
TIME (MIN) = 65	DISCHARGE (CFS) = 0.2
TIME (MIN) = 70	DISCHARGE (CFS) = 0.2
TIME (MIN) = 75	DISCHARGE (CFS) = 0.2
TIME (MIN) = 80	DISCHARGE (CFS) = 0.2
TIME (MIN) = 85	DISCHARGE (CFS) = 0.2
TIME (MIN) = 90	DISCHARGE (CFS) = 0.2
TIME (MIN) = 95	DISCHARGE (CFS) = 0.2
TIME (MIN) = 100	DISCHARGE (CFS) = 0.2
TIME (MIN) = 105	DISCHARGE (CFS) = 0.2
TIME (MIN) = 110	DISCHARGE (CFS) = 0.2
TIME (MIN) = 115	DISCHARGE (CFS) = 0.2
TIME (MIN) = 120	DISCHARGE (CFS) = 0.2
TIME (MIN) = 125	DISCHARGE (CFS) = 0.2
TIME (MIN) = 130	DISCHARGE (CFS) = 0.2
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TIME (MIN) = 140	DISCHARGE (CFS) = 0.2
TIME (MIN) = 145	DISCHARGE (CFS) = 0.2
TIME (MIN) = 150	DISCHARGE (CFS) = 0.2
TIME (MIN) = 155	DISCHARGE (CFS) = 0.2
TIME (MIN) = 160	DISCHARGE (CFS) = 0.2
TIME (MIN) = 165	DISCHARGE (CFS) = 0.3
TIME (MIN) = 170	DISCHARGE (CFS) = 0.3
TIME (MIN) = 175	DISCHARGE (CFS) = 0.3
TIME (MIN) = 180	DISCHARGE (CFS) = 0.3
TIME (MIN) = 185	DISCHARGE (CFS) = 0.3
TIME (MIN) = 190	DISCHARGE (CFS) = 0.3
TIME (MIN) = 195	DISCHARGE (CFS) = 0.3
TIME (MIN) = 200	DISCHARGE (CFS) = 0.4
TIME (MIN) = 205	DISCHARGE (CFS) = 0.4
TIME (MIN) = 210	DISCHARGE (CFS) = 0.4
TIME (MIN) = 215	DISCHARGE (CFS) = 0.5
TIME (MIN) = 220	DISCHARGE (CFS) = 0.5
TIME (MIN) = 225	DISCHARGE (CFS) = 0.7
TIME (MIN) = 230	DISCHARGE (CFS) = 0.7
TIME (MIN) = 235	DISCHARGE (CFS) = 1.1
TIME (MIN) = 240	DISCHARGE (CFS) = 1.6
TIME (MIN) = 245	DISCHARGE (CFS) = 5.49
TIME (MIN) = 250	DISCHARGE (CFS) = 0.9
TIME (MIN) = 255	DISCHARGE (CFS) = 0.6
TIME (MIN) = 260	DISCHARGE (CFS) = 0.5
TIME (MIN) = 265	DISCHARGE (CFS) = 0.4
TIME (MIN) = 270	DISCHARGE (CFS) = 0.3
TIME (MIN) = 275	DISCHARGE (CFS) = 0.3
TIME (MIN) = 280	DISCHARGE (CFS) = 0.3
TIME (MIN) = 285	DISCHARGE (CFS) = 0.2
TIME (MIN) = 290	DISCHARGE (CFS) = 0.2
TIME (MIN) = 295	DISCHARGE (CFS) = 0.2
TIME (MIN) = 300	DISCHARGE (CFS) = 0.2
TIME (MIN) = 305	DISCHARGE (CFS) = 0.2
TIME (MIN) = 310	DISCHARGE (CFS) = 0.2
TIME (MIN) = 315	DISCHARGE (CFS) = 0.2
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TIME (MIN) = 325	DISCHARGE (CFS) = 0.2
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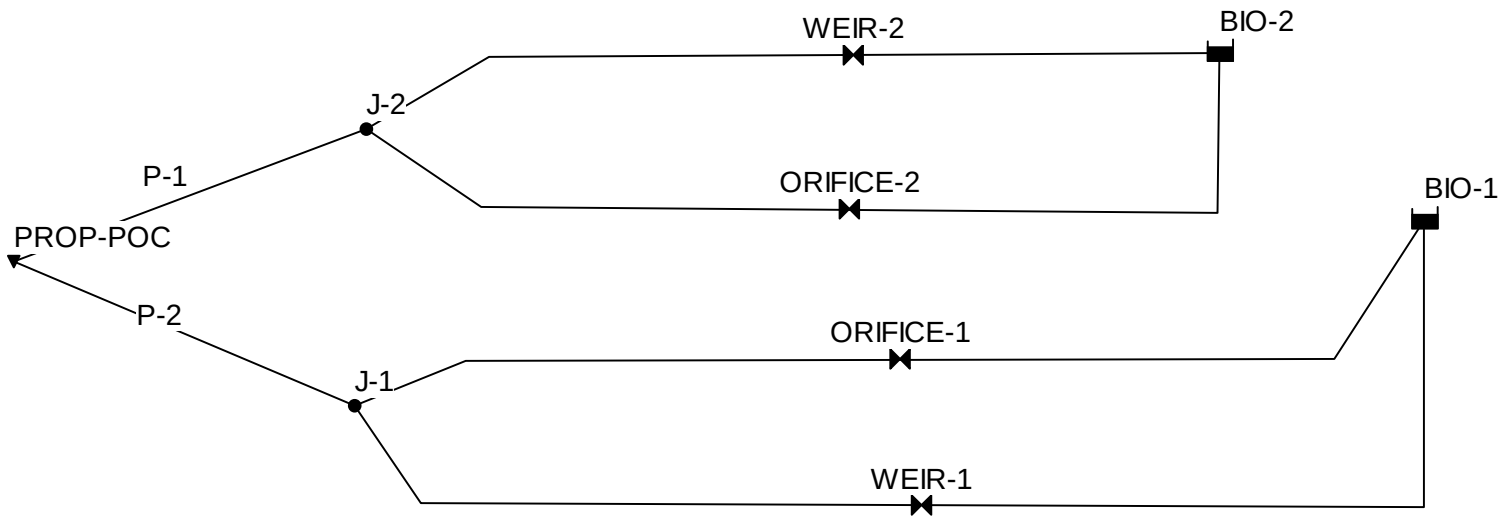
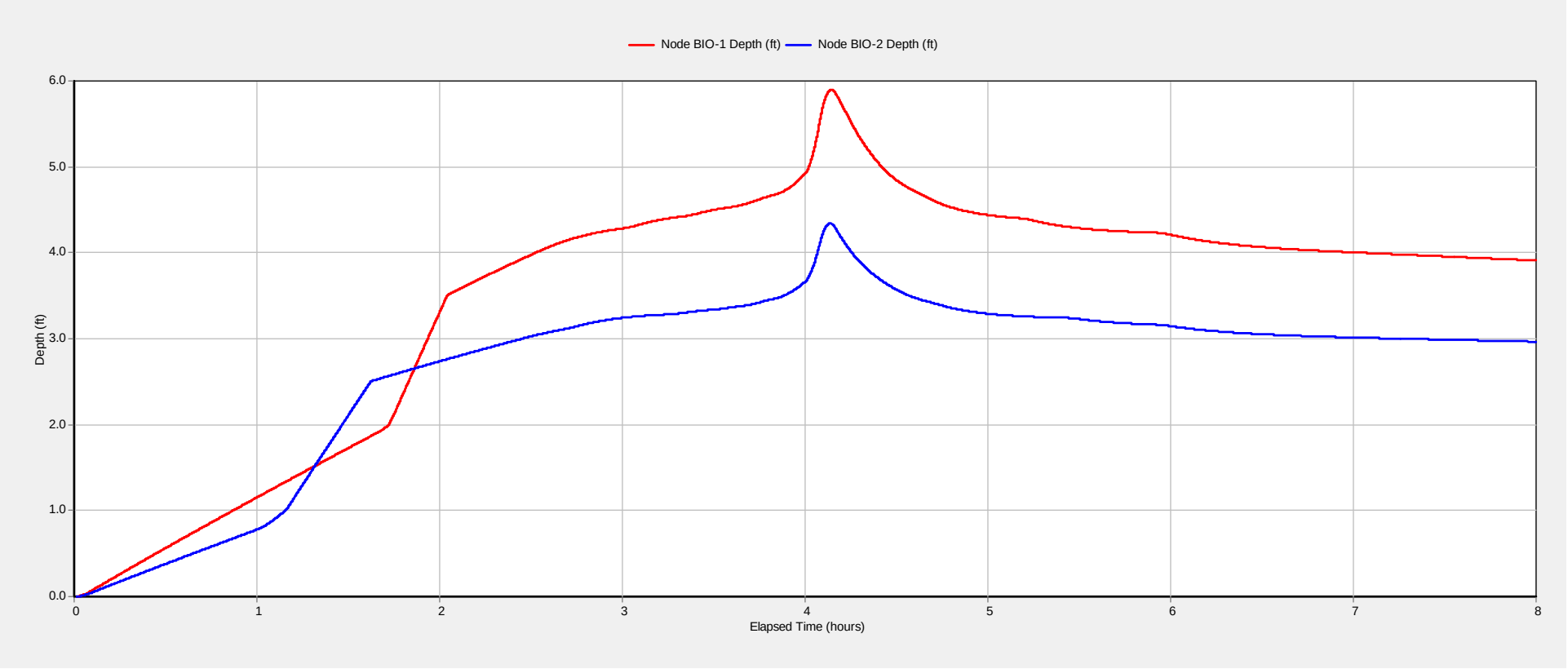
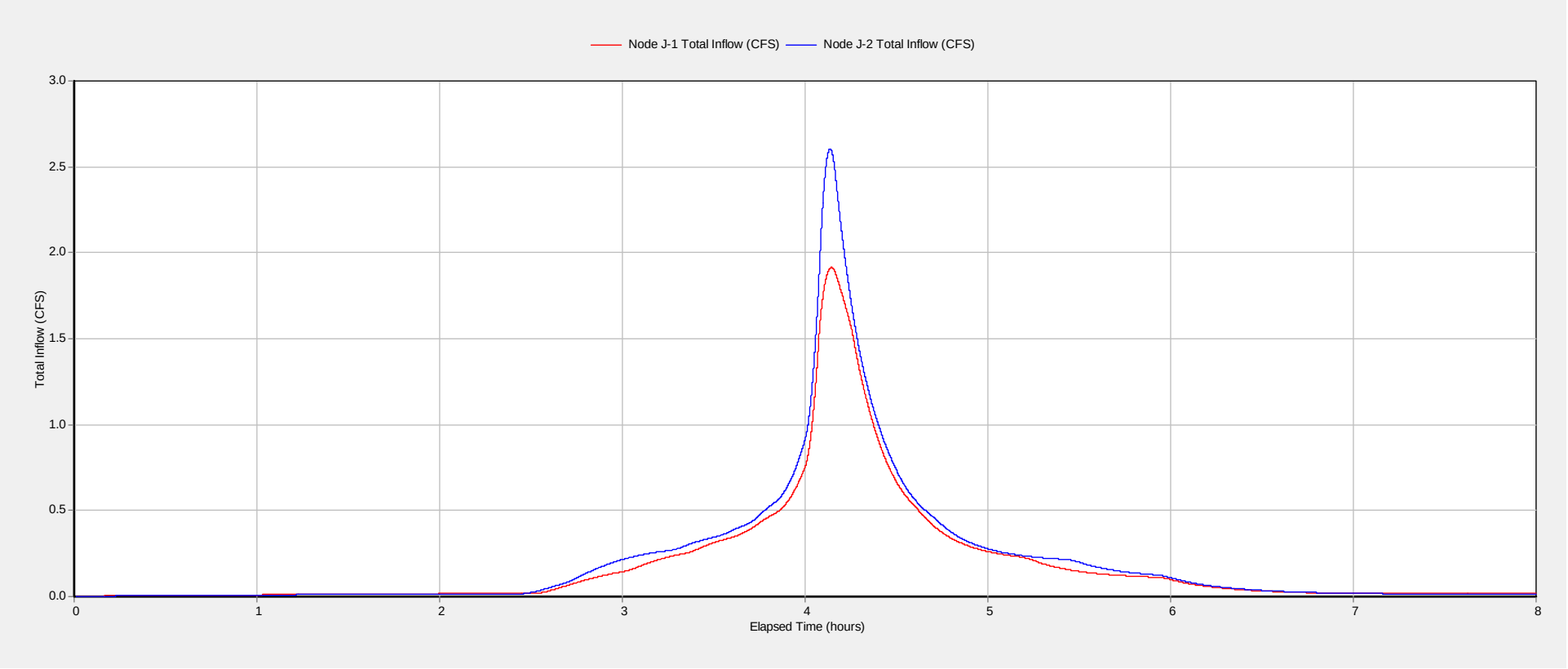
TIME (MIN) = 335	DISCHARGE (CFS) = 0.1
TIME (MIN) = 340	DISCHARGE (CFS) = 0.1
TIME (MIN) = 345	DISCHARGE (CFS) = 0.1
TIME (MIN) = 350	DISCHARGE (CFS) = 0.1
TIME (MIN) = 355	DISCHARGE (CFS) = 0.1


WEIR-2
BIO-2
J-2
P-1
ORIFICE-2
BIO-1
PROP-POC
P-2
ORIFICE-1
J-1
WEIR-1


Node BIO-1 Depth (ft)
Node BIO-2 Depth (ft)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Depth (ft)
0
1
2
3
4
5
6
7
8
Elapsed Time (hours)


Node J-1 Total Inflow (CFS)
Node J-2 Total Inflow (CFS)
Total Inflow (CFS)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
Elapsed Time (hours)

```
[TITLE]
;;Project Title/Notes

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

START_DATE            08/08/1963
START_TIME            00:00:00
REPORT_START_DATE     08/08/1963
REPORT_START_TIME     00:00:00
END_DATE              08/08/1963
END_TIME              08:00:00
SWEEP_START           01/01
SWEEP_END             12/31
DRY_DAYS              0
REPORT_STEP           00:00:01
WET_STEP              00:00:01
DRY_STEP              00:00:01
ROUTING_STEP          0:00:01

INERTIAL_DAMPING      PARTIAL
NORMAL_FLOW_LIMITED   BOTH
FORCE_MAIN_EQUATION   H-W
VARIABLE_STEP         0.75
LENGTHENING_STEP      0
MIN_SURFAREA          12.557
MAX_TRIALS            8
HEAD_TOLERANCE        0.005
SYS_FLOW_TOL          5
LAT_FLOW_TOL          5
MINIMUM_STEP          0.5
THREADS               1

[EVAPORATION]
;;Data Source          Parameters
;;--------------       ----------
MONTHLY               0.070   0.100   0.130   0.170   0.190   0.220   0.240   0.220   0.190   0.130   0.090   0.060
DRY_ONLY              NO

[JUNCTIONS]
;;Name                Elevation       MaxDepth        InitDepth       SurDepth        Aponded
;;--------------      ----------      ----------      ----------      ----------      ----------
J-1                   0               0               0               0               0
J-2                   0               0               0               0               0

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

[STORAGE]
;;Name                Elev.           MaxDepth        InitDepth       Shape           Curve Name/Params               N/A             Fevap           Psi             Ksat            IMD
;;--------------      --------        ----------      ----------      ----------      ----------------------------    --------        --------                        --------        --------
BIO-1                 0               6.0             0               TABULAR         BIO-1                           0               0
BIO-2                 0               5.0             0               TABULAR         BIO-2                           0               0

[CONDUITS]
;;Name                From Node               To Node                 Length          Roughness       InOffset        OutOffset       InitFlow        MaxFlow
;;--------------      ----------------        ----------------        ----------      ----------      ----------      ----------      ----------      ----------
P-1                   J-2                     PROP-POC                1               0.01            0               0               0               0
P-2                   J-1                     PROP-POC                1               0.01            0               0               0               0

[ORIFICES]
;;Name                From Node               To Node                 Type            Offset          Qcoeff          Gated           CloseTime
;;--------------      ----------------        ----------------        ------------    ----------      ----------      --------        ----------
ORIFICE-1             BIO-1                   J-1                     SIDE            0               0.65            NO              0
ORIFICE-2             BIO-2                   J-2                     SIDE            0               0.65            NO              0

[WEIRS]
;;Name                From Node               To Node                 Type            CrestHt         Qcoeff          Gated           EndCon          EndCoeff        Surcharge       RoadWidth       RoadSurf
;;--------------      ----------------        ----------------        ------------    ----------      ----------      --------        --------        ----------      ----------      ----------      ----------
WEIR-1                BIO-1                   J-1                     TRAPEZOIDAL     4.0             3.33            NO              0               0               YES
WEIR-2                BIO-2                   J-2                     TRAPEZOIDAL     3.0             3.33            NO              0               0               YES

[XSECTIONS]
;;Link                Shape           Geom1                   Geom2           Geom3           Geom4           Barrels         Culvert
;;--------------      ------------    ----------------        ----------      ----------      ----------      ----------      ----------
P-1                   DUMMY           0                       0               0               0               1
P-2                   DUMMY           0                       0               0               0               1
ORIFICE-1             CIRCULAR        0.047                   0               0               0
ORIFICE-2             CIRCULAR        0.047                   0               0               0
WEIR-1                TRAPEZOIDAL     1.5                     0.25            1.0             1.0
WEIR-2                TRAPEZOIDAL     1.5                     0.5             1.0             1.0

[INFLOWS]
```

;;Node	Constituent	Time Series	Type	Mfactor	Sfactor	Baseline	Pattern
BIO-1	FLOW	A-1	FLOW	1.0	1.0		
BIO-2	FLOW	A-2	FLOW	1.0	1.0		

[CURVES]

;;Name	Type	X-Value	Y-Value
BIO-2	Storage	0	420
BIO-2		1	420
BIO-2		1.01	210
BIO-2		2.5	210
BIO-2		2.51	1050
BIO-2		4.5	1560
;			
BIO-1	Storage	0	280
BIO-1		2	280
BIO-1		2.01	140
BIO-1		3.5	140
BIO-1		3.51	600
BIO-1		6.0	1031

[TIMESERIES]

;;Name	Date	Time	Value
A-1		0:00	0
A-1		0:05	0.1
A-1		0:10	0.1
A-1		0:15	0.1
A-1		0:20	0.1
A-1		0:25	0.1
A-1		0:30	0.1
A-1		0:35	0.1
A-1		0:40	0.1
A-1		0:45	0.1
A-1		0:50	0.1
A-1		0:55	0.1
A-1		1:00	0.1
A-1		1:05	0.1
A-1		1:10	0.1
A-1		1:15	0.1
A-1		1:20	0.1
A-1		1:25	0.1
A-1		1:30	0.1
A-1		1:35	0.1
A-1		1:40	0.1
A-1		1:45	0.2
A-1		1:50	0.2
A-1		1:55	0.2
A-1		2:00	0.2
A-1		2:05	0.2
A-1		2:10	0.2
A-1		2:15	0.2
A-1		2:20	0.2
A-1		2:25	0.2
A-1		2:30	0.2
A-1		2:35	0.2
A-1		2:40	0.2
A-1		2:45	0.2
A-1		2:50	0.2
A-1		2:55	0.2
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A-1		3:10	0.3
A-1		3:15	0.3
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A-1		3:25	0.4
A-1		3:30	0.4
A-1		3:35	0.4
A-1		3:40	0.5
A-1		3:45	0.6
A-1		3:50	0.6
A-1		3:55	0.9
A-1		4:00	1.3
A-1		4:05	4.76
A-1		4:10	0.8
A-1		4:15	0.5
A-1		4:20	0.4
A-1		4:25	0.3
A-1		4:30	0.3
A-1		4:35	0.3
A-1		4:40	0.2
A-1		4:45	0.2
A-1		4:50	0.2
A-1		4:55	0.2
A-1		5:00	0.2
A-1		5:05	0.2
A-1		5:10	0.2
A-1		5:15	0.1
A-1		5:20	0.1
A-1		5:25	0.1
A-1		5:30	0.1

```
A-1                             5:35            0.1
A-1                             5:40            0.1
A-1                             5:45            0.1
A-1                             5:50            0.1
A-1                             5:55            0.1
A-1                             6:00            0
;
A-2                             0:00            0
A-2                             0:05            0.1
A-2                             0:10            0.1
A-2                             0:15            0.1
A-2                             0:20            0.1
A-2                             0:25            0.1
A-2                             0:30            0.1
A-2                             0:35            0.1
A-2                             0:40            0.1
A-2                             0:45            0.1
A-2                             0:50            0.1
A-2                             0:55            0.1
A-2                             1:00            0.1
A-2                             1:05            0.2
A-2                             1:10            0.2
A-2                             1:15            0.2
A-2                             1:20            0.2
A-2                             1:25            0.2
A-2                             1:30            0.2
A-2                             1:35            0.2
A-2                             1:40            0.2
A-2                             1:45            0.2
A-2                             1:50            0.2
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A-2                             2:00            0.2
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A-2                             2:20            0.2
A-2                             2:25            0.2
A-2                             2:30            0.2
A-2                             2:35            0.2
A-2                             2:40            0.2
A-2                             2:45            0.3
A-2                             2:50            0.3
A-2                             2:55            0.3
A-2                             3:00            0.3
A-2                             3:05            0.3
A-2                             3:10            0.3
A-2                             3:15            0.3
A-2                             3:20            0.4
A-2                             3:25            0.4
A-2                             3:30            0.4
A-2                             3:35            0.5
A-2                             3:40            0.5
A-2                             3:45            0.7
A-2                             3:50            0.7
A-2                             3:55            1.1
A-2                             4:00            1.6
A-2                             4:05            5.49
A-2                             4:10            0.9
A-2                             4:15            0.6
A-2                             4:20            0.5
A-2                             4:25            0.4
A-2                             4:30            0.3
A-2                             4:35            0.3
A-2                             4:40            0.3
A-2                             4:45            0.2
A-2                             4:50            0.2
A-2                             4:55            0.2
A-2                             5:00            0.2
A-2                             5:05            0.2
A-2                             5:10            0.2
A-2                             5:15            0.2
A-2                             5:20            0.2
A-2                             5:25            0.2
A-2                             5:30            0.1
A-2                             5:35            0.1
A-2                             5:40            0.1
A-2                             5:45            0.1
A-2                             5:50            0.1
A-2                             5:55            0.1
A-2                             6:00            0

[REPORT]
;;Reporting Options
INPUT          NO
CONTROLS       NO
SUBCATCHMENTS  ALL
NODES   ALL
LINKS   ALL

[TAGS]

[MAP]
```

```
DIMENSIONS      0.000   0.000   10000.000       10000.000
Units           None

[COORDINATES]
;;Node                X-Coord              Y-Coord
;;--------------      ------------------   ------------------
J-1                   6015.167             3854.766
J-2                   6049.121             4669.650
PROP-POC              5007.881             4284.844
BIO-1                 9162.311             4400.687
BIO-2                 8559.061             4894.742

[VERTICES]
;;Link                X-Coord              Y-Coord
;;--------------      ------------------   ------------------
ORIFICE-1             8897.221             3995.610
ORIFICE-1             6343.384             3990.580
ORIFICE-2             8558.087             4428.006
ORIFICE-2             6388.656             4443.293
WEIR-1                9161.524             3560.503
WEIR-1                6207.571             3571.821
WEIR-2                6411.291             4884.689
```

Appendices

Appendix 1

County of San Diego Hydrology Manual

Soil Hydrologic Groups

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

PROJECT SITE
Soil Group D

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COU
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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3 0 3 Miles

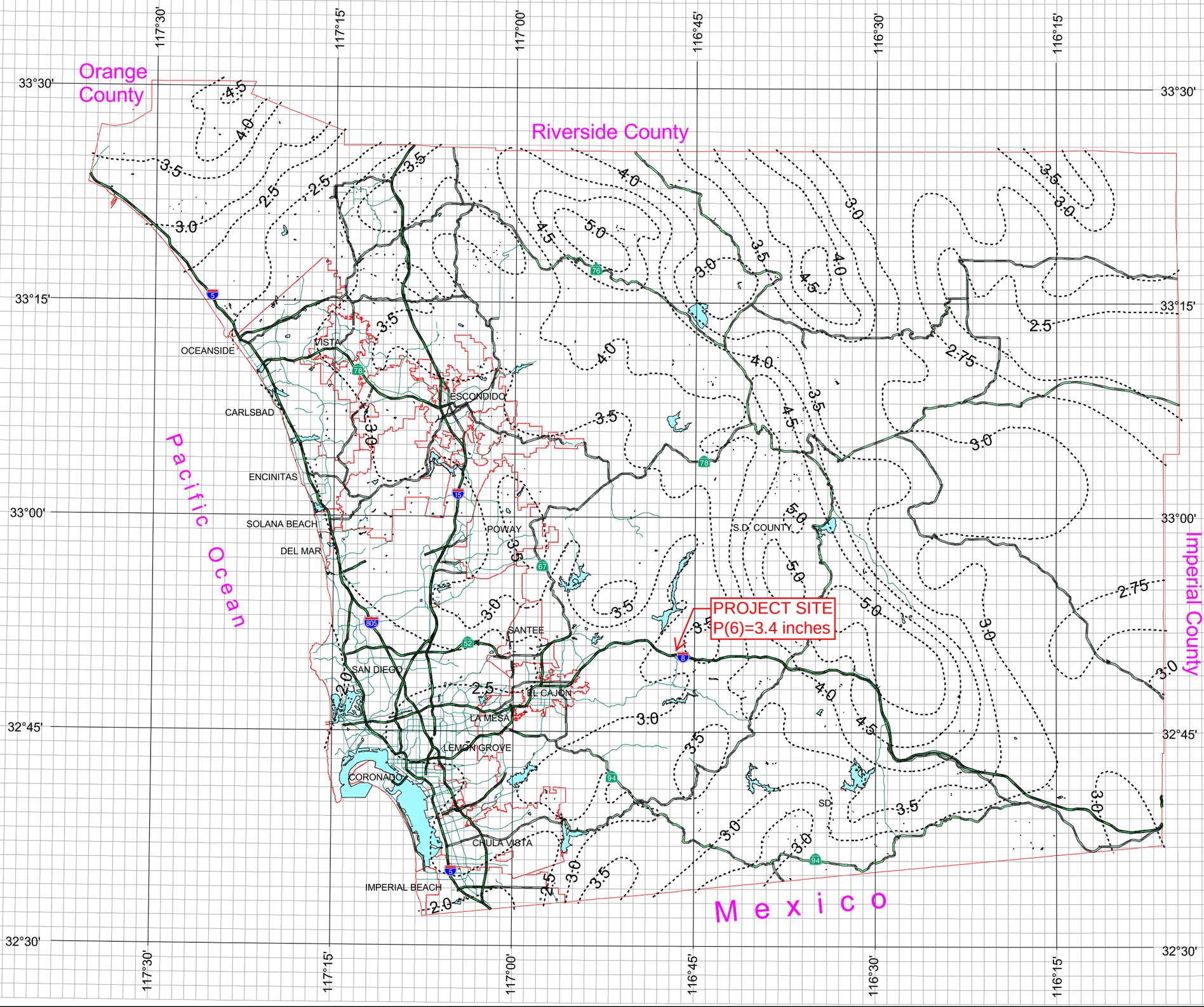
Appendix 2

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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Appendix 3

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

PROJECT SITE
P(6)=7.0 inches

Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

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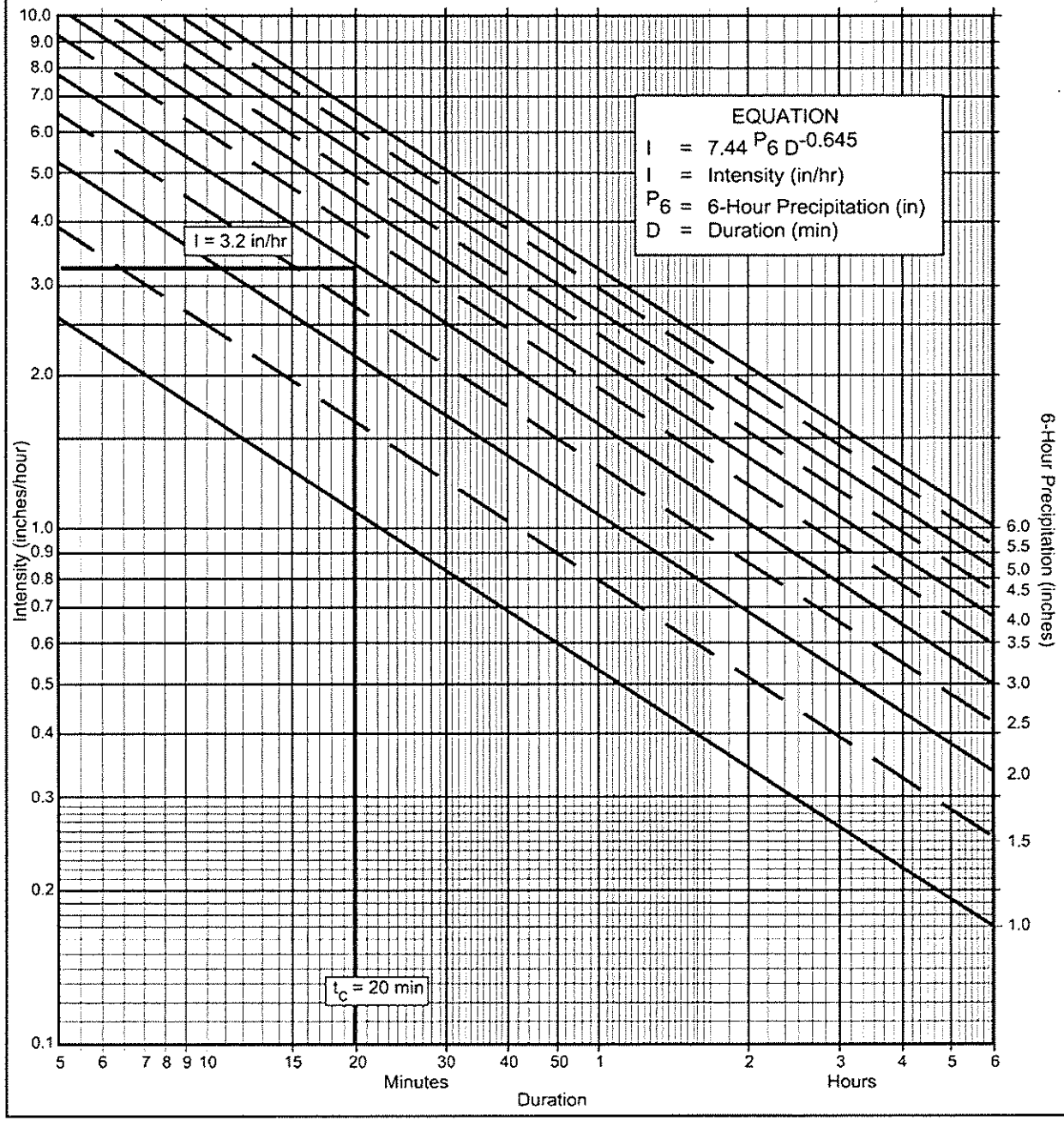
Appendix 4



Directions for Application:

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

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

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

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

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

Application For

(a) Selected frequency _____ year

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

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

(d) t_x = _____ min.

(e) I = _____ in./hr.

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

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

Intensity-Duration Design Chart - Example

Appendix 5

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

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

Appendix 6

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

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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- Shell Station Expansion (Draft)
Prepared By: GeoCon, Inc
Date: December 21, 2017

GEOTECHNICAL INVESTIGATION

SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

TONY SHORES
EL CAJON, CALIFORNIA

DECEMBER 21, 2017
PROJECT NO. G2217-52-01

Project No. G2217-52-01
December 21, 2017

Tony Shores
2020 Hillsdale Road
El Cajon, California 92019

Subject: GEOTECHNICAL INVESTIGATION
SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

Dear Mr. Shores:

In accordance with your authorization of our Proposal No. LG-17283 dated November 6, 2017, we herein submit the results of our geotechnical investigation for the subject site. We performed our investigation to evaluate the underlying soil and geologic conditions and potential geologic hazards and to assist in the design of the proposed improvements. The accompanying report presents the results of our study and conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. The site is considered suitable for development provided the recommendations of this report are followed.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

DRAFT

Lilian E. Rodriguez
RCE 83227

DRAFT

Shawn Foy Weedon
GE 2714

DRAFT

John Hoobs
CEG 1524

LER:SFW:JH:ejc

(e-mail) ZAAP Architecture and Planning
Attention: Mr. Tom Sheehan

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed commercial improvements to a Shell Gas Station in the Alpine area of the County of San Diego, California. The purpose of this geotechnical investigation is to evaluate the surface and subsurface soil conditions, general site geology and to identify geotechnical constraints that may impact development of the property.

To aid in preparing this report we reviewed:

1. *[Preliminary] Site Plan – Phase 1C, Tavern Road Gas Station, Alpine, California,* prepared by ZAAP Architectural + Planning, dated October 17, 2017 (Project No. 17010).

2. *[Preliminary] Alta/ NSPS Land Title Survey, Alpine Shell, Alpine, California,* prepared by Omega Land Surveying Incorporated, plot dated June 26, 2017.

The scope of this investigation included the review of aerial photographs and readily available published and unpublished geologic literature (see List of References), excavating nine exploratory trenches to a maximum depth of 12 feet, soil sampling, laboratory testing, engineering analyses and preparing this geotechnical investigation report.

Appendix A presents the exploratory trench logs and details of the field investigation. We performed laboratory tests on selected soil samples obtained during the field investigation to evaluate pertinent physical and chemical properties for engineering analyses and to assist in providing geotechnical engineering recommendations for project design. Details of the laboratory tests and a summary of the test results are presented in Appendix B and on the trench logs in Appendix A. The Storm Water Management Investigation is presented in Appendix C.

2. SITE AND PROJECT DESCRIPTION

The project site consists of two parcels located north of Interstate 8 and west of Tavern Road in the community of Alpine, California (see Vicinity Map, Figure 1). The site is bordered by Tavern Road to the north and the east, undeveloped land and the Interstate 8 westbound onramp to the south, and undeveloped land and a dirt storage yard of an adjacent property to the west. The eastern parcel of the site (Parcel 2) is currently occupied by a Shell Gas Station consisting of a convenience store structure, gas pumps, miscellaneous ancillary structures, asphalt parking and driveways, and other associated improvements. The Shell Gas Station is accessed by driveway entrances from Tavern Road. The majority of the western parcel (Parcel 1) is undeveloped sloping land consisting of a dirt access road along the eastern perimeter of the parcel, rock and soil stockpiles, and brush/trees. The

Parcel 1 area of the site generally descends to the west with a naturally occurring canyon drainage traversing the central portion of the parcel.

The Parcel 2 area where the existing Shell Station is located was likely previously graded with approximately 1½:1 to 2:1 (horizontal to vertical) descending fill slopes with a maximum height of about 30 feet along the west and south perimeters. Elevations at the site range from approximately 1,715 feet above Mean Sea Level (MSL) within the central-western portion of Parcel 1 to 1,765 feet MSL in the northeastern end of the site on Parcel 2. The gas station area slopes gently to the south with a total relief of approximately 3 feet.

Based on review of the preliminary architectural plans prepared by ZAAP Architectural + Planning, we understand the planned project will consist of the reconfiguration and expansion of the existing gas station. The improvements will consist of the removal of the existing convenience store structure and constructing a new structure consisting of a new restaurant, gas station convenience store, and drive-thru restaurant located within the south-central portion of the site. We expect the existing gas station convenience store structure will be removed to allow the proper grading for the planned structures. The canopy and gas pumps can likely remain during the construction operations. The new structure will have a building coverage of approximately 7,000 square feet. In addition, improvements will consist of the construction of a new coffee kiosk, asphalt parking and driveways, two bioswales and other associated improvements. The grading for the planned expansion will require fills up to approximately 30 feet with 2:1 (horizontal to vertical) fill slopes up to approximately 45 feet high along the west and southwest ends of the site. Retaining walls may be installed along the south-central portion of the site to accommodate the planned drive-thru lane. We used the referenced preliminary site plan and land title survey as a base for our Geologic Map, Figure 2.

The site location, descriptions, and proposed development discussed herein are based on a site investigation, review of the preliminary architectural site plans and land title survey and our discussions with you. If development plans differ from those described herein, Geocon Incorporated should be contacted for review of the plans and possible revisions to this report.

3. SOIL AND GEOLOGIC CONDITIONS

We encountered topsoil, undocumented fill, older alluvium and Granitic Rock during our field investigation. The occurrence and distribution of the units are presented on the trench logs in Appendix A, and on the Geologic Map, Figure 2. Figure 3 presents a Geologic Cross-Section providing our subsurface geologic interpretation. The geologic units are described in order of increasing age.

3.1 Undocumented Fill (Qudf)

We encountered undocumented fill to a maximum depth of 8 feet in the exploratory trenches located within the existing fill slope. The undocumented fill is likely associated with the grading required to construct the existing Shell Station pad. We expect the undocumented fill thickest at the southern end of the existing gas station at the top of the existing fill slope with an estimated thickness of up to approximately 20 to 25 feet. We expect the southern portion of the proposed structure is underlain by up to approximately 15 feet of undocumented fill. The fill thickness is likely less than 5 feet adjacent to Tavern Road. The fill encountered in the exploratory trenches generally consists of loose to medium dense, dry to moist, yellowish to reddish brown, silty sand. A geotechnical report documenting the testing and observation of the fill soils was not available, therefore, the existing fill soil is designated as undocumented. The undocumented fill is considered unsuitable for support of additional fill and/or structural loads in its present condition and will require compete removal where possible in areas of planned development. The majority of this material will likely be suitable for reuse as compacted fill provided debris and vegetation is removed.

3.2 Topsoil (unmapped)

We observed topsoil overlying Older Alluvium within the Parcel 1 area with a thickness of up to approximately 1½ feet. The topsoil consists of loose, yellowish to reddish brown, silty sand. The topsoil is unsuitable in its present condition and will require remedial grading in areas of planned improvement. This material is suitable for use as compacted fill from a geotechnical engineering standpoint provided the soil is relatively free of vegetation.

3.3 Older Alluvium (Qoal)

We encountered older alluvium underlying topsoil or undocumented fill with a thickness ranging from approximately 1 to 2½ feet within the exploratory trenches T-2 through T-9. The older alluvium generally consists of medium dense to very dense, dry to damp, reddish brown, silty sand. The older alluvium is prone to hydroconsolidation and is considered unsuitable for support of fill and/or structural loads and will require removal in areas of planned improvement. This material is suitable for use as compacted fill from a geotechnical engineering standpoint provided the soil is relatively free of vegetation.

3.4 Granitic Rock (Kgr)

Early Cretaceous-aged granitic rock underlies the topsoil and/or older alluvium at depths ranging from approximately 1 to 9½ feet below existing grades. The granitic rock generally is highly weathered and moderately weak consisting of a medium- to coarse-grained tonalite. Deeper excavations into the granitic rock may encounter refusal. The granitic rock is considered suitable for support of the proposed building and improvements.

4. GROUNDWATER

We did not encounter groundwater during our field investigation and we do not expect groundwater to have a significant influence on construction operations or the performance of the improvements. It is not uncommon for seepage conditions to develop where none previously existed. Seepage is dependent on seasonal precipitation, irrigation and land use, among other factors, and varies as a result. Proper surface drainage will be critical to future performance of the project.

5. GEOLOGIC HAZARDS

5.1 Faulting and Seismicity

A review of the referenced geologic materials and our knowledge of the general area indicate that the site is not underlain by active, potentially active, or inactive faults. An active fault is defined by the California Geological Survey (CGS) as a fault showing evidence for activity within the last 11,000 years. The site is not located within a State of California Earthquake Fault Zone.

According to the computer program *EZ-FRISK* (Version 7.65), 9 known active faults are located within a search radius of 50 miles from the property. We used the 2008 USGS fault database to evaluate the fault parameters. The nearest known active fault is the Elsinore Fault system located approximately 21 miles northeast of the site, and is the dominant source of potential ground motion. Earthquakes that might occur on the Elsinore fault or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Elsinore fault are 7.9 and 0.18g, respectively. Table 5.1.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relationship to the site location. We calculated peak ground acceleration (PGA) using Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) NGA acceleration-attenuation relationships.

TABLE 5.1.1
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 2008 (g)
Elsinore	21	7.9	0.18	0.13	0.17
Newport-Inglewood	24	7.5	0.14	0.10	0.12
Rose Canyon	24	6.9	0.11	0.09	0.08
Earthquake Valley	25	6.8	0.10	0.08	0.07
Coronado Bank	35	7.4	0.10	0.07	0.08
Palos Verdes Connected	35	7.7	0.12	0.08	0.10
San Jacinto	41	7.9	0.11	0.08	0.10
Brawley Gridded, Strike Slip	44	6.5	0.05	0.04	0.04
Brawley Gridded, Normal	44	6.5	0.04	0.04	0.03

We used the computer program *EZ-FRISK* to perform a probabilistic seismic hazard analysis. The computer program *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes on each mappable Quaternary fault is proportional to the faults slip rate. The program accounts for fault rupture length as a function of earthquake magnitude, and 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) in the analysis. Table 5.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 5.1.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2007 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.35	0.38	0.43
5% in a 50 Year Period	0.27	0.28	0.30
10% in a 50 Year Period	0.21	0.21	0.22

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 the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structure should be evaluated in accordance with the California Building Code (CBC) guidelines.

5.2 Ground Rupture

Ground surface rupture occurs when movement along a fault is sufficient to cause a gap or rupture where the upper edge of the fault zone intersects the earth surface. The potential for ground rupture is considered to be very low due to the absence of active faults at the subject site.

5.3 Slope Stability

Slope stability analyses for the proposed fill slopes and the existing descending fill slope along the south end of the site with inclinations as steep as 2:1 (horizontal to vertical) indicate a calculated factor of safety of at least 1.5 under static conditions for both deep-seated and surficial failure. Figures 4 and 5 present the slope stability calculations for deep-seated and surficial failures for the proposed and existing fill slopes, respectively.

We performed the slope stability analyses based on the interpretation of geologic conditions encountered during our field investigation. Additional analyses may be required during the grading operations if the geologic conditions vary significantly.

Slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, slopes should be drained and properly maintained to reduce erosion.

5.4 Tsunamis and Seiches

A tsunami is a series of long-period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The site is located approximately 25 miles from the Pacific Ocean, at elevations ranging from approximately 1,715 to 1,765 feet MSL; therefore, the risk of tsunami impacting the site is considered negligible.

Seiches are standing wave oscillations of an enclosed water body after the original driving force has dissipated. Driving forces are typically caused by seismic ground shaking. The site is not located adjacent to a body of water; therefore, the risk of seiches impacting the site is considered negligible.

5.5 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, on-site soils are cohesionless/silt or clay with low plasticity, groundwater is encountered, and soil relative densities are less than about 70 percent. If the 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 may occur whether the potential for liquefaction exists or not. Due to the dense nature of the underlying older alluvium and granitic rock, the planned compacted fill and the lack of a near surface groundwater table, the potential for liquefaction occurring within the site soil is considered negligible.

5.6 Landslides

Based on the examination of aerial photographs in our files, review of published geologic maps for the site vicinity, and the nature of the formational material, it is our opinion that landslides are not present at the property or at a location that could impact the subject site.

5.7 Hydroconsolidation

Hydroconsolidation is the tendency of unsaturated soil structure to collapse upon saturation resulting in the overall settlement of the affected soil and overlying foundations or improvements supported thereon. A potential for settlement due to hydroconsolidation of the older alluvium exists. The potential for hydroconsolidation can be reduced by remedial grading and the use of stiffer foundation systems. Based on the laboratory test results, the potential for hydroconsolidation of the older alluvium is 0.8 percent. The older alluvium should be removed and replaced with properly compacted fill due to the hydroconsolidation potential.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 From a geotechnical engineering standpoint, it is our opinion that the site is suitable for development provided the recommendations presented herein are implemented in design and construction of the project.

6.1.2 Our field investigation indicates the site is underlain by undocumented fill, topsoil, older alluvium and granitic rock. Remedial grading of the fill, topsoil and older alluvium should be performed within the limits of grading where possible. The fill, topsoil and older alluvium should be generally free of vegetation and debris prior to placement as compacted fill or, if unable to be cleaned, exported offsite. The granitic rock is considered adequate for the support of compacted fill and/or structural loads. We expect that the proposed structure and surface improvements will be supported by properly compacted fill.

6.1.3 Potential geologic and geotechnical hazards at the site include moderate to strong seismic ground shaking and settlements of surficial soils left-in-place. Based on our investigation and available geologic information, active or potentially active faults are not present underlying or trending toward the site.

6.1.4 We expect the limits of the remedial grading operations will be contained within the property limits as shown on the grading plans. In addition, we expect grading may be limited to the areas outside existing structures that will be remain including the underground storage area and gas pumps. However, the existing convenience store will require removal to allow for the planned grading operations. We should be contacted to provide additional recommendations if the convenience store will not be removed before the grading operations. Temporary excavations for remedial grading along the project margins and around structures to remain should extend into the site at inclinations of 1:1 (horizontal to vertical).

6.1.5 Excavation of the undocumented fill, topsoil, older alluvium and underlying granitic rock should generally be possible with moderate to heavy effort using conventional, heavy-duty equipment during grading and trenching operations. Gravel, cobble and some boulders should be expected during the grading operations.

6.1.6 The site is located approximately 21 miles from the nearest active fault. Based on our background research, it is our opinion active, potentially active, or inactive faults do not extend across or trend toward the site. Risks associated with seismic activity consist of the potential for strong seismic shaking.

6.1.7 We did not encounter groundwater during our investigation and do not expect groundwater would impact site development. However, wet conditions and seepage could affect proposed development if grading operations occur during the rainy season or where seepage occur. In addition, we encountered a septic system in our trenches T-6 and T-9. Some saturated soil may exist where the septic system is located.

6.1.8 We expect the proposed structures can be supported on a conventional shallow foundation system with concrete slabs-on-grade embedded into properly compacted fill. Other foundation types may be required if the convenience store is not removed before the grading operations.

6.1.9 Proper drainage should be maintained in order to preserve the engineering properties of the fill in the sheet-graded pad and slope areas. Recommendations for site drainage are provided herein.

6.1.10 Surface settlement monuments will not be required prior to or during site development.

6.2 Soil Characteristics

6.2.1 The soil encountered in the field investigation is considered to be "non-expansive" and "expansive" (expansion index [EI] less of 20 or less and greater than 20, respectively) as defined by 2016 California Building Code (CBC) Section 1803.5.3. Table 6.2.1 presents soil classifications based on the expansion index. We expect a majority of the soil encountered possess a "very low" to "low" expansion potential (EI of 50 or less) in accordance with ASTM D 4829.

TABLE 6.2.1
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM D 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	

6.2.2 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Appendix B presents results of the laboratory water-soluble sulfate content tests. The test results indicate the on-site materials at the location

tested possesses "S0" sulfate exposure to concrete structures as defined by 2016 CBC Section 1904 and ACI 318-14 Chapter 19. Concrete placed at the site should be designed using an "S0" sulfate exposure. 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.

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

6.3 Seismic Design Criteria – California Building Code

6.3.1 We used the computer program *U.S. Seismic Design Maps*, provided by the USGS to evaluate the seismic design criteria. Table 6.3.1 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 second. The building structure and improvements 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. The values presented in Table 6.3.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 6.3.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
Spectral Response – Class B (short), S_S	0.968g	Figure 1613.3.1(1)
Spectral Response – Class B (1 sec), S_1	0.360g	Figure 1613.3.1(2)
Site Coefficient, F_a	1.113	Table 1613.3.3(1)
Site Coefficient, F_v	1.681	Table 1613.3.3(2)
Maximum Considered Earthquake Spectral Response Acceleration (short), S_{MS}	1.077g	Section 1613.3.3 (Eqn 16-37)
Maximum Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	0.604g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.718g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.403g	Section 1613.3.4 (Eqn 16-40)

6.3.2 Table 6.3.2 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 6.3.2
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 or 2016 CBC Reference
Site Class	D	Section 1613.3.2 (CBC)
Mapped MCE_G Peak Ground Acceleration, PGA	0.364g	Figure 22-7 (ASCE)
Site Coefficient, F_{PGA}	1.136	Table 11.8-1 (ASCE)
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.413g	Section 11.8.3 (Eqn 11.8-1, ASCE)

6.3.3 Conformance to the criteria in Tables 6.3.1 and 6.3.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.4 Temporary Excavations

6.4.1 The recommendations included herein are provided for stable excavations. It is the responsibility of the contractor to provide a safe excavation during the construction of the proposed project.

6.4.2 Temporary slopes should be made in conformance with OSHA requirements. The topsoil and undocumented fill should be considered a Type C soil, new compacted fill should be considered a Type B soil (Type C if seepage is encountered) and the older alluvium and granitic rock should be considered a Type A soil (Type B soil if seepage or groundwater is encountered) in accordance with OSHA requirements. In general, special shoring requirements will not be necessary if temporary excavations will be less than 4 feet in height. Temporary excavations greater than 4 feet in height, however, should be sloped back at an appropriate inclination. These excavations should not be allowed to become saturated or to dry out. Surcharge loads should not be permitted to a distance equal to the height of the excavation from the top of the excavation. The top of the excavation should be a minimum of 15 feet from the edge of existing improvements. Excavations steeper than those recommended or closer than 15 feet from an existing surface improvement should be shored in accordance with applicable OSHA codes and regulations.

6.5 Grading

6.5.1 Grading should be performed in accordance with the *Recommended Grading Specifications* in Appendix D. Where the recommendations herein conflict with Appendix D, the recommendations of this section take precedence.

6.5.2 Geocon Incorporated should provide testing and observation services during the earthwork operations.

6.5.3 A pre-construction meeting with a county representative, owner, architect, grading contractor, civil engineer, and a representative of Geocon Incorporated should be held prior to the beginning of grading and development operations. Grading requirements and building construction methods can be discussed at that time.

6.5.4 Grading of the site should commence with the removal and export of the existing concrete slabs, vegetation, debris and rock stockpiles from the areas of development. If existing underground improvements require removal, the resulting depressions should be properly backfilled in accordance with the procedures described herein.

6.5.5 The surficial materials (undocumented fill, topsoil and older alluvium) within the limits of the planned structures and within areas of planned fill should be removed to expose granitic rock materials, where possible, and replaced with compacted fill. In addition, the upper 1 to 2 feet of the existing materials in new pavement areas should be removed and replaced with properly compacted fill. We expect removals will be limited at the property lines because off-site grading will not be performed. In addition, we expect grading may be limited to the areas outside existing structures that will be remain including the underground storage area and gas pumps.

6.5.6 We expect the southern portion of the proposed building is underlain by up to approximately 15 feet of surficial materials, and there may be portions of the building underlain by shallow fill less than a few feet thick. The surficial materials within the limits of the planned building should be removed to granitic rock and replaced with compacted fill. The building pad should be undercut a minimum of 3 feet and replaced with properly compacted fill where the granitic rock is encountered within 3 feet of finish grade. The limit of the removals should extend at least 5 feet outside of the planned building limits, where possible.

6.5.7 The base of the removals and undercut areas should be scarified, moisture conditioned as necessary, 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 in accordance with ASTM D 1557.

6.5.8 Recommendations for the handling and disposal of oversized rock in fill areas are presented in Figure 6 and in Appendix D. In general, structural fill placed and compacted at the site should consist of material that can be classified into four zones:

Zone A: Material placed within 3 feet from building pad grade, 8 feet from roadway grade, and to at least 1 foot below the deepest utility within roadways should consist of "soil" fill with an approximate maximum particle dimension of 6 inches with a minimum of 40 percent of the soil passing the ¾-inch sieve. In addition, the upper 3 feet of pad grade should have at least 20 percent of the soil passing the No. 4 sieve.

Zone B: Material placed below 8 feet from grade (below *Zone A* and *C*) may consist of "rock" fill or "soil/rock" fill (as defined in Appendix D). Blasted rock should generally consist of 2 foot minus rock material with occasional rock up to 4 foot in maximum dimension. Alternatively, "soil" fill may be placed in Zone B containing rock with a maximum dimension of 2 feet. Rocks up to 4 feet in maximum dimension can be individually placed in a properly compacted soil matrix with rocks separated at least 8 feet apart.

Zone C: Within 3 to 8 feet of pad grade and between 5 and 15 feet from face of slope, fill material should consist of "soil" fill with an approximate maximum particle dimension of 1 foot. Rocks up to 2 feet in maximum dimension may be placed, provided they are distributed in a matrix of compacted "soil" fill.

Zone D: Within the outer 5 feet of fill slopes, the fill should consist of rock up to 1 foot in maximum dimension in a matrix of compacted "soil" fill.

6.5.9 The site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soil native to the site is suitable for use as fill if relatively free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content, as determined in accordance with ASTM Test Procedure D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.

6.5.10 Import fill (if necessary) should consist of granular materials with a "very low" to "low" expansion potential (EI of 50 or less) free of deleterious material or rock larger than 3 inches and should be compacted as recommended herein. 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.

6.5.11 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soil with an expansion index of 50 or less and at least 35 percent sand-size particles should be acceptable as "soil" fill. Soil of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength. The use of cohesionless soil in the outer portion of fill slopes should be avoided. Fill slopes should be overbuilt at least 2 feet and cut back or be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet to maintain the moisture content of the fill. The slopes should be track-walked at the completion of each slope such that the fill is compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content to the face of the finished slope.

6.5.12 Placement of rock fills should be planned in the deeper fill areas to facilitate rock disposal. Overexcavation of fill areas may be required to accommodate the necessary rock volumes generated during blasting. Capping material used for placement near finish grade within roadways, building pads, and slope zones should be stockpiled during excavation and remedial grading operations. Overexcavation of units that generate capping material may be necessary to achieve sufficient volumes to achieve finish grade.

6.5.13 Rock fill placement should be performed in accordance with the Recommended Grading Specifications provided in Appendix D. We do not expect blasting would be required due to the planned import necessary for the proposed site elevations. Blasting of rock material, if necessary, should be performed to maximize rock breakage to 2-foot minus material. Rock fill placement should generally be limited to 2-foot-thick horizontal layers and compacted using rock trucks and bulldozers. Significant volumes of water are typically required during rock fill placement. The downstream areas can generate large volumes of water that can be re-used during construction.

6.5.14 Finished slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, the slopes should be drained and properly maintained to reduce erosion.

6.6 Settlement Due to Fill Loads

6.6.1 Fill soil, even though properly compacted, may experience significant settlement over the lifetime of the improvements that it supports. The ultimate settlement potential of the fill is a function of the soil classification, placement relative compaction, and subsequent increases in the soil moisture content.

6.6.2 Due to the variable fill thickness, a potential for differential settlement across the proposed building exists. Based on measured settlement of similar fill depths on this and other sites and the time period since the fill was placed, we estimate that maximum settlement of the compacted fill will be approximately 0.4 percent of the fill thickness soon after the grading operations are complete.

6.6.3 The proposed building will be underlain by a maximum differential thickness of compacted fill on the order of 20 feet. The settlement of compacted fill is expected to continue over a relatively extended time period resulting from both gravity loading and hydrocompression upon wetting from rainfall and/or landscape irrigation.

6.6.4 The amount of differential settlement and the estimated maximum angular distortion that could occur for the building is 1 inch and 1/360, respectively.

6.6.5 The estimated differential settlement for fill underlying the building should be considered in the design of improvements and adjacent flatwork. Additionally, the total and differential settlement should be incorporated into the design for pavement areas.

6.6.6 Deep foundations are the most effective means of reducing the ultimate settlement potential of the proposed structure to a negligible amount. However, installing deep foundations may not be economically feasible. Highly reinforced shallow foundation systems and slabs-on-grade may be used for support of the structure; however, the shallow foundation systems would not eliminate the potential for distress related to differential settlement of the underlying fill. Some cosmetic distress should be expected over the life of the structure as a result of long-term differential settlement. The building owner, tenants, and future owners should be made aware that cosmetic distress, including separation of caulking at wall joints, small, non-structural wall panel cracks, and separation of concrete flatwork, is likely to occur. Recommendations for deep foundations can be provided to evaluate the comparative risks and costs upon request.

6.7 Shallow Foundations and Concrete Slabs-On-Grade

6.7.1 The proposed structures can be supported on a shallow foundation system founded in the compacted fill. Foundations for the structure should consist of continuous strip footings and/or isolated spread footings. Continuous footings should be at least 12 inches wide and extend at least 24 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 2 feet and should also extend at least 24 inches below lowest adjacent pad grade. Figure 7 shows a wall/column footing dimension detail. In addition, 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

6.7.2 Steel reinforcement for continuous footings should consist of at least four No. 5 steel reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. Steel reinforcement for the spread footings should be designed by the project structural engineer.

6.7.3 The recommendations herein are based on soil characteristics only (EI of 50 or less) and is not intended to replace reinforcement required for structural considerations.

6.7.4 The recommended allowable bearing capacity for foundations with minimum dimensions described herein and bearing in properly compacted fill is 2,000 pounds per square foot (psf). The values presented herein are for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

6.7.5 We estimate the total and differential settlements under the imposed allowable loads to be about ½ inch based on a 5-foot square footing.

6.7.6 Concrete floor slabs should possess a thickness of at least 5 inches and reinforced with a minimum of No. 4 steel reinforcing bars at 18 inches on center in both horizontal directions. The structural engineer should design the steel required for the planned loading conditions.

6.7.7 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). In addition, the membrane should be installed in accordance with manufacturer's recommendations and ASTM requirements and installed in a manner that prevents puncture. The vapor retarder used should be specified by the project architect or

developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

6.7.8 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. It is common to have 3 to 4 inches of sand for 5-inch in the southern California region. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

6.7.9 Isolated footings, if present, should have the minimum embedment depth and width recommended for conventional foundations. 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. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

6.7.10 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.

6.7.11 We should observe the foundation excavations prior to the placement of reinforcing steel to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. If unexpected soil conditions are encountered, foundation modifications may be required.

6.7.12 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisturized to maintain a moist condition as would be expected in any such concrete placement.

6.7.13 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal to vertical), special foundations 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 to 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. An acceptable alternative to deepening the footings would be the use of a post-tensioned slab and foundation system or increased footing and slab reinforcement. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.

- 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 that would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

6.7.14 The foundation and concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting expected loads.

6.7.15 Concrete slabs should be provided with adequate construction joints and/or expansion joints to control unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute when establishing crack-control spacing. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed concrete finished floors are planned.

6.7.16 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

6.7.17 Where exterior flatwork abuts the structure at entrant or exit areas, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to

reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

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

6.8 Concrete Flatwork

6.8.1 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 spaced at least 18 inches center-to-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. 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.

6.8.2 Even with the incorporation of the recommendations within this report, the exterior concrete flatwork has a likelihood of experiencing some uplift due to expansive soil beneath grade; therefore, the steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.

6.9 Retaining Walls

6.9.1 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 density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at 2:1 (horizontal to vertical), we recommend an active soil pressure of 50 pcf. Soil with an expansion index (EI) of greater than 50 should not be used as backfill material behind retaining walls.

6.9.2 Retaining walls should be designed to ensure stability against overturning sliding, excessive foundation pressure. Where a keyway is extended below the wall base with the

intent to engage passive pressure and enhance sliding stability, it is not necessary to consider active pressure on the keyway.

6.9.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall. Where walls are restrained from movement at the top (at-rest condition), an additional uniform pressure of 7H psf should be added to the active soil pressure for walls 8 feet or less. For walls greater than 8 feet tall, an additional uniform pressure of 13H psf should be applied to the wall starting at 8 feet from the top of the wall. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added. Figure 8 presents the retaining wall loading diagram.

6.9.4 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 17H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.413g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.3.

6.9.5 The retaining walls may be designed using either the active and restrained (at-rest) loading condition or the active and seismic loading condition as suggested by the structural engineer. Typically, it appears the design of the restrained condition for retaining wall loading may be adequate for the seismic design of the retaining walls. However, the active earth pressure combined with the seismic design load should be reviewed and also considered in the design of the retaining walls.

6.9.6 In general, wall foundations having a minimum depth and width of 1 foot may be designed for an allowable soil bearing pressure of 2,000 psf. The allowable soil bearing pressure may be increased by an additional 300 psf for each additional foot of depth and width, to a maximum allowable bearing capacity of 3,000 psf. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, retaining wall foundations should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

6.9.7 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls. In the event that other types of walls (such as mechanically stabilized earth [MSE] walls, soil nail walls, or soldier pile walls) are planned, Geocon Incorporated should be consulted for additional recommendations.

6.9.8 Drainage openings through the base of the wall (weep holes) should not be used where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted granular (EI of 50 or less) free-draining backfill material with no hydrostatic forces or imposed surcharge load. Figure 9 presents a typical retaining wall drainage detail. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

6.9.9 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

6.9.10 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.

6.10 Lateral Loading

6.10.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid density of 350 pounds per cubic foot (pcf) should be used for the design of footings or shear keys. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

6.10.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.4 should be used for design. The friction coefficient may be reduced depending on the vapor barrier or waterproofing material used for construction in accordance with the manufacturer's recommendations (normally about 0.2 to 0.25).

6.10.3 The passive and frictional resistant loads can be combined for design purposes. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

6.11 Preliminary Pavement Recommendations

6.11.1 We calculated the flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) using an estimated Traffic Index (TI) of 5.0, 5.5, 6.0, and 7.0 for parking stalls, driveways, medium truck traffic areas, and heavy truck traffic areas, respectively. The project civil engineer and owner should review the pavement designations to determine appropriate locations for pavement thickness. The final pavement sections for the parking lot should be based on the R-Value of the subgrade soil encountered at final subgrade elevation. We understand that import soils may be required to achieve finish grade, therefore, we have assumed an R-Value of 30 and 78 for the subgrade soil and base materials, respectively, for the purposes of this preliminary analysis. Table 6.11.1 presents the preliminary flexible pavement sections.

TABLE 6.11.1
PRELIMINARY FLEXIBLE PAVEMENT SECTION

Location	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Parking stalls for automobiles and light-duty vehicles	5.0	30	3	6
Driveways for automobiles and light-duty vehicles	5.5	30	3	7
Medium truck traffic areas	6.0	30	3.5	8
Driveways for heavy truck traffic	7.0	30	4	10

6.11.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above

optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

6.11.3 Base materials should conform to Section 26-1.028 of the *Standard Specifications for The State of California Department of Transportation (Caltrans)* with a ¾-inch maximum size aggregate. The asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook)*.

6.11.4 The base thickness can be reduced if a reinforcement geogrid is used during the installation of the pavement. Geocon should be contact for additional recommendations, if required.

6.11.5 A rigid Portland cement concrete (PCC) pavement section should be placed in driveway entrance aprons, trash bin loading/storage areas and loading dock areas. The concrete pad for trash truck areas should be large enough such that the truck wheels will be positioned on the concrete during loading. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R-08 *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 6.11.2.

TABLE 6.11.2
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	100 pci
Modulus of rupture for concrete, M_R	500 psi
Traffic Category, TC	A and C
Average daily truck traffic, ADTT	10 and 100

6.11.6 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 6.11.3.

TABLE 6.11.3
RIGID PAVEMENT RECOMMENDATIONS

Location	Portland Cement Concrete (inches)
Automobile Parking Areas (TC=A)	5.5
Heavy Truck and Fire Lane Areas (TC=C)	7.0

6.11.7 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch).

6.11.8 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 7-inch-thick slab would have a 9-inch-thick edge). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

6.11.9 To control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab. Crack-control joints should not exceed 30 times the slab thickness with a maximum spacing of 12.5 feet and 15 feet for the 5.5 and 6-inch-thick slabs and thicker, respectively, and should be sealed with an appropriate sealant to prevent the migration of water through the control joint to the subgrade materials. The depth of the crack-control joints should be determined by the referenced ACI report. The depth of the crack-control joints should be at least ¼ of the slab thickness when using a conventional saw, or at least 1 inch when using early-entry saws on slabs 9 inches or less in thickness, as determined by the referenced ACI report discussed in the pavement section herein. Cuts at least ¼ inch wide are required for sealed joints, and a ⅜ inch wide cut is commonly recommended. A narrow joint width of $^{1}/_{10}$ to $^{1}/_{8}$-inch wide is common for unsealed joints.

6.11.10 To provide load transfer between adjacent pavement slab sections, a butt-type construction joint should be constructed. The butt-type joint should be thickened by at least 20 percent at the edge and taper back at least 4 feet from the face of the slab. As an alternative to the butt-type construction joint, dowelling can be used between construction joints for pavements of 7 inches or thicker. As discussed in the referenced ACI guide, dowels should consist of smooth, 1-inch-diameter reinforcing steel 14 inches long embedded a minimum of 6 inches into the slab on either side of the construction joint. Dowels should be located at the midpoint of the slab, spaced at 12 inches on center and lubricated to allow joint movement while still transferring loads. In addition, tie bars should be installed at the as recommended in Section 3.8.3 of the referenced ACI guide. The structural engineer should provide other alternative recommendations for load transfer.

6.11.11 Concrete curb/gutter should be placed on soil subgrade compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Cross-gutters should be placed on subgrade soil compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Base materials should not be placed below the curb/gutter, cross-gutters, or sidewalk so water is not able to migrate from the adjacent parkways to the pavement sections. Where flatwork is located directly adjacent to the curb/gutter, the concrete flatwork should be structurally connected to the curbs to help reduce the potential for offsets between the curbs and the flatwork.

6.12 Site Drainage and Moisture Protection

6.12.1 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.

6.12.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

6.12.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material should be considered.

6.12.4 We understand detention basins, bioswales, retention basins, water infiltration, low impact development (LID), or storm water management devices are being considered. The recommendations provided herein pertain to the geotechnical aspects of design and possible impacts of implementation. Appendix C presents the results of the storm water investigation.

6.13 Grading and Foundation Plan Review

6.13.1 Geocon Incorporated should review the grading plans and foundation plans for the project prior to final design submittal to evaluate whether additional analyses and/or recommendations are required.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The 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.

2. This report is issued with the understanding that it is the responsibility of the owner or 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.

3. 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.

4. 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.

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N

NO SCALE

VICINITY MAP

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SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

DATE 12 - 21 - 2017	PROJECT NO. G2217 - 52 - 01	FIG. 1

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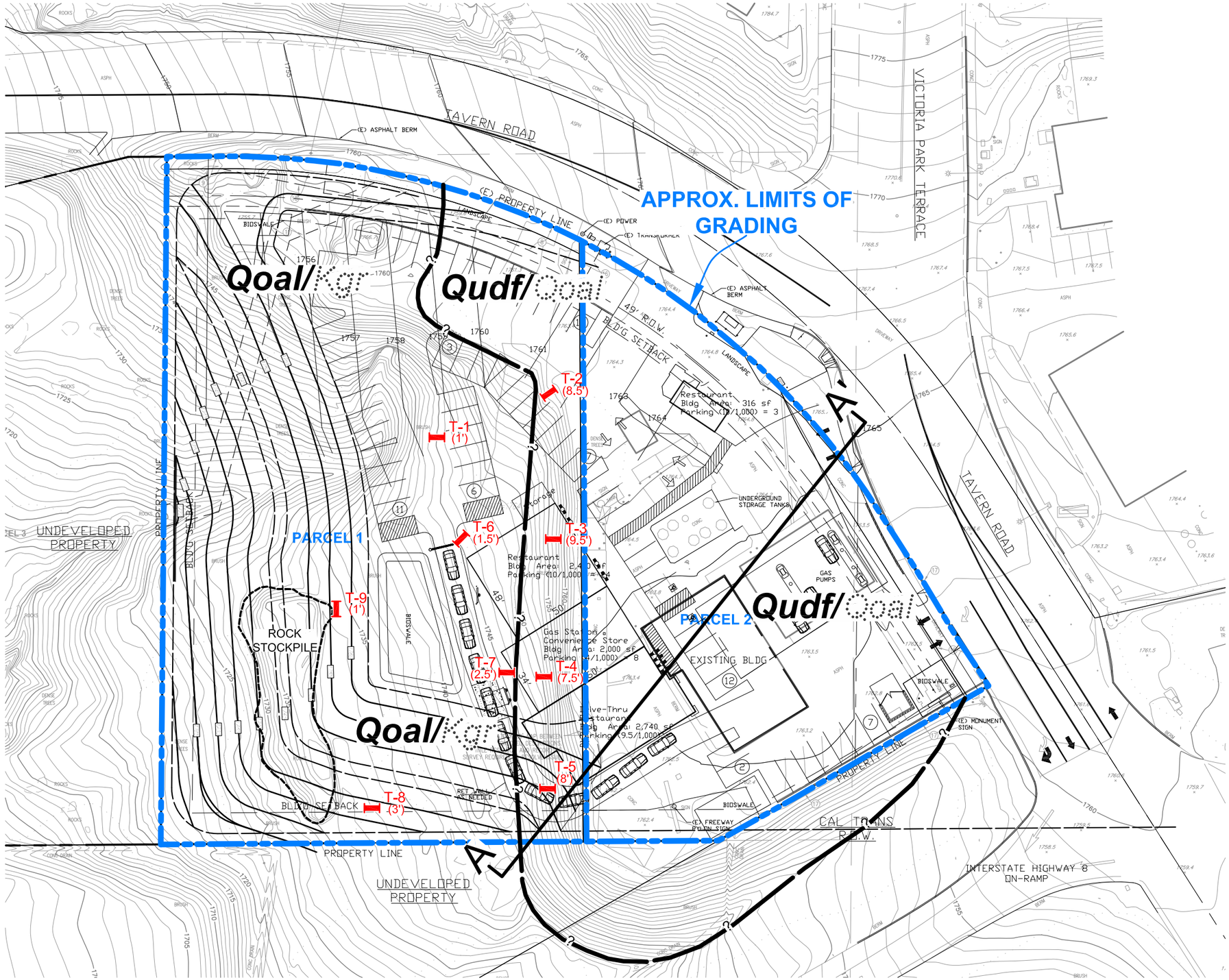
SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

DRAFT



0' 50' 100'

SCALE 1"= 50' (On 11x17)

GEOCON LEGEND

Qudf .....UNDOCUMENTED FILL

Qoal .....OLDER ALLUVIUM (Dotted Where Buried)

Kgr .....GRANITIC ROCK (Tonalite; Dotted Where Buried)

T-9 .....APPROX. LOCATION OF EXPLORATORY TRENCH

(9.5') .....APPROX. DEPTH TO GRANITIC ROCK (Feet)

A A' .....APPROX. LOCATION OF GEOLOGIC CROSS-SECTION

.....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

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FIGURE 2

DATE 12 - 21 - 2017

GEOLOGIC MAP

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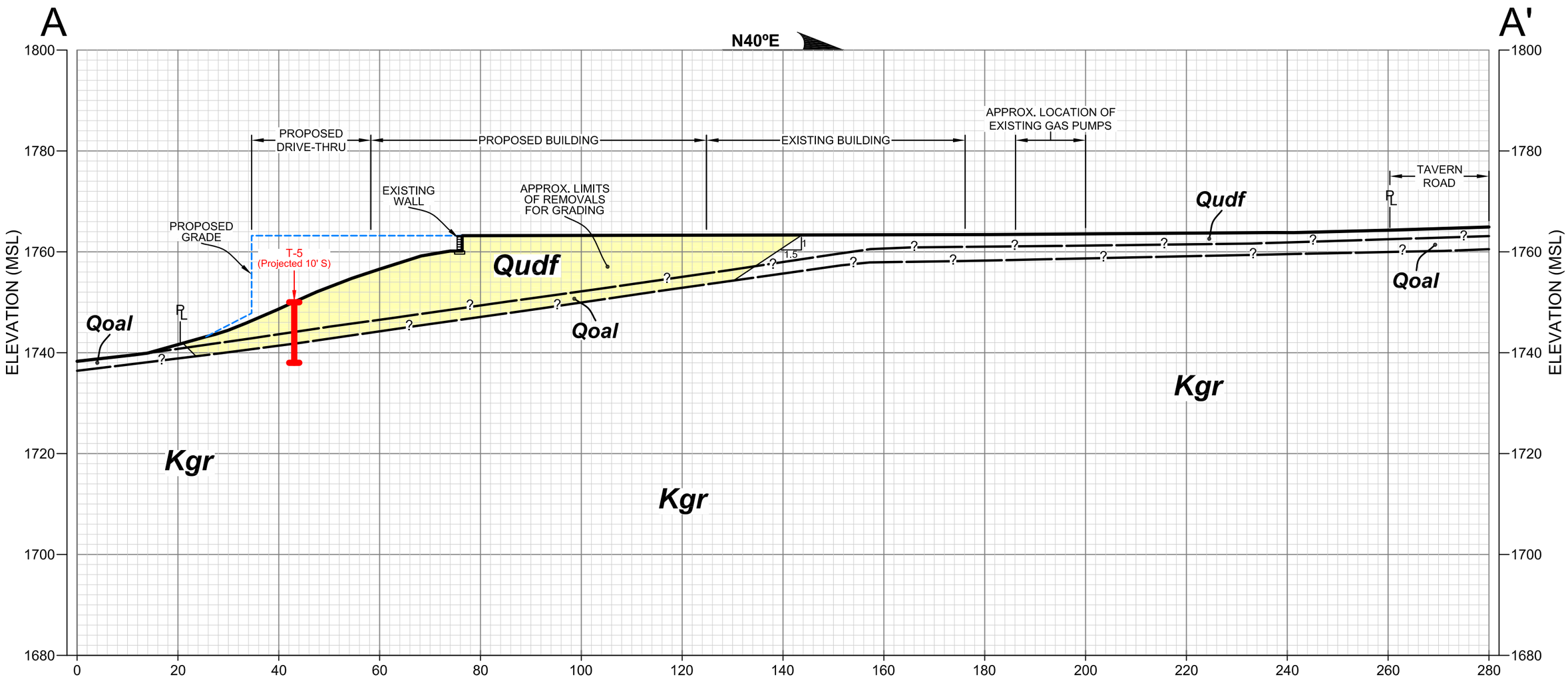
SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA



GEOCON LEGEND

Qudf .....UNDOCUMENTED FILL

Qoal .....OLDER ALLUVIUM

Kgr .....GRANITIC ROCK (Tonalite)

T-5 .....APPROX. LOCATION OF EXPLORATORY TRENCH

.....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

GEOLOGIC CROSS-SECTION A-A'

SCALE: 1" = 20' (Vert. = Horiz.)

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PROJECT NO. G2217 - 52 - 01
FIGURE 3
DATE 12 - 21 - 2017

GEOLOGIC CROSS - SECTION

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Surficial Slope Stability Evaluation

Slope Height, H (feet)	∞	
Vertical Depth of Stauration, Z (feet)	3	
Slope Inclination	2.00	:1
Slope Inclination, I (degrees)	26.6	
Unit Weight of Water, γW (pcf)	62.4	
Total Unit Weight of Soil, γ_T (pcf)	125	
Friction Angle, ϕ (degrees)	28	
Cohesion, C (psf)	500	
Factor of Safety = $(C+(\gamma_T-\gamma_W)Z\cos^2 i \tan\phi)/(\gamma_T Z \sin i \cos i)$	3.87	

References: (1) Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage* , Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62.

(2) Skempton, A. W., and F. A. Delory, *Stability of Natural Slopes in London Clay* , Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81.

Slope Stability Evaluation

Slope Height, H (feet)	45	
Slope Inclination	2.0	:1
Total Unit Weight of Soil, γ_T (pcf)	125	
Friction Angle, ϕ (degrees)	28	
Cohesion, C (psf)	500	
$\gamma_{C\phi} = (\gamma H \tan\phi)/C$	6.0	
N_{Cf} (from Chart)	22.5	
Factor of Safety = $(N_{Cf}C)/(\gamma H)$	2.00	

References: (1) Janbu, N. *Stability Analysis of Slopes with Dimensionless Parameters,* Harvard Soil Mechanics, Series No. 46, 1954.

(2) Janbu, N. *Discussion of J.M. Bell, DimensionlessParameters for Homogeneous Earth Slopes,* Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

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SW / SW

SLOPE STABILITY ANALYSIS - PROPOSED FILL SLOPES

SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

DATE 12-21-2017 | PROJECT NO. G2217-52-01 | FIG. 4

Surficial Slope Stability Evaluation

Slope Height, H (feet)	∞	
Vertical Depth of Stauration, Z (feet)	3	
Slope Inclination	2.00	:1
Slope Inclination, I (degrees)	26.6	
Unit Weight of Water, γW (pcf)	62.4	
Total Unit Weight of Soil, γ_T (pcf)	125	
Friction Angle, ϕ (degrees)	26	
Cohesion, C (psf)	200	
Factor of Safety = $(C+(\gamma_T-\gamma_W)Z\cos^2 i \tan\phi)/(\gamma_T Z \sin i \cos i)$	1.82	

References: (1) Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage* , Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62.

(2) Skempton, A. W., and F. A. Delory, *Stability of Natural Slopes in London Clay* , Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81.

Slope Stability Evaluation

Slope Height, H (feet)	30	
Slope Inclination	2.0	:1
Total Unit Weight of Soil, γ_T (pcf)	125	
Friction Angle, ϕ (degrees)	26	
Cohesion, C (psf)	200	
$\gamma_{C\phi} = (\gamma H \tan\phi)/C$	9.1	
N_{Cf} (from Chart)	30	
Factor of Safety = $(N_{Cf}C)/(\gamma H)$	1.60	

References: (1) Janbu, N. *Stability Analysis of Slopes with Dimensionless Parameters,* Harvard Soil Mechanics, Series No. 46, 1954.

(2) Janbu, N. *Discussion of J.M. Bell, DimensionlessParameters for Homogeneous Earth Slopes,* Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

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SLOPE STABILITY ANALYSIS - EXISTING FILL SLOPES

SHELL STATION EXPANSION
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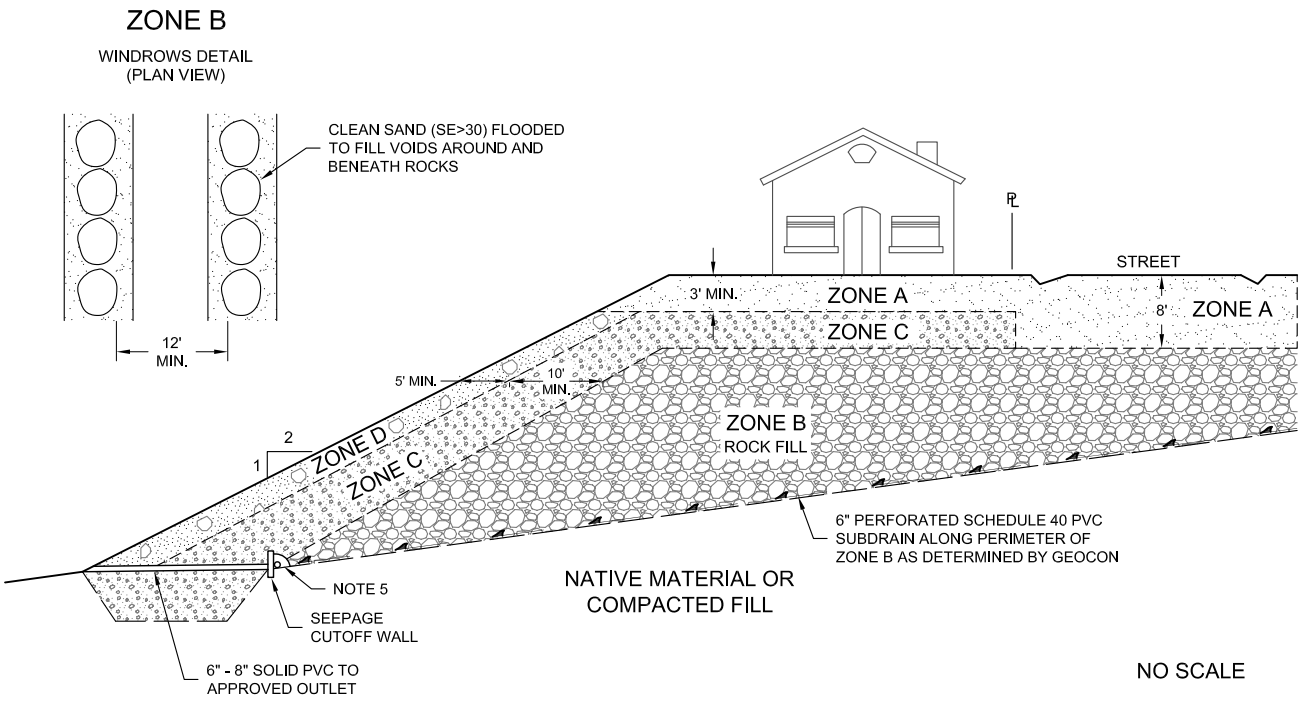
DATE 12-21-2017 | PROJECT NO. G2217-52-01 | FIG. 5



LEGEND

ZONE A: COMPACTED SOIL FILL. NO ROCK FRAGMENTS OVER 6 INCHES IN DIMENSION.

ZONE B: BLASTED ROCK FILL GENERALLY CONSISTING OF 2 FOOT MINUS MATERIAL WITH OCCASIONAL INDIVIDUAL ROCK UP TO 4 FEET MAXIMUM DIMENSION
ALTERNATE: ROCKS 2 TO 4 FEET IN MAXIMUM DIMENSION CAN BE PLACED IN WINDROWS IN COMPACTED SOIL FILL POSSESSING A SAND EQUIVALENT OF AT LEAST 30.

ZONE C: ROCKS UP TO 2 FEET IN MAXIMUM DIMENSION IN A MATRIX OF COMPACTED SOIL FILL WITHIN BUILDING PADS AND SLOPE AREAS ONLY.

ZONE D: ROCKS UP TO 1 FOOT IN MAXIMUM DIMENSION IN A MATRIX OF COMPACTED SOIL FILL.

NOTES

1. COMPACTED SOIL FILL IN UPPER 8 FEET SHALL CONTAIN AT LEAST 40 PERCENT SOIL PASSING THE 3/4 - INCH SIEVE (BY WEIGHT) AND IN THE UPPER 3 FEET OF PAD GRADE AT LEAST 20% SOIL PASSING THE NO. 4 SIEVE (BY WEIGHT) AND COMPACTED IN ACCORDANCE WITH SPECIFICATIONS FOR STRUCTURAL FILL.
2. CONTINUOUS OBSERVATION REQUIRED BY GEOCON DURING ROCK PLACEMENT.
3. ROCK FILL (LESS THAN 40 PERCENT SOIL SIZES) MAY BE PERMITTED IN DESIGNATED AREAS UPON THE RECOMMENDATION OF THE GEOTECHNICAL ENGINEER.
4. DEPTH OF ZONE A SHOULD BE AT LEAST 8 FEET AND EXTENDED TO AT LEAST 2 FEET BELOW DEEPEST UTILITY WITHIN ROADWAYS.
5. 6" PERFORATED SCHEDULE 40 PVC SUBDRAIN ALONG THE TOE AND PORTIONS OF THE PERIMETER OF ZONE B.
6. BASE OF ZONE B SHOULD SLOPE A MINIMUM OF 3 PERCENT.

OVERSIZE ROCK DISPOSAL DETAIL

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SHELL STATION EXPANSION
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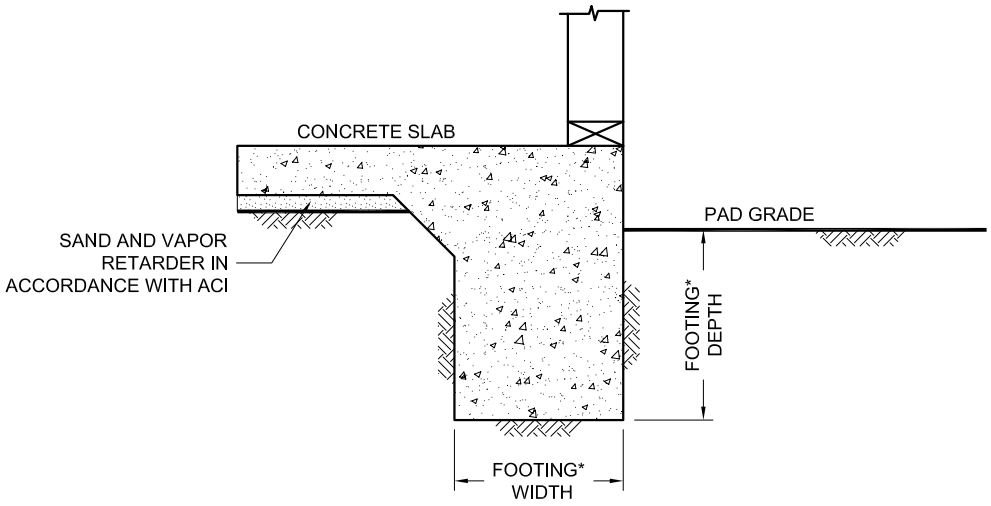

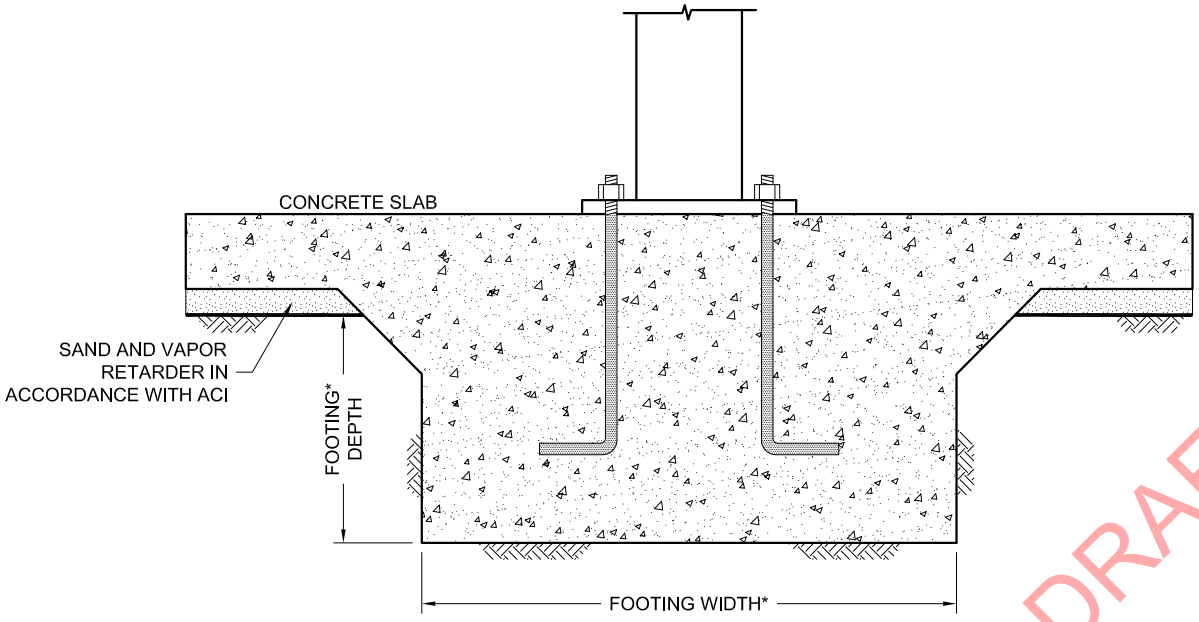

*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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SHELL STATION EXPANSION
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DATE 12 - 21 - 2017	PROJECT NO. G2217 - 52 - 01	FIG. 7

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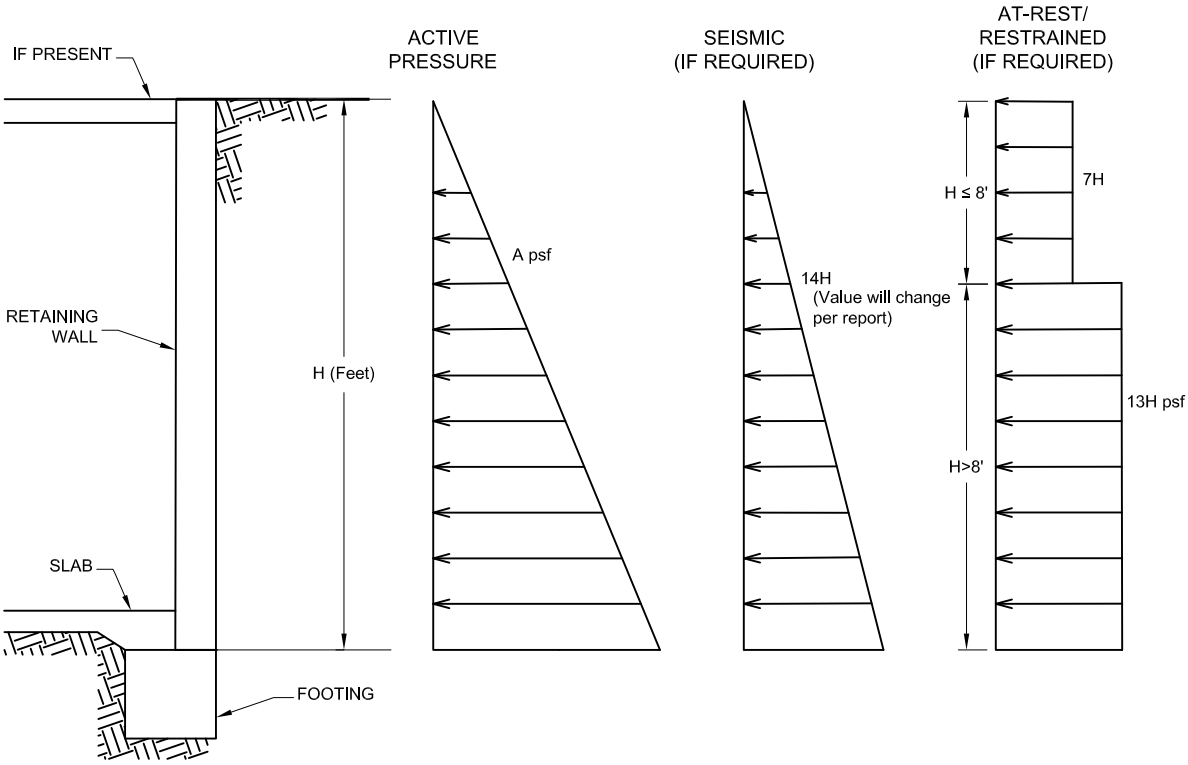

ACTIVE PRESSURE, A (psf)		
EXPANSION INDEX, EI	LEVEL BACKFILL	2:1 SLOPING BACKFILL
EI ≤ 50	35	50
EI ≤ 90	40	55

NOTES:

1..... A SURCHARGE OF 2 FEET OF SOIL (250 PSF VERTICAL LOAD) SHOULD BE ADDED TO THE DESIGN OF THE WALL WHERE TRAFFIC LOADS ARE WITHIN A HORIZONTAL DISTANCE EQUAL TO ⅔ THE WALL HEIGHT. OTHER SURCHARGES SHOULD BE APPLIED, AS APPLICABLE.

2..... EXPANSION INDEX GREATER THAN 50/90 SHOULD NOT BE USED FOR WALL BACKFILL PER REPORT.

3..... RETAINING WALLS SHOULD BE PROPERLY DRAINED AND WATER PROOFED.

4..... THE PROJECT STRUCTURAL ENGINEER SHOULD EVALUATE THE WALL LOADING COMBINATIONS.

NO SCALE

RETAINING WALL LOADING DIAGRAM

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SHELL STATION EXPANSION
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DATE 12 - 21 - 2017	PROJECT NO. G2217 - 52 - 01	FIG. 8

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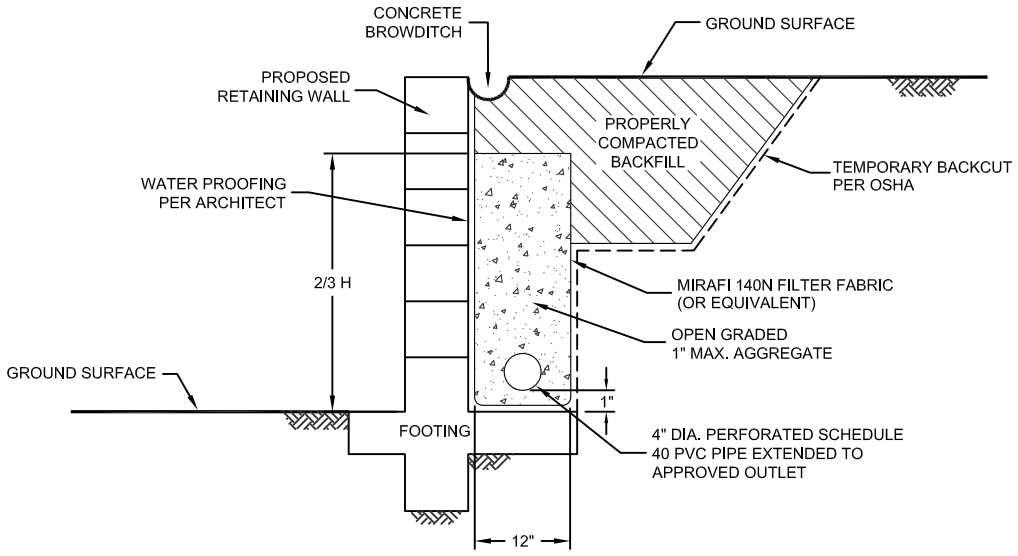

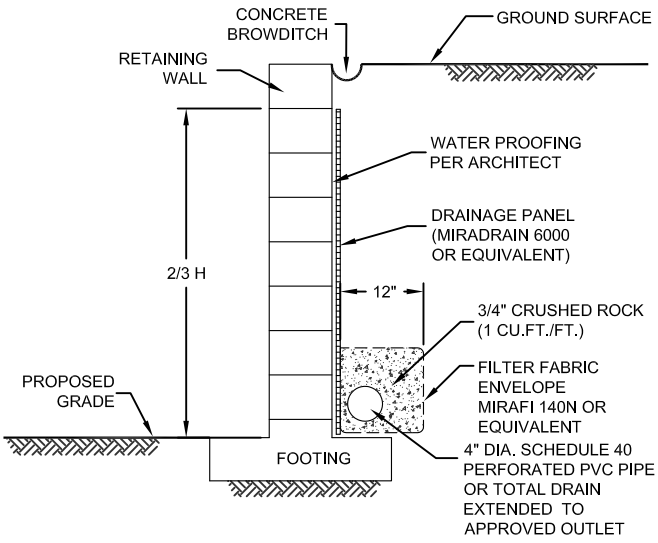

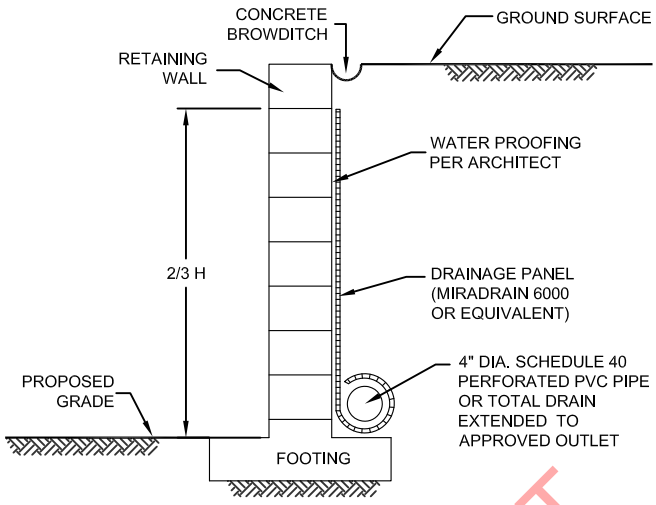

NOTE :

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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SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

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DATE 12 - 21 - 2017	PROJECT NO. G2217 - 52 - 01	FIG. 9

Plotted:12/21/2017 9:55AM | By:RUBEN AGUILAR | File Location:Y:\PROJECTS\G2217-52-01 Shell Station Expansion\DETAILS\Typical Retaining Wall Drainage Detail (RWDD7A).dwg

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

We performed the fieldwork for our investigation on November 29, 2017. Our subsurface exploration consisted of excavating nine exploratory trenches to a maximum depth of approximately 12 feet using a track-mounted John Deere 555G backhoe. The locations of the trenches are shown on the Geologic Map, Figure 2. The trench logs, and an explanation of the geologic units encountered are presented on Figures A-1 through A-9. We located the trenches in the field using existing reference points; therefore, actual locations may deviate slightly.

We obtained bulk and chunk samples at appropriate intervals and transported them to the laboratory for testing. We estimated elevations shown on the trench logs from the provided topographic map. Each excavation was backfilled with the soil cuttings generated during excavation.

We visually examined, classified, and logged the soil encountered in the trenches in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). The logs depict the soil and geologic conditions observed and the depth at which samples were obtained.

PROJECT NO. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1 ELEV. (MSL.) 1746' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**TOPSOIL** Loose, dry to damp, yellowish to reddish brown, Silty, fine to coarse SAND; trace rootlets			
2					**GRANITIC ROCK (Kgr)** Completely weathered, yellowish to grayish brown, moderately weak to weak TONALITE; excavates as fine to coarse SAND with gravel-sized rock fragments			
					TRENCH TERMINATED AT 3 FEET Groundwater not encountered			

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

G2217-52-01.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. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2 ELEV. (MSL.) 1764' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL (Qudf)** Loose, dry to damp, light grayish to yellowish brown, Silty, fine to coarse SAND; organics, gravel, roots, metal and plastic debris in upper 4 feet			
2					-Mostly angular gravel up to 1" in diameter from 2 to 3 feet			
					-Trace boulders up to approx. 6" in diameter			
4					-Becomes loose to medium dense, reddish brown			
6	T2-1			SM	**OLDER ALLUVIUM (Qoal)** Dense, damp, reddish brown, Silty, fine to coarse SAND			
8					**GRANITIC ROCK (Kgr)** Completely weathered, moist, yellowish to grayish brown, moderately weak TONALITE; excavates as fine to coarse SAND with gravel sized rock fragments			
10					TRENCH TERMINATED AT 10.5 FEET Groundwater not encountered			

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

G2217-52-01.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. G2217-52-01

TRENCH T 3

ELEV. (MSL.) **1759'** DATE COMPLETED **11-29-2017**

EQUIPMENT **TRACK-MOUNTED JD 555G BACKHOE** BY: **L. RODRIGUEZ**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T3-1			SM	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, dry to damp, light yellowish to reddish brown, Silty, fine to coarse SAND; trace clasts granitic rock; trace rootlets			
2					-H.P. approx. 4.5 tsf			
4					-Becomes light yellowish to grayish brown; H.P. approx. 2.5 tsf			
6								
8				SM	**OLDER ALLUVIUM (Qoal)** Dense to very dense, dry to damp, reddish brown, Silty, fine to coarse SAND; micaceous			
10					**GRANITIC ROCK (Kgr)** Highly weathered, yellowish to grayish brown, moderately weak TONALITE; excavates as fine to coarse SAND with gravel sized rock fragments			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

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

G2217-52-01.GPJ

SAMPLE SYMBOLS

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

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PROJECT NO. G2217-52-01

TRENCH T 4

ELEV. (MSL.) **1753'** DATE COMPLETED **11-29-2017**

EQUIPMENT **TRACK-MOUNTED JD 555G BACKHOE** BY: **L. RODRIGUEZ**

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	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, damp, light reddish brown, Silty, fine to coarse SAND; trace organics; trace gravel sized rock fragments; H.P.=3.0 tsf			
	T4-1							
2					-Becomes loose, light grayish brown; H.P.=0.5 tsf			
4					-Becomes medium dense, dark brown; H.P.=4.0 tsf			
6								
	T4-2			SM	**OLDER ALLUVIUM (Qoal)** Dense, dry to damp, reddish brown, Silty, fine to coarse SAND; pinhole voids; micaceous		109.7	9.0
8					**GRANITIC ROCK (Kgr)** Highly weathered, yellowish to grayish brown, moderately weak TONALITE; excavates as Silty, fine to coarse SAND with gravel sized rock fragments			
					TRENCH TERMINATED AT 9 FEET Groundwater not encountered			

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

G2217-52-01.GPJ

SAMPLE SYMBOLS

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

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PROJECT NO. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 5 ELEV. (MSL.) 1750' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL (Qudf)** Loose to medium dense, damp, light reddish brown, Silty, fine to coarse SAND; trace clasts granitic rock; trace organics			
	T5-1							
2								
	T5-2				-Becomes medium dense, moist, dark reddish brown			
4								
6				SM	**OLDER ALLUVIUM (Qoal)** Dense, moist, reddish brown, Silty, fine to coarse SAND -Trace cobble approx. 7" in diameter			
8					**GRANITIC ROCK (Kgr)** Completely weathered, reddish to grayish brown, weak TONALITE; excavates as Silty, fine to coarse SAND with gravel-sized rock fragments			
10					-Becomes highly weathered, yellowish to grayish brown			
12					TRENCH TERMINATED AT 12 FEET Groundwater not encountered			

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

G2217-52-01.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... DISTURBED OR BAG SAMPLE
... STANDARD PENETRATION TEST
... CHUNK SAMPLE
... DRIVE SAMPLE (UNDISTURBED)
... 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. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 6 ELEV. (MSL.) 1746' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**OLDER ALLUVIUM (Qoal)** Dense to very dense, damp, reddish brown, Silty, fine to coarse SAND; clasts granitic rock			
2					**GRANITIC ROCK (Kgr)** Highly weathered, yellowish to grayish brown, moderately weak TONALITE; excavates as fine to coarse SAND with gravel sized rock fragments -Septic system with 2" diameter gravel encountered at 2' at southwest end of trench			
4					TRENCH TERMINATED AT 4 FEET Groundwater not encountered			

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

G2217-52-01.GPJ

SAMPLE SYMBOLS

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

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PROJECT NO. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 7 ELEV. (MSL.) 1746' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**OLDER ALLUVIUM (Qoal)** Dense to very dense, damp, reddish brown, Silty, fine to coarse SAND; clasts granitic rock			
2					**GRANITIC ROCK (Kgr)** Highly weathered, yellowish to grayish brown, moderately weak TONALITE; excavates as fine to coarse SAND with gravel sized rock fragments			
4					TRENCH TERMINATED AT 4 FEET Groundwater not encountered			

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

G2217-52-01.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. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.) 1733.5' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**TOPSOIL** Loose, dry, light brown, Silty, fine to coarse SAND; some organics			
2				SM	**OLDER ALLUVIUM (Qoal)** Dense to very dense, dry to damp, reddish brown, Silty, fine to coarse SAND; trace gravel			
4					**GRANITIC ROCK (Kgr)** Completely weathered, yellowish to grayish brown, weak TONALITE; excavates as fine to coarse SAND with gravel sized rock fragments -Septic system with 2" diameter gravel encountered at 3 feet at east end of trench			
					TRENCH TERMINATED AT 5 FEET Groundwater not encountered			

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

G2217-52-01.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. G2217-52-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) 1734.5' DATE COMPLETED 11-29-2017 EQUIPMENT TRACK-MOUNTED JD 555G BACKHOE BY: L. RODRIGUEZ	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T9-1			SM	**OLDER ALLUVIUM (Qoal)** Dense to very dense, damp, reddish brown, Silty, fine to coarse SAND; micaceous			
2					**GRANITIC ROCK (Kgr)** Completely to moderately weathered, grayish to yellowish brown, moderately strong TONALITE; excavates as gravel to cobble sized rock fragments			
					TRENCH TERMINATED AT 3 FEET Groundwater not encountered			

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

G2217-52-01.GPJ

SAMPLE SYMBOLS

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

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APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with generally currently accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. We tested selected soil samples for their in-place density and moisture content, maximum dry density and optimum moisture content, shear strength, expansion index, pH, resistivity, water-soluble sulfate characteristics, grain size and consolidation. Tables B-I through B-V and Figures B-1 and B-2 present the results of our laboratory tests. In addition, the in-place dry density and moisture content test results are presented on the trench logs in Appendix A.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557

Sample No.	Depth (Feet)	Description (Geologic Unit)	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T3-1	½-3	Yellowish to reddish brown, Silty fine to coarse SAND (Qudf)	131.9	9.2
T9-1	0-1½	Reddish brown, Silty fine to coarse SAND (Qvop/Kgr)	132.9	9.0

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

Sample No.	Depth (feet)	Geologic Unit	Dry Density (pcf)	Moisture Content (%)		Peak [Ultimate[1]] Cohesion (psf)	Peak [Ultimate[1]] Angle of Shear Resistance (degrees)
				Initial	Final		
T3-1[2]	½-3	Qudf	118.8	8.9	15.3	625 [500]	30 [30]
T9-1[2]	0-1½	Qoal/Kgr	119.7	8.6	15.0	600 [525]	28 [28]

[1] Ultimate measured at 0.2-inch deflection.
[2] Sample Remolded.

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

Sample No.	Depth (feet)	Geologic Unit	Moisture Content (%)		Dry Density (pcf)	Expansion Index	ASTM Expansion Classification	2016 CBC Expansion Classification
			Before Test	After Test				
T3-1	½-3	Qudf	7.5	15.1	119.3	11	Non-Expansive	Very Low

TABLE B-IV
SUMMARY OF LABORATORY PH AND RESISTIVITY TEST RESULTS
CALIFORNIA TEST NO. 643

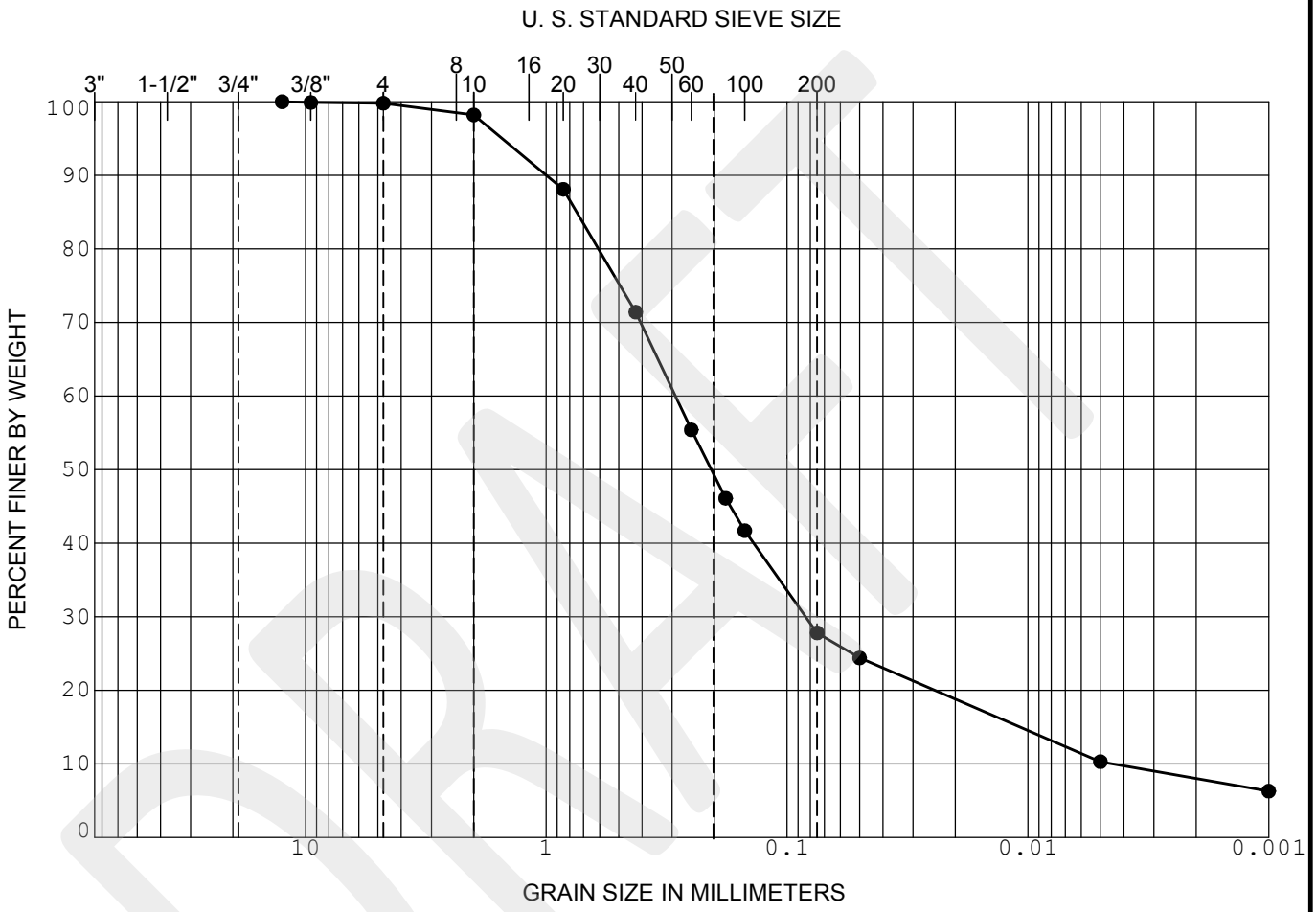
Sample No.	Depth (Feet)	Geologic Unit	pH	Minimum Resistivity (ohm-centimeters)
T3-1	½-3	Qudf	8.0	2800

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

Sample No.	Depth (Feet)	Geologic Unit	Water-Soluble Sulfate (%)	ACI 318 Sulfate Exposure
T3-1	½-3	Qudf	0.005	S0

PROJECT NO. G2217-52-01

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



	SAMPLE	DEPTH (ft)	CLASSIFICATION	NAT WC	LL	PL	PI
●	T3-1	0.5	SM - Silty SAND				
⊠							
▲							

GRADATION CURVE

SHELL STATION EXPANSION

COUNTY OF SAN DIEGO, CALIFORNIA

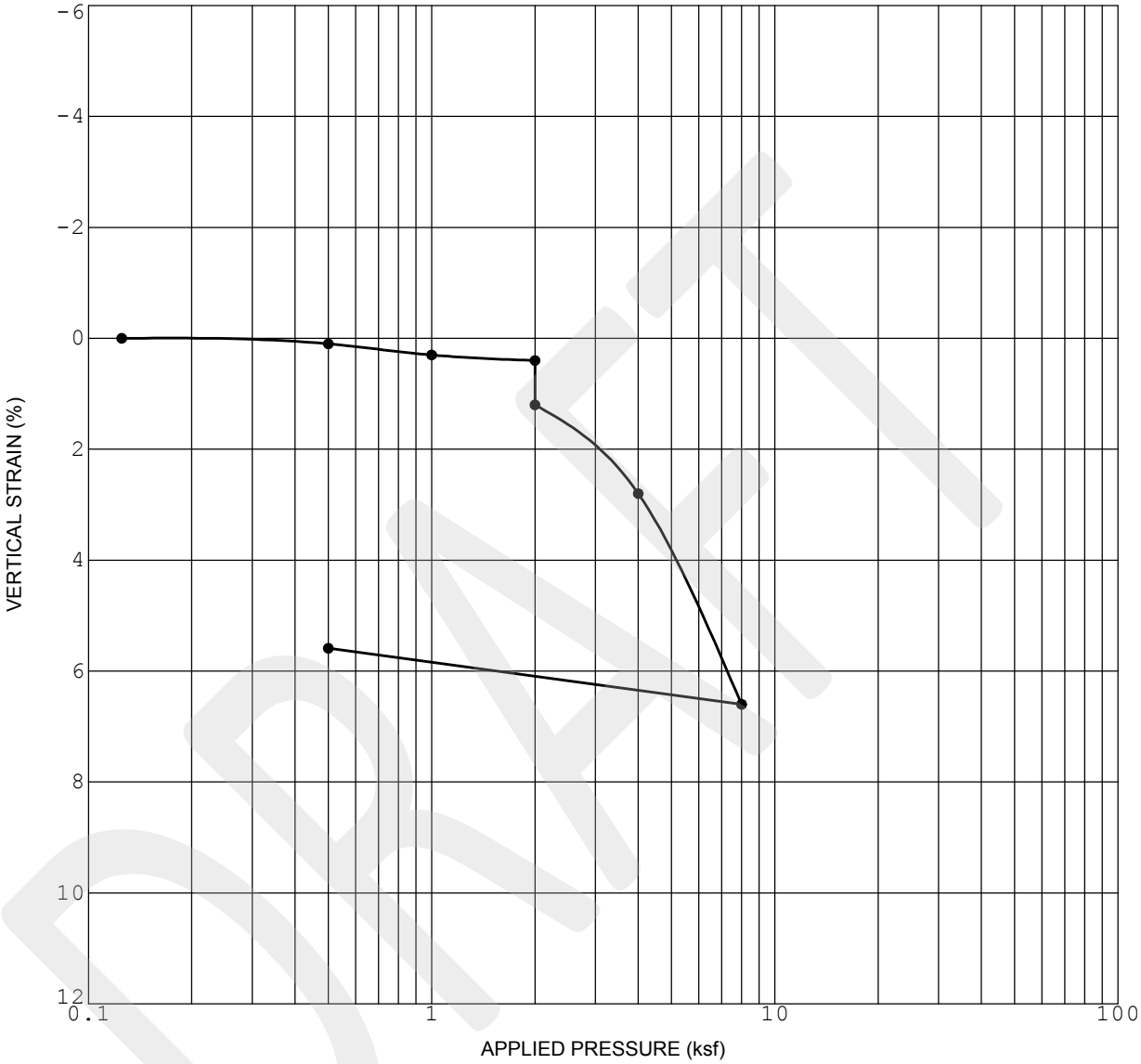
G2217-52-01.GPJ

Figure B-1

GEOCON

PROJECT NO. G2217-52-01

SAMPLE NO. T4-2



Initial Dry Density (pcf)	109.7	**Initial Saturation (%)**	46.5
Initial Water Content (%)	9.0	**Sample Saturated at (ksf)**	2.0

CONSOLIDATION CURVE

SHELL STATION EXPANSION

COUNTY OF SAN DIEGO, CALIFORNIA

G2217-52-01.GPJ

Figure B-2

GEOCON

APPENDIX C

APPENDIX C

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices will be used in accordance with the *BMP Design Manual* currently used by the County of San Diego. 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-I presents the descriptions of the hydrologic soil groups. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

TABLE C-I
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 man-made fill and natural materials consisting of topsoil, Older Alluvium and Granitic Rock. The fill should be classified as Soil Group D. Table C-II presents the information from the USDA website for the subject property. The Hydrologic Soil Group Map, provided at the end of this appendix, presents output from the USDA website showing the limits of the soil units.

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

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group
Cienaba Rocky Coarse Sandy Loam, 9 to 30 Percent Slopes	CmE2	100	D

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-III describes the differences in the definitions.

TABLE C-III
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 did not perform infiltration testing at the site because the site conditions and characteristics of the underlying soil at the site precludes allowing infiltration at the site. Full and partial infiltration is

infeasible at the site due to the thickness and soil characteristics of the existing and planned fill at the site, the presence of existing slopes adjacent to the site, and the planned fill slopes. A detailed discussion is presented herein.

Infiltration categories include full infiltration, partial infiltration and no infiltration. Table C-IV presents the commonly accepted definitions of the potential infiltration categories based on the infiltration rates.

TABLE C-IV
INFILTRATION CATEGORIES

Infiltration Category	Field Infiltration Rate, I (Inches/Hour)	Factored Infiltration Rate*, I (Inches/Hour)
Full Infiltration	$I > 1.0$	$I > 0.5$
Partial Infiltration	$0.10 < I \leq 1.0$	$0.05 < I \leq 0.5$
No Infiltration (Infeasible)	$I < 0.10$	$I < 0.05$

*Using a Factor of Safety of 2.

Groundwater Elevations

We did not encounter groundwater or seepage during the site investigation. We expect groundwater exists at depths greater than 100 feet below existing grades.

New or Existing Utilities

Utilities will be constructed within the site boundaries. Full or partial infiltration should not be allowed in the areas of the utilities to help prevent potential damage/distress to improvements. Mitigation measures to prevent water from infiltrating the utilities consist of setbacks, installing cutoff walls around the utilities and installing subdrains and/or installing liners.

Existing and Planned Structures

Existing roadways and Interstate 8 exist adjacent to the site. Water should not be allowed to infiltrate in areas where it could affect the neighboring properties and existing adjacent structures, improvements and roadways. Mitigation for existing structures consists of not allowing water infiltration within a 1:1 plane from existing foundations and extending the infiltration areas at least 10 feet below the existing adjacent improvements.

Slopes Hazards

Existing fill and naturally occurring descending slopes exist on the site and to the west and south of the property extending to an adjacent property and Interstate 8. If infiltration is allowed adjacent to

the existing slopes at the site, water migration and the resulting seepage forces can negatively affect the stability of the slopes and cause erosion. The existing fill and formational materials possess limited vertical infiltration characteristics and water allowed to infiltrate on the site would migrate laterally to the adjacent properties, roadways and Interstate 8. Infiltration devices should not be installed adjacent to slopes unless they are lined, possess a minimum setback distance of 50 feet, or extend below the height of the slope. Due to the heights of the existing and proposed slopes, we expect the basins will be lined for the planned property.

Storm Water Evaluation Narrative

The western portion of the site (Parcel 1) is underlain by older alluvium overlying Granitic Rock, consists of naturally occurring descending slopes and an existing natural drainage, and is also bordered to the west and south by existing naturally occurring slopes. Infiltration should not be allowed adjacent to slopes. In addition, the existing older alluvium and Granitic Rock consists of very dense materials that are not typically conducive to infiltration. Therefore, due to the sloping conditions, the adjacent slopes to the west and south, and the very dense characteristics of the older alluvium and Granitic Rock, infiltration should not be allowed within a majority of the western half of the site.

The existing gas station site (Parcel 2) located on the eastern portion of the site is underlain by varying depths of undocumented fill overlying older alluvium and Granitic Rock. An existing fill slope with a height up to approximately 25 feet extends along a majority of the western edge and southern edge of the gas station site. We expect fills up to approximately 20 to 25 feet exist below the southern end of the gas station site. Infiltration should not be allowed within 50 feet of the existing fill slope or in areas underlain by greater than 5 feet of fill. In addition, the area on the gas station site outside the 50-foot setback area from the existing slope consists of existing improvements including an underground storage tank, gas pumps and several underground utilities that will remain. Several underground utilities also exist along the adjacent Tavern Road. Infiltration should not be allowed in areas of the existing improvements or adjacent to the existing roadway. Therefore, due to the fill slope, fill thicknesses, and presence of existing improvements, infiltration should not be allowed on the gas station site.

We opine the property is considered infeasible to full and partial infiltration. The planned storm water devices should be properly lined to prevent water migration into the underlying soil and to prevent distress to the adjacent existing and proposed slopes and adjacent properties and improvements.

Storm Water Management Devices

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. The penetration of the liners at the subdrains 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. Liners should be installed on the side walls of the proposed basins in accordance with a partial infiltration design.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1 or Form I-8) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet D.5-1 or Form I-9) that helps the project civil engineer estimate the factor of safety based on several factors. Table C-V describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE C-V
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 previous table, Table C-VI presents the estimated factor values for the evaluation of the factor of safety. This table only presents 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-VI
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	1	0.25
Site Soil Variability	0.25	2	0.50
Depth to Groundwater/ Impervious Layer	0.25	1	0.25
Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75

[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:

We did not perform infiltration tests at the site because the site conditions and characteristics of the underlying soil at the site precludes allowing infiltration. The fill materials and existing formational older alluvium and Granitic Rock should be classified as Soil Group D. Materials characterized as a Hydrologic Soil Group D typically possess infiltration rates less than 0.5 inches per hour.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

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:

The western portion of the site (Parcel 1) is underlain by older alluvium overlying Granitic Rock, consists of naturally occurring descending slopes and an existing natural drainage, and is also bordered to the west and south by existing naturally occurring slopes. Infiltration should not be allowed adjacent to slopes. In addition, the existing older alluvium and Granitic Rock consists of very dense materials that are not typically conducive to infiltration. Therefore, due to the sloping conditions, the adjacent slopes to the west and south, and the very dense characteristics of the older alluvium and Granitic Rock, infiltration should not be allowed within a majority of the western half of the site.

The existing gas station site (Parcel 2) located on the eastern portion of the site is underlain by varying depths of undocumented fill overlying older alluvium and Granitic Rock. An existing fill slope with a height up to approximately 25 feet extends along a majority of the western edge and southern edge of the gas station site. We expect fills up to approximately 20 to 25 feet exist below the southern end of the gas station site. Infiltration should not be allowed within 50 feet of the existing fill slope or in areas underlain by greater than 5 feet of fill. In addition, the area on the gas station site outside the 50-foot setback area from the existing slope consists of existing improvements including an underground storage tank, gas pumps and several underground utilities that will remain. Several underground utilities also exist along the adjacent Tavern Road. Infiltration should not be allowed in areas of the existing improvements or adjacent to the existing roadway. Therefore, due to the fill slope, fill thicknesses, and presence of existing improvements, infiltration should not be allowed on the gas station site.

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: We did not encounter groundwater or seepage during the site investigation. We expect groundwater exists at depths greater than 100 feet below existing grades. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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: We do not expect infiltration will cause water balance issues such as seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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:

We did not perform infiltration tests at the site because the site conditions and characteristics of the underlying soil at the site precludes allowing infiltration. The fill materials and existing formational older alluvium and Granitic Rock should be classified as Soil Group D. Materials characterized as a Hydrologic Soil Group D typically possess infiltration rates less than 0.05 inches per hour.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

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:

The western portion of the site (Parcel 1) is underlain by older alluvium overlying Granitic Rock, consists of naturally occurring descending slopes and an existing natural drainage, and is also bordered to the west and south by existing naturally occurring slopes. Infiltration should not be allowed adjacent to slopes. In addition, the existing older alluvium and Granitic Rock consists of very dense materials that are not typically conducive to infiltration. Therefore, due to the sloping conditions, the adjacent slopes to the west and south, and the very dense characteristics of the older alluvium and Granitic Rock, infiltration should not be allowed within a majority of the western half of the site.

The existing gas station site (Parcel 2) located on the eastern portion of the site is underlain by varying depths of undocumented fill overlying older alluvium and Granitic Rock. An existing fill slope with a height up to approximately 25 feet extends along a majority of the western edge and southern edge of the gas station site. We expect fills up to approximately 20 to 25 feet exist below the southern end of the gas station site. Infiltration should not be allowed within 50 feet of the existing fill slope or in areas underlain by greater than 5 feet of fill. In addition, the area on the gas station site outside the 50-foot setback area from the existing slope consists of existing improvements including an underground storage tank, gas pumps and several underground utilities that will remain. Several underground utilities also exist along the adjacent Tavern Road. Infiltration should not be allowed in areas of the existing improvements or adjacent to the existing roadway. Therefore, due to the fill slope, fill thicknesses, and presence of existing improvements, infiltration should not be allowed on the gas station site.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

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: We did not encounter groundwater or seepage during the site investigation. We expect groundwater exists at depths greater than 100 feet below existing grades. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
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: We did not provide a study regarding water rights. However, these rights are not typical in the San Diego County area. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
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.**

APPENDIX D

APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

SHELL STATION EXPANSION
COUNTY OF SAN DIEGO, CALIFORNIA

PROJECT NO. G2217-52-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9

and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

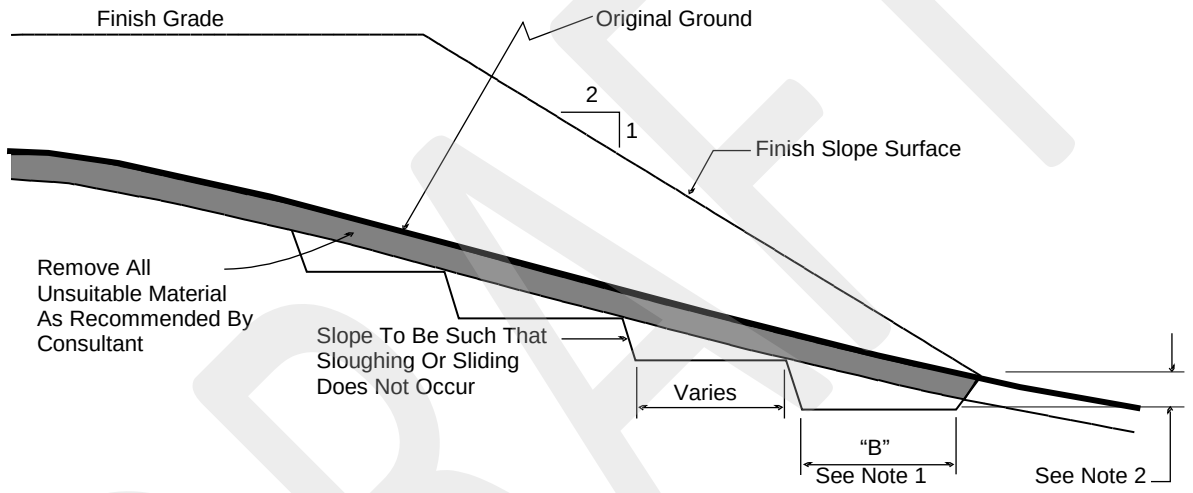
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES:
(1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection

variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

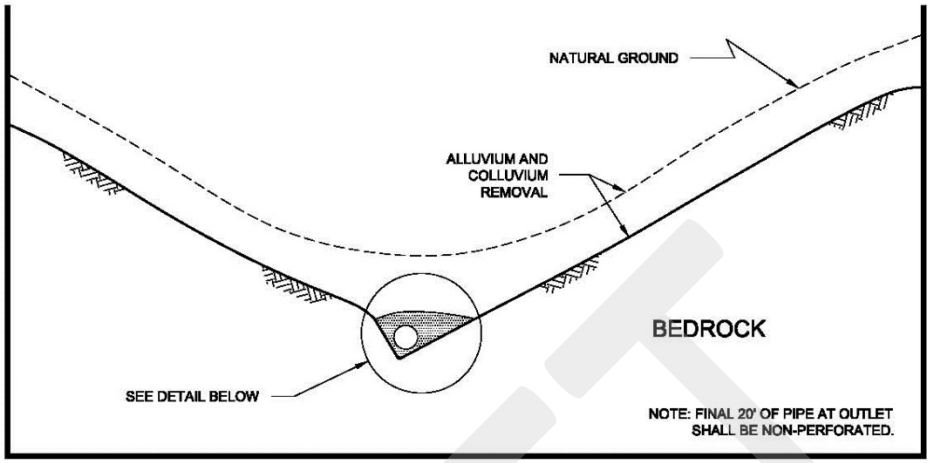
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

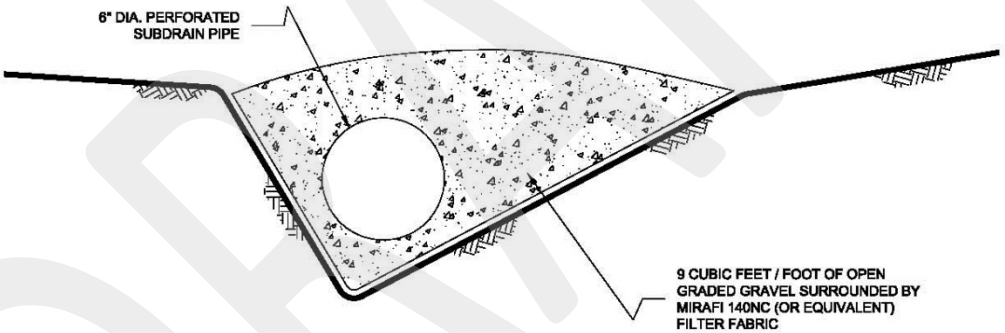
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

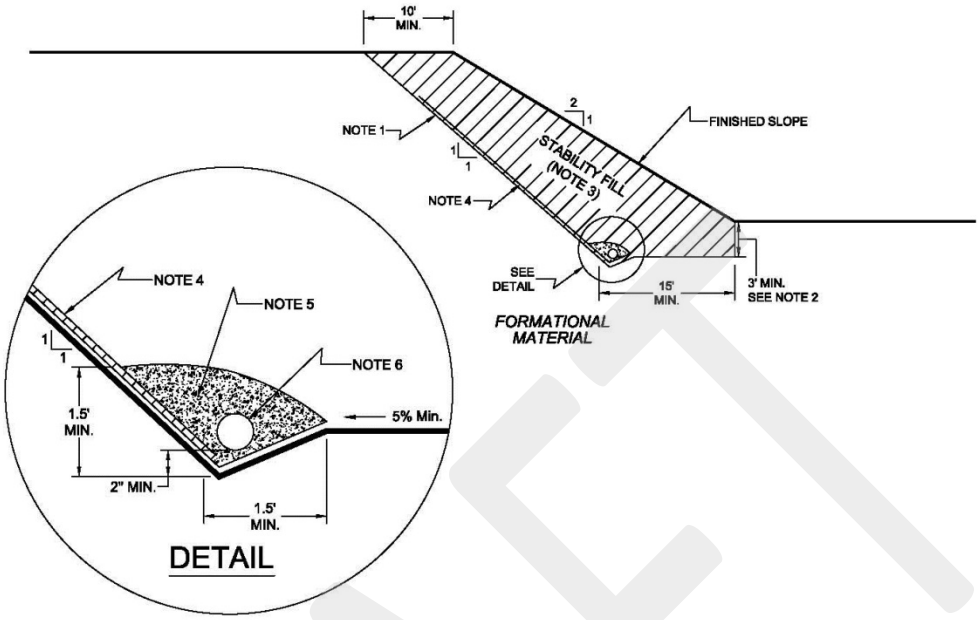
1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS
LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

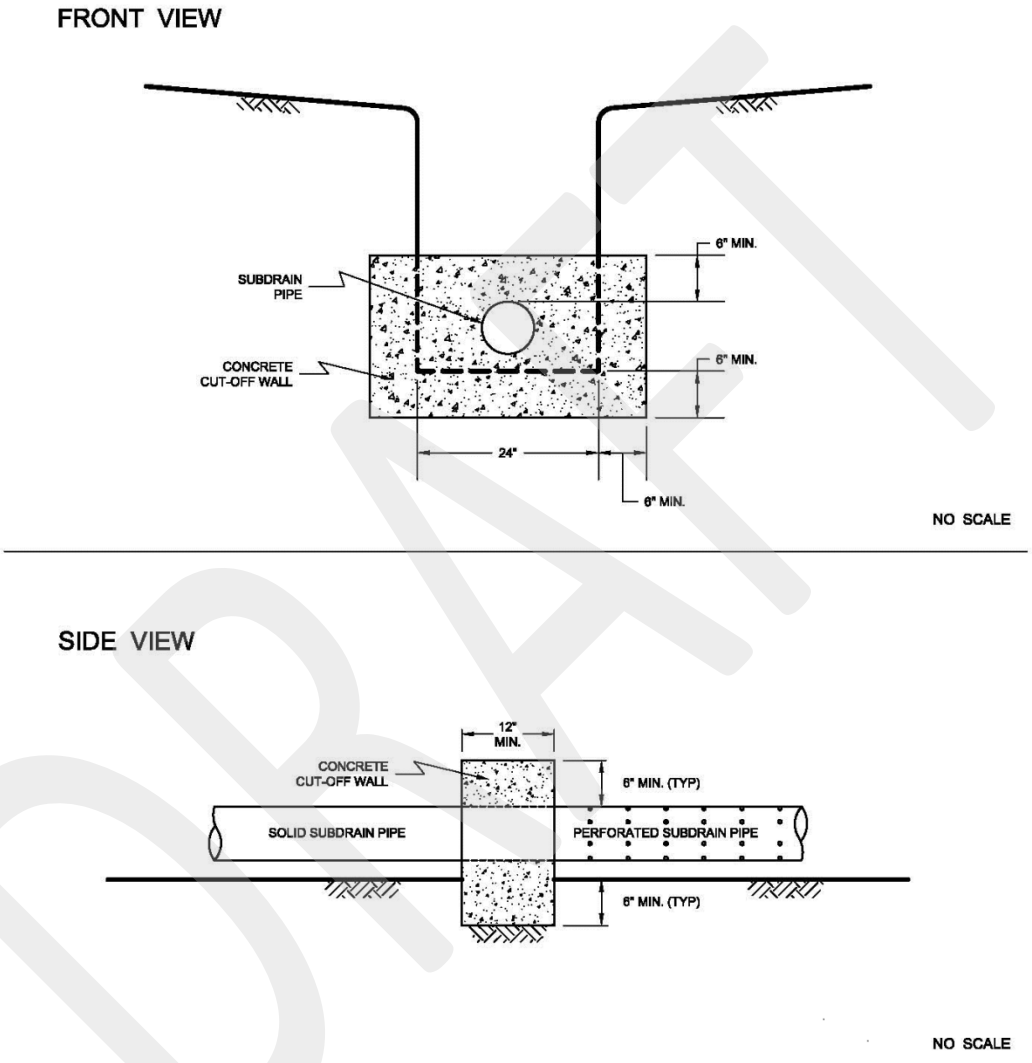
NO SCALE

7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

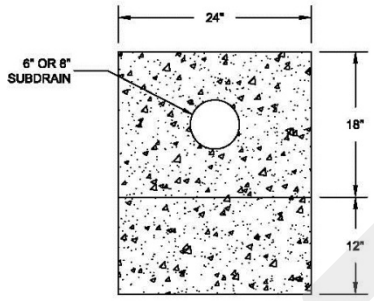
TYPICAL CUT OFF WALL DETAIL



7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

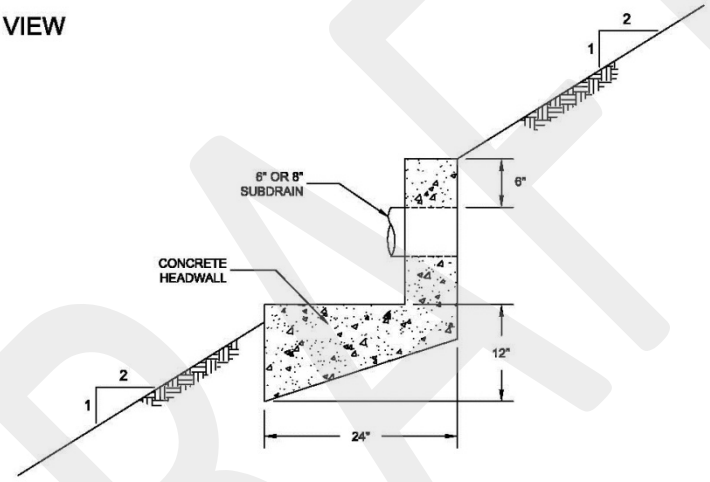
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop.*

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

1. *2016 California Building Code, California Code of Regulations, Title 24, Part 2, based on the 2015 International Building Code,* prepared by California Building Standards Commission, dated July, 2016.

2. *ACI 318-14, Building Code Requirements for Structural Concrete* and *Commentary on Building Code Requirements for Structural Concrete,* prepared by the American Concrete Institute, dated September, 2014.

3. *ACI 330-08, Guide for the Design and Construction of Concrete Parking Lots,* prepared by the American Concrete Institute, dated June, 2008.

4. Anderson, J. G., T. K. Rockwell, and D. C. Agnew, *Past and Possible Future Earthquakes of Significance to the San Diego Region*: Earthquake Spectra, 1989, v.5, no. 2, p.299-333.

5. Boore, D. M. and G. M Atkinson, *Ground Motion Prediction Equations for the Average Horizontal Component of PGA, PVG, and 5%-Ramped PSA at Spectral Periods Between 0.01s and 10.0s,* Earthquake Spectra, Vol. 24, Issue I, February 2008.

6. Campbell, K. W., Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.

7. Chiou, Brian S-J and Young's, Robert R., *A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra*, preprint for article to be published in NGA Special Edition of Earthquake Spectra, Spring 2008.

8. Jennings, C. W., 1994, *Fault Activity Map of California and Adjacent Areas*, California Geologic Data Map Series, Map No. 6.

9. Lindvall, S. C., T. K. Rockwell, and C. E. Lindvall, *The Seismic Hazard of San Diego Revised: New Evidence for Magnitude 6+ Holocene* E*arthquakes on the Rose Canyon Fault Zone*: Proceedings of the Fourth U.S. National Conference on Earthquake Engineering, 1990, 11 p.

10. Risk Engineering, *EZ-FRISK*, (Version 7.65) 2014.

11. Todd, Victoria, R., 2004 *Preliminary Geologic Map of the El Cajon 30' x 60' Quadrangle, Southern California,* USGS, Open File Report 2004-1361, Scale 1:100,000.

12. Unpublished reports and maps on file with Geocon Incorporated.

13. USGS computer program, *U.S. Seismic Design Maps*, http://earthquake.usgs.gov/designmaps/us/application.php.

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ATTACHMENT 8

Copy of Project's Biological Resource Letter Report

This is the cover sheet for Attachment 8.

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

Title: Biological Resource Letter Report for the Tavern Road Gas Station Project
Prepared By: Helix Environmental Planning
Date: February 21, 2018

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February 21, 2018 ZAA-01

Mr. Tony Shores
2020 Hillside Road
El Cajon, CA 92019

Subject: Biological Resource Letter Report for the Tavern Road Gas Station Project

Dear Mr. Shores:

This letter report presents the results of a biological resource technical study completed by HELIX Environmental Planning, Inc. (HELIX) for the Tavern Road Gas Station Project (project) located in the unincorporated community of Alpine in San Diego County, California. The study was conducted to assess existing biological conditions and provide an analysis of the proposed impacts of the project. This letter report is intended to summarize the existing biological resources within the site and provide an analysis of potential impacts to sensitive biological resources in accordance with the California Environmental Quality Act (CEQA) and applicable federal, state, and local policy, including consistency with the adopted County of San Diego (County) Multiple Species Conservation Program (MSCP) Subarea Plan (County 1997).

INTRODUCTION

Project Location

The approximately 2.3-acre project site is located within the unincorporated community of Alpine within the south-central portion of the County of San Diego (County), California (Figure 1). It is depicted within Section 28 of Township 15 South, Range 2 East on the West on the San Bernardino Base and Meridian U.S. Geological Survey (USGS) 7.5-minute Alpine quadrangle map (Figure 2). The site is further located to the west of Victoria Park Terrace, south of Tavern Road, and immediately north of the westbound Interstate (I-) 8 on-ramp (Figure 3). The site is located within the Metro-Lakeside-Jamul Segment of the County's MSCP (County 1997), outside of Pre-Approved Mitigation Area (PAMA).

The site is partly developed with an existing gas station, convenience store, drive-thru restaurant, 12 parking spaces, and a drive-thru coffee kiosk located within the eastern section of the project site (Figure 3). The western portion of the project site is undeveloped with an area that has been previously disturbed by grading activities.

Project Description

The proposed project consists of two development phases. Phase 1 includes relocating and rebuilding the convenience store and drive thru restaurant; increasing the building size from 2,454 square feet (sf) to 4,780 sf; adding two gas pumps; adding a new drive thru; adding 24 parking spaces; and installing a

A. Project-related grading, clearing, construction or other activities would temporarily or permanently remove sensitive native or naturalized habitat (as listed in Table 5 in the County Guidelines for Determining Significance [County 2010b], excluding those without a mitigation ratio) on or off the project site.

Impacts to sensitive uplands require mitigation include temporary and permanent impacts to 0.4 acre of Diegan coastal sage scrub and 0.06 acre of (granitic) chamise chaparral (Table 2; Figure 6). Unavoidable impacts to sensitive uplands would be significant. Habitat-based mitigation is proposed in accordance with the BMO.

Table 2
IMPACTS TO VEGETATION COMMUNITIES/LAND USES AND MITIGATION

Vegetation Community[1]	Tier	Impact (Acres)[2]	Mitigation Ratio	Mitigation Required
Diegan coastal sage scrub–disturbed (32500)	II	0.4	1:1	0.4
Chamise chaparral (37200)	III	0.6	0.5:1	0.3
Disturbed Habitat (11300)	IV	0.5	--	--
Developed (12000)	--	0.8	--	--
	TOTAL	**2.3**	**--**	**0.7**

[1]Vegetation categories and numerical codes are from Holland (1986) and Oberbauer (2008).
[2]Upland habitats are rounded to the nearest 0.1 acre.

Proposed Mitigation Measures

Impacts to sensitive habitat would be mitigated through implementation of the following measures **BIO-3**:

BIO-3 Mitigation for impacts to 0.4 acre of Diegan coastal sage scrub shall occur at a minimum 1:1 ratio through the purchase of 0.4 acre of coastal sage scrub credits at an approved mitigation bank, such as the Willows Road Conservation Bank, or other location deemed acceptable by the County. Project impacts to 0.6 acre of chamise chaparral will be mitigated at a 0.5:1 ratio through the purchase of 0.3 acre of chamise chaparral credits at an approved mitigation bank, such as the Willows Road Conservation Bank, or other location deemed acceptable by the County.

CONCLUSION

The project would result in significant impacts to sensitive natural communities; however, through implementation mitigation measure **BIO-3** to fully compensate the loss of habitat impacts would be reduced to below a level of significance. Mitigation is proposed at ratios consistent with those required by the County.

Issue 3–Jurisdictional Wetlands and Waterways

Would the project have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Effects Found Not to be Significant

No federally-protected wetlands are present on site, and the project will avoid impacts to non-wetland waters of the U.S. The project would not result in impacts to wetland waters of the U.S. subject to the regulatory jurisdiction of the USACE pursuant to Section 404 of the CWA.

Proposed Mitigation Measures

No mitigation is required.

Conclusion

Project implementation would not result in significant impacts to federally protected wetlands or waterways. No mitigation is required.

Issue 4–Wildlife Movement and Nursery Sites

Would the project interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Effects Found Not to be Significant

A. The project would not impede wildlife access to foraging habitat, breeding habitat, water sources, or other areas necessary for their reproduction.

The project site does not occur within any known corridors or linkages. The project site and vicinity are semi-developed, and wildlife is expected to travel relatively unobstructed through the local area. The project is located immediately adjacent to the I-8 Freeway and existing commercial development. The project would not impede wildlife access to on- or off-site areas that may be used for foraging, breeding, and/or obtaining water or access to areas necessary for reproduction. The site does not support critical populations of animal species or known nursery sites. Impacts would be less than significant.

B. The project would not substantially interfere with connectivity between blocks of habitat and would not potentially block or substantially interfere with a local or regional wildlife corridor or linkage.

The project is not located between blocks of habitat and would not substantially interfere with connectivity between blocks of habitat. The site is not located within a local or regional wildlife corridor or linkage and would not potentially block or substantially interfere with a local or regional wildlife corridor or linkage. Impacts would be less than significant.

**Please see front pocket for a digital copy of the full Biology Report by Helix Environmental Planning.