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Civil Engineering • Land Planning • Surveying

STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)

LIBERTY CHARTER HIGH SCHOOL

April 30, 2017

Prepared For:

Hamann Property Management
1000 Pioneer Way
El Cajon, CA 92020

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County of San Diego
PRIORITY DEVELOPMENT PROJECT (PDP) SWQMP

Liberty Charter High School
PDS2015-MUP-15-027

1530 Jamacha Road
El Cajon, CA 92020

ASSESSOR'S PARCEL NUMBER:
498-330-39-00

ENGINEER OF WORK:

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APPROVAL DATE:

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ATTACHMENTS

Attachment 1: Backup for PDP Pollutant Control BMPs
- Attachment 1a: Storm Water Pollutant Control Worksheet Calculations
- Attachment 1b: DMA Exhibit
- Attachment 1c: Individual Structural BMP DMA Mapbook

Attachment 2: Backup for PDP Hydromodification Control Measures
- Attachment 2a: Flow Control Facility Design
- Attachment 2b: Hydromodification Management Exhibit
- Attachment 2c: Management of Critical Coarse Sediment Yield Areas
- Attachment 2d: Geomorphic Assessment of Receiving Channels (optional)
- Attachment 2e: Vector Control Plan (if applicable)

Attachment 3: Structural BMP Maintenance Plan
- Attachment 3a: Structural BMP Maintenance Thresholds and Actions
- Attachment 3b: Draft Maintenance Agreements / Notifications(when applicable)

Attachment 4: County of San Diego PDP Structural BMP Verification for DPW Permitted Land Development Projects

Attachment 5: Copy of Plan Sheets Showing Permanent Storm Water BMPs

Attachment 6: Copy of Project's Drainage Report

Attachment 7: Copy of Project's Geotechnical and Groundwater Investigation Report

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: Liberty Charter High School
Permit Application Number: PDS2015-MUP-15-027

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

Scott R Harry
Print Name

KARN Engineering and Surveying, Inc.
Company

April 30, 2017
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	October 2015	Initial Submittal
2	March 9, 2016	Updated to new template
3	January 27, 2017	Changed BMPs to Biofiltration Basins
4	April 30, 2017	Revisions to Biofiltration Details.

Final Design

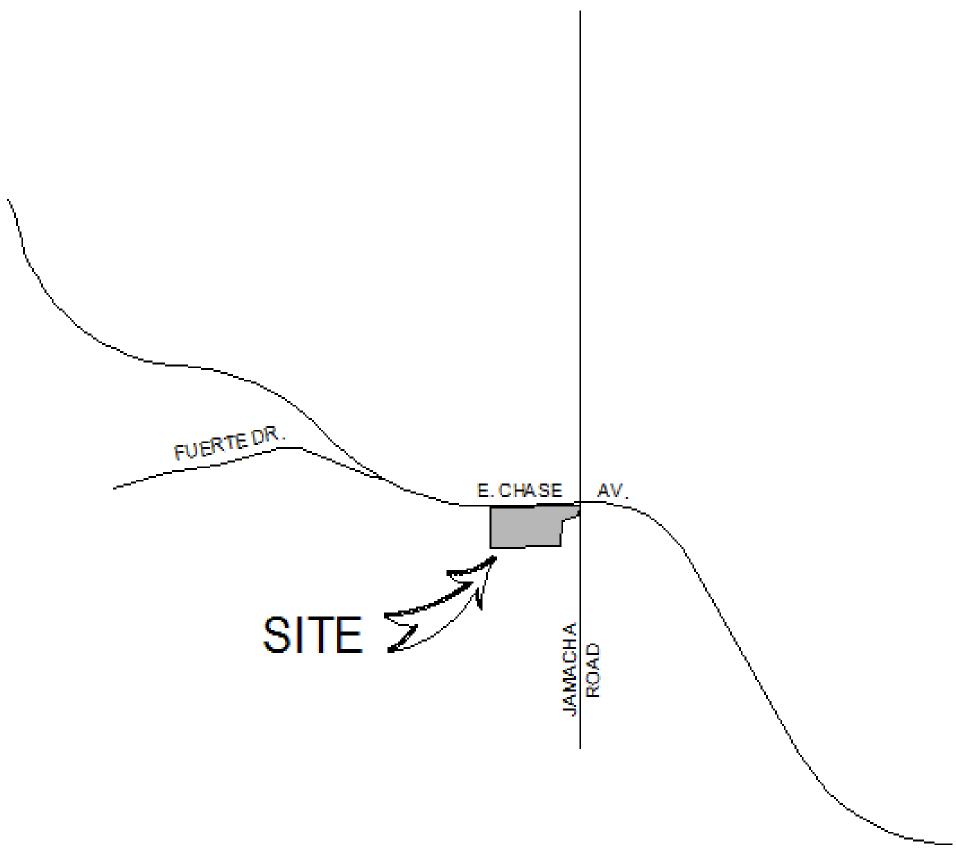
Submittal Number	Date	Summary of Changes
1		Initial Submittal
2		
3		
4		

Plan Changes

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

PROJECT VICINITY MAP

Project Name: Liberty Charter High School
Record ID: PDS2015-15-MUP-15-027



Step 1: Project type determination (Standard or Priority Development Project)

Is the project part of another Priority Development Project (PDP)? ☐ Yes ☒No If so, a PDP SWQMP is required. Go to Step 2.			
The project is (select one): ☐ New Development ☒Redevelopment			
The total proposed newly created or replaced impervious area is: 133,113 ft²			
The total existing (pre-project) impervious area is: 48,719 ft²			
The total area disturbed by the project is: 277,050 ft²			
If the total area disturbed by the project is 1 acre (43,560 sq. ft.) or more OR the project is part of a larger common plan of development disturbing 1 acre or more, a Waste Discharger Identification (WDID) number must be obtained from the State Water Resources Control Board. WDID: TBD			
Is the project in any of the following categories, (a) through (f)?			
Yes ☒	No ☐	(a)	New development projects that create 10,000 square feet or more of impervious surfaces (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.

Project type determination (continued)

Yes ☐	No ☒	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). *Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See BMP Design Manual Section 1.4.2 for additional guidance.*
Yes ☐	No ☒	(e)	New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
Yes ☒	No ☐	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See BMP Design Manual Section 1.4.2 for additional guidance.*

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

☐ No – the project is <u>not</u> a Priority Development Project (Standard Project).

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

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

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

The area of existing (pre-project) impervious area at the project site is: 48,719 ft^2 (A)
The total proposed newly created or replaced impervious area is 133,113 ft^2 (B)
Percent impervious surface created or replaced (B/A)*100: 273 %
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 ☐ PDP with ACP	Standard and PDP requirements apply, including PDP SWQMP. **Complete PDP SWQMP.** If participating in offsite alternative compliance, **complete Step 6.3 and an ACP SWQMP.**
	☐ PDP Exemption	**Go to Step 1.2 below.**

Step 1.2: Exemption to PDP definitions

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

Step 2: Construction Storm Water BMP Checklist

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

Table 1. Construction Storm Water BMP Checklist

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook 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 (Summer)	SS-2, SS-4	☒	
Hydraulic Stabilization Hydroseeding[2] (Summer)	SS-4	☐	
Bonded Fiber Matrix or Stabilized Fiber Matrix (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, SC-2	☒	
Will use erosion control measures from Item A on flat areas also	SS-3, 4, 7	☐	
County Standard Desilting Basin (must treat all site runoff)	PDS 660, SC-2	☐	
Mulch, straw, wood chips, soil application	SS-6, SS-8	☐	

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	SS-10	☒	
D. Select sediment control method for all disturbed areas (choose at least one)			
Silt Fence	SC-1	☒	
Fiber Rolls (Straw Wattles)	SC-5	☒	
Gravel & Sand Bags	SC-6 & 8	☒	
Dewatering Filtration	NS-2	☐	
Storm Drain Inlet Protection	SC-10	☒	
Engineered Desilting Basin (sized for 10-year flow)	SC-2	☐	
E. Select method for preventing offsite tracking of sediment (choose at least one)			
Stabilized Construction Entrance	TC-1	☒	
Construction Road Stabilization	TC-2	☐	
Entrance/Exit Tire Wash	TC-3	☐	
Entrance/Exit Inspection & Cleaning Facility	TC-1	☐	
Street Sweeping and Vacuuming	SC-7	☒	
F. Select the general site management BMPs			
F.1 Materials Management			
Material Delivery & Storage	WM-1	☒	
Spill Prevention and Control	WM-4	☒	
F.2 Waste Management			
Waste Management Concrete Waste Management	WM-8	☒	
Solid Waste Management	WM-5	☒	
Sanitary Waste Management	WM-9	☒	
Hazardous Waste Management	WM-6	☒	

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

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)	909 Sweetwater River HU, 909.2 Middle Sweetwater HA, Hillsdale HSA
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 property is an approximately 6.36 acre generally undeveloped site that slopes in a northeasterly direction towards the intersection of Chase Avenue and Jamacha Road in El Cajon, CA. Chase Avenue has been developed across the project frontage and an existing commercial driveway crosses the northeast corner of the property. The surrounding area consists of a mixed use of residential, commercial and agriculture. The area generally consists of a combination of Soil Type B and Type D with pervious soils in the zero to six foot depth range.	
Existing Land Cover Includes (select all that apply and provide each area on site): ☒Vegetative Cover ________ Acres (228,331 Square Feet) ☐Non-Vegetated Pervious Areas ________ Acres (____________ Square Feet) ☒Impervious Areas ________ Acres (48,719 Square Feet) *Description / Additional Information:*	
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐NRCS Type A ☒NRCS Type B ☐NRCS Type C ☒NRCS Type D	
Approximate Depth to Groundwater (GW) (or N/A if no infiltration is used): ☐GW Depth < 5 feet ☐5 feet < GW Depth < 10 feet ☐10 feet < GW Depth < 20 feet ☒GW Depth > 20 feet	

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

Description / Additional Information:

Step 3.2: Description of Existing Site Drainage Patterns

How is storm water runoff conveyed from the site? At a minimum, this description should answer:

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

Describe existing site drainage patterns:

The existing drainage conveyance is a combination of urban and natural. 5.6 acres of offsite run-on drains from existing homes west of the project in an easterly and southerly direction through the project site. The offsite flows combine with the onsite natural flows and drain overland to an existing storm drain system near the intersection of Chase Avenue and Jamacha Road.

There are no onsite drainage facilities.

The drainage patterns and areas are depicted in the hydrology and hydraulic study

Step 3.3: Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:

The project is a charter high school for grades nine through twelve. Site development will include 48,000 square feet of classrooms in 2 buildings that are each two stories, onsite parking, common areas and a sports field.

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

Impervious areas include the building footprint, common areas, parking lot, and Chase Avenue widening.

List/describe proposed pervious features of the project (e.g., landscape areas):

All pervious areas will be landscaped and the proposed sports field will be planted with natural turf.

Does the project include grading and changes to site topography?

☒Yes
☐No

Description / Additional Information:
The site is being developed into two split level pads. The upper pad includes parking and the buildings. The lower pad includes the sports field. The grading maintains the existing drainage flow patterns and outlet location.

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	228,331 sf	143,937	-59%
Pervious (non-vegetated)	0.0	0.0	
Impervious	48,719	133,113	+73%

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 project is proposing development of the site into a charter high school consisting of a parking lot, athletic field and two school buildings. On-site drainage will surface flow into a storm drain system that will convey the runoff into a biofiltration basin near the northeast corner of the sports field. Chase Avenue runoff will be conveyed within the Chase Avenue right of way to a second biofiltration basin within the existing parking area near the northeast corner of the property. The biofiltration basins are designed to act as a storage facilities for hydromodification and the 100 year storm event while also providing water quality treatment (see hydromdification and 100 year routing analysis). Off-site run-on (5.6 acres of existing development) will be conveyed through a bypass pipe to the northeast corner of the property where it will connect to the existing Jamacha Road storm drain system.

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:

Roof drainage will be conveyed to the stormwater system and treated before discharging offsite.

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 treated discharge will be conveyed in a Jamacha Road pipe that discharges into an open channel on the easterly side of the road. The channel discharges into the Sweetwater River, which flows to the Sweetwater Reservoir and ultimately discharges into San Diego Bay

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs 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
Sweetwater Reservoir	Dissolved Oxygen	Bacteria, Dissolved Copper, Lead, Zinc (wet weather).
Sweetwater River, Lower	Enterococcus, Fecal Coliform, Phosphorus, Selenium, TDS, Total Nitrogen, Toxicity.	Bacteria, Dissolved Copper, Lead, Zinc (wet weather).
San Diego Bay	PCBs, Benthic Community Effects, Sediment Toxicity, Copper, Total Coliform, Enterococcus, Fecal Coliform, Chlordane, PAHs	Bacteria, Dissolved Copper, Lead, Zinc (wet weather).

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		X	

Nutrients		X	X
Heavy Metals		X	X
Organic Compounds		X	X
Trash & Debris		X	
Oxygen Demanding Substances		X	X
Oil & Grease		X	
Bacteria & Viruses		X	X
Pesticides		X	X

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 for the watershed in which the project resides.

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

Step 3.7.1 Critical Coarse Sediment Yield Areas*

***This Section only required if hydromodification management requirements apply**

Projects must satisfy critical coarse sediment requirements by either avoiding impacts to onsite critical coarse sediment (Step A) AND bypassing upstream sources of critical coarse sediment (Step B), or by demonstrating the project has no net impact to the receiving water (Step C). Show the backup evidence of the following determinations in Attachment 2c. Refer to Appendix H of the BMP DM for more detailed critical coarse sediment guidance pertaining to identification, avoidance, bypass, and demonstration of no net impact.

A: Avoid Onsite Critical Coarse Sediment

Onsite sources of critical coarse sediment are protected through to the County's Resource Protection Ordinance. Applicants must characterize their project per one of the categories below and proceed as directed.

☒Project is subject to and in compliance with RPO requirements

☒Applicant must provide mapping of coarse sediment areas that are ≥25% slope and ≥50' in height as determined per the County of San Diego Resource Protection Ordinance. *(Note: these areas may be further refined per guidance in Section H.1.2 of the BMP DM)*

☐Project is not subject to RPO requirements

☐Applicant is not required to identify or avoid any onsite sources of coarse sediment.

☐Project was initially subject to RPO requirements but qualified for an exemption per RPO Section 86.604(e)(2)(cc) or 86.604(e)(3)

☐ Applicant is not preserving sources of onsite critical coarse sediment and must demonstrate no net impact to the receiving water (Step C)

B: Bypass Upstream and Onsite Critical Coarse Sediment

<table>
<tr><td>All project applicants must identify sources of upstream critical coarse sediment from hillslopes and first order streams that drain through the project site. Hillslope sources must be identified as coarse sediment areas that are ≥25% slope, ≥50’ in height, and draining through the project site (Note: these areas may be further refined per guidance in Section H.1.2 of the BMP DM). First order streams are identified as field ditches, gullies, ephemeral gullies, and/or NHD streams. Additionally, the sources of onsite critical coarse sediment preserved in Step A must also be effectively bypassed.
☒Project bypasses all sources of upstream and onsite critical coarse sediment
☒Applicant has satisfied bypass requirements.

☐Project does not bypass all sources of upstream and onsite critical coarse sediment

☐Applicant has not satisfied bypass requirements and must demonstrate the project has no net impact to the receiving water (Step C).

☐Project does not have upstream and onsite sources of critical coarse sediment.

☐ Applicant has satisfied bypass requirements.</td></tr>
<tr><td>C: Demonstrate No Net Impact</td></tr>
<tr><td>Project applicants that do not satisfy all of the criteria above must achieve compliance by demonstrating the project has no net impact to the receiving water.
☒N/A, project satisfies all criteria specified in Steps B and C.
☐ Applicant has satisfied all critical coarse sediment requirements
☐Project did not satisfy all criteria from Step B and C.
☐ Applicant has not satisfied critical coarse sediment requirements and must demonstrate the project has no net impact to the receiving water per Appendix H.4</td></tr>
</table>

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. *POC A – Biofiltration Basin A* *POC B – Biofiltration Basin B*
Has a geomorphic assessment been performed for the receiving channel(s)? ☒No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐Yes, the result is the low flow threshold is 0.1Q2 ☐Yes, the result is the low flow threshold is 0.3Q2 ☐Yes, the result is the low flow threshold is 0.5Q2 *If a geomorphic assessment has been performed, provide title, date, and preparer:* *Discussion / Additional Information: (optional)*

Step 3.8: Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

Step 4: Source Control BMP Checklist

Source Control BMPs			
All development projects must implement source control BMPs 4.2.1 through 4.2.6 where applicable and feasible. See Chapter 4.2 and Appendix E of the County BMP Design Manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following: ☐ "Yes" means the project will implement the source control BMP as described in Chapter 4.2 and/or Appendix E of the County BMP Design Manual. Discussion / justification is not required. ☐ "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. ☐ "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification must be provided.			
Source Control Requirement	**Applied?**		
4.2.1 Prevention of Illicit Discharges into the MS4	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.1 not implemented:			
4.2.2 Storm Drain Stenciling or Signage	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.2 not implemented:			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐No	☒N/A
Discussion / justification if 4.2.3 not implemented:			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐Yes	☐No	☒N/A
Discussion / justification if 4.2.4 not implemented:			

Source Control Requirement	Applied?		
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒Yes	☐No	☐N/A
Discussion / justification if 4.2.5 not implemented:			
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 all "No" answers shown above.			

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

Step 5: Site Design BMP Checklist

Site Design BMPs			
All development projects must implement site design BMPs SD-A through SD-H where applicable and feasible. See Chapter 4.3 and Appendix E of the County BMP Design Manual for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following: • "Yes" means the project will implement the site design BMP as described in Chapter 4.3 and/or Appendix E of the County BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification must be provided.			
Site Design Requirement	**Applied?**		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.1 not implemented:			
4.3.2 Conserve Natural Areas, Soils, and Vegetation	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.2 not implemented:			
4.3.3 Minimize Impervious Area	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.3 not implemented:			
4.3.4 Minimize Soil Compaction	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.4 not implemented:			

Site Design Requirement	Applied?		
4.3.5 Impervious Area Dispersion	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.5 not implemented:			
4.3.6 Runoff Collection	☐Yes	☒No	☐N/A
Discussion / justification if 4.3.6 not implemented: Runoff Collection is not feasible due to the size and volume that would be required for the catchment devices. The BMP manual states that Runoff Collection should be utilized on “small subcatchments or on residential lots”, and therefore, is not applicable to this project.			
4.3.7 Landscaping with Native or Drought Tolerant Species	☒Yes	☐No	☐N/A
Discussion / justification if 4.3.7 not implemented:			
4.3.8 Harvesting and Using Precipitation	☐Yes	☒No	☐N/A
Discussion / justification if 4.3.8 not implemented: Harvest and Use Precipitation is not feasible due to the size and volume that would be required for the catchment devices. Please see attached ETWU calculations in Attachment 1. The irrigation demand is minimal and underground cisterns are not feasible for this project due to the volume of runoff generated from the site. The County does not currently have regulations allowing re-use for indoor plumbing facilities. Section B.3 of the County BMP Manual states that Worksheet B.3-1 should be utilized to “evaluate the feasibility of harvest and use, full retention, and partial retention BMPs…” Utilizing Worksheet B.3-1 the project is categorized as a Category 4 project, which requires that “Applicant must implement partial retention BMPs” and capture and use techniques are not required.			

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.

Harvesting and Re-Use. It was determined that Harvesting and Use of storm water is not feasible for this project. The County does not have a program for the use of storm water for toilet and urinal flushing, and re-use of irrigation run-off is not practical given the large volume of runoff from the site and the limited irrigation demand. Section B.3 of the County BMP Manual states that Worksheet B.3-1 should be utilized to "evaluate the feasibility of harvest and use, full retention, and partial retention BMPs…" Utilizing Worksheet B.3-1 the project is categorized as a Category 4 project, which requires that "Applicant must implement partial retention BMPs" and capture and use techniques are not required.

Pervious pavers are proposed near the northeast corner of the site as a self-retaining BMP. It is not feasible to drain this area to one of the proposed biofiltration basins. Per Fact Sheet SD-D this area meets the Self-Retaining criteria because the "total drainage area (including permeable pavement) to area of permeable pavement is 1.5:1 or less". The ratio for this project is 1:1.

A small area of the Chase Avenue sidewalk and curb east of the existing retail driveway will be reconstructed. This de minimis DMA is at a lower elevation than Biofiltration Basin B and cannot be conveyed with gravity flow to the basin.

Infiltration feasibility (see Attachment 1). Infiltration testing was performed by Construction Testing and Engineering, Inc. (CTE). Infiltration rates were shown to be greater than 0.1 inch/hr and CTE is recommending lining of the sides of the biofiltration basins with no liner on the basin bottom.

Based on Worksheet B.3-1 and evaluation of site parameters biofiltration basins were chosen as the structural BMPs for this project for both water quality treatment and hydromodification.

(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. IMP A
Construction Plan Sheet No. Preliminary Grading Plan
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)	To be determined during final design phase of project.
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.	Category 1
Discussion (as needed): *(Continue on subsequent pages as necessary)*	

(Copy this page as needed to provide information for each individual proposed structural BMP)
Structural BMP ID No. <u>IMP B</u>
Construction Plan Sheet No. <u>Preliminary Grading Plan</u>
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)	To Be Determined.
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.	Category 1
Discussion (as needed):	

Step 6.3 : Offsite Alternative Compliance Participation Form

PDP INFORMATION	
Record ID:	**N/A**
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.2-1 (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) -Worksheet B.3-1 (optional) -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.1-1: Calculation of Design Capture Volume (V1.3)

Category	#	Description	i	ii	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	BMP_A	BMP_B	unitless
	1	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	unitless
	2	85th Percentile 24-hr Storm Depth	0.50	0.50	inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.020	0.020	in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	107,959	35,395	sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)			sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)			sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)			sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)	61,846		sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)			sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	97,921	11,241	sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)			sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)			sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)			sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)			sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)			sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)			sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)			sq-ft
	19	Number of Tree Wells Proposed per SD-A			#
	20	Average Mature Tree Canopy Diameter			ft
	21	Number of Rain Barrels Proposed per SD-E			#
	22	Average Rain Barrel Size			gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series			unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas			percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	267,726	46,636	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.50	0.76	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	unitless
	31	Initial Weighted Runoff Factor	0.50	0.76	unitless
	32	Initial Design Capture Volume	5,578	1,477	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	sq-ft
	34	Total Pervious Dispersion Area	0	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.50	0.76	unitless
	38	Design Capture Volume After Dispersion Techniques	5,578	1,477	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.50	0.76	unitless
	42	Final Effective Tributary Area	133,863	35,443	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	5,578	1,477	cubic-feet

Worksheet B.1-1 General Notes:

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

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

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	7,055	cubic-feet
	1	Proposed Development Type	Schools	unitless
	2	Number of Residents or Employees at Proposed Development	30	#
	3	Total Planted Area within Development	171,008	sq-ft
	4	Water Use Category for Proposed Planted Areas	Moderate	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	Yes	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	No	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	No	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	No	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	6.62	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	199	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	196.52	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	772	cubic-feet
	13	Total Anticipated Use Over 36 Hours	970	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.14	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	Yes	yes/no
Result	18	Feasibility Category	4	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

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

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

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

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

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

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

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

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

Automated Worksheet B.5-1: Sizing Lined or Unlined Biofiltration BMPs (V1.3)

Category	#	Description	i	ii	Units
BMP Inputs	0	Drainage Basin ID or Name	BMP_A	BMP_B	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.020	0.020	in/hr
	2	Effective Tributary Area	133,863	35,443	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.019	0.011	ratio
	4	Design Capture Volume Tributary to BMP	5,578	1,477	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Unlined	Unlined	unitless
	6	Provided Biofiltration BMP Surface Area	2,683	846	sq-ft
	7	Provided Surface Ponding Depth	12	9	inches
	8	Provided Soil Media Thickness	18	18	inches
	9	Provided Depth of Gravel Above Underdrain Invert	15	9	inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	2.25	1.00	inches
	11	Provided Depth of Gravel Below the Underdrain	3	3	inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	27	8	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.40	0.40	unitless
	15	Effective Retention Depth	2.10	2.10	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	66	66	hours
	17	Volume Retained by BMP	496	157	cubic-feet
	18	Fraction of DCV Retained	0.09	0.11	ratio
	19	Portion of Retention Performance Standard Satisfied	0.14	0.16	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.07	0.08	ratio
	21	Design Capture Volume Remaining for Biofiltration	5,188	1,359	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	0.2542	0.0452	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	4.09	2.31	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	4.09	2.31	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	24.56	13.84	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	21.60	16.20	inches
	29	Drawdown Time for Surface Ponding	3	4	hours
	30	Drawdown Time for Effective Biofiltration Depth	5	7	hours
	31	Total Depth Biofiltered	46.16	30.04	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	7,782	2,039	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	7,782	2,039	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	3,891	1,019	cubic-feet
	35	Option 2 - Provided Storage Volume	3,891	1,019	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	1.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**0**	cubic-feet

Worksheet B.5-1 General Notes:

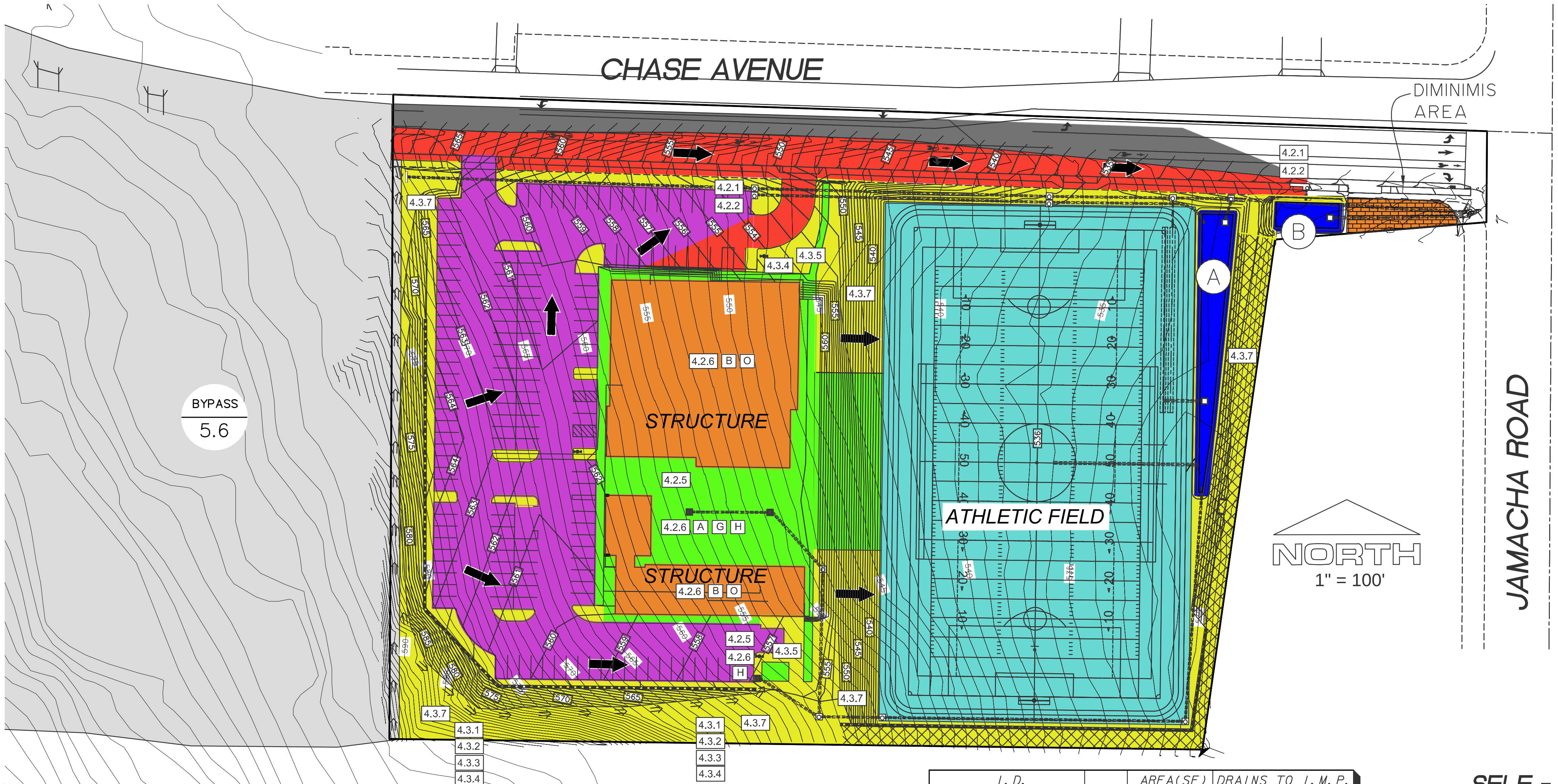
A. Applicants may use this worksheet to size Lined or Unlined Biofiltration BMPs (BF-1, PR-1) for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red/orange and summarized below. BMPs fully satisfying the pollutant control

Automated Worksheet B.5-3: Alternate Minimum Biofiltration Footprint Ratio (V1.3)

Category	#	Description	[illegible]	[illegible]	Units
Drainage Basin Info	0	Drainage Basin ID or Name	BMP_A	BMP_B	unitless
	1	Drains to following BMP Type	Biofiltration	Biofiltration	unitless
	2	Final Effective Tributary Area	133,863	35,443	sq-ft
Biofiltration Clogging Inputs	3	Is Proposed Biofiltration BMP <3% of Effective Tributary Area Desired?	Yes	Yes	yes/no
	4	Average Annual Precipitation	11.0	11.0	inches
	5	Load to Clog (default =2.0)	2.0	2.0	lb/sq-ft
	6	Allowable Period to Accumulate Clogging Load (default =10)	5	5	years
	7	Pretreatment Measures Included?	No	No	yes/no
	8	Commercial: TSS=128 mg/L, C= 0.80			sq-ft
	9	Education: TSS=132 mg/L, C= 0.50	133,863		sq-ft
	10	Industrial: TSS=125 mg/L, C= 0.90			sq-ft
	11	Low Traffic Areas: TSS=50 mg/L, C= 0.50			sq-ft
	12	Multi-Family Residential: TSS=40 mg/L, C= 0.60			sq-ft
	13	Roof Areas: TSS=14 mg/L, C= 0.90			sq-ft
	14	Single Family Residential: TSS=123 mg/L, C= 0.40			sq-ft
	15	Transportation: TSS=78 mg/L, C= 0.90		35,443	sq-ft
	16	Vacant/Open Space: TSS=216 mg/L, C= 0.10			sq-ft
Minimum Footprint Calculations	17	Effective-Area Based on Specified Land Use Coefficients	66,932	31,899	sq-ft
	18	Average TSS Concentration for Tributary	132	78	mg/L
	19	Average Annual Runoff	122,708	32,489	cubic-feet
	20	Average Annual TSS Load	1,011	158	lb/yr
	21	Average Annual TSS Load After Pretreatment Measures	1,011	158	lb/yr
	22	Minimum Allowable Biofiltration Footprint Ratio	0.019	0.011	ratio

Worksheet B.5-3 General Notes:

A. Applicants may use this worksheet to calculate Alternate Minimum Biofiltration Footprint Ratios for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Inputs for Lines 4-7 (precipitation, load to clog, clogging



EXISTING SITE CONDITIONS

UNDEVELOPED NATIVE LANDSCAPE

SOIL GROUP

WEST HALF OF SITE - VsD (TYPE B) VISTA COARSE SANDY LOAM
EAST HALF OF SITE - PfC (TYPE D) PLACENTIA SANDY LOAM

GROUND WATER

NO GROUND WATER OBSERVED AT 15' DEPTH.

CRITICAL COARSE SEDIMENT

NO "STEEP SLOPE LANDS" EXIST ON-SITE. RUN-ON FLOWS WILL BEEN BYPASSED.

(A) IMP A - BIOFILTRATION BASIN

BOTTOM AREA = 1,477 SF
BMP AREA = 2,683 SF

(B) IMP B - BIOFILTRATION BASIN

BOTTOM AREA = 574 SF
BMP AREA = 846 SF

SOURCE CONTROL BMPs

- 4.2.1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
- 4.2.2 STORM DRAIN STENCILING OR SIGNAGE
- 4.2.5 PROTECT TRASH STORAGE AREAS
- 4.2.6 A ON-SITE STORM DRAIN INLETS
  - B INTERIOR FLOOR DRAINS, ELEVATOR SHAFTS
  - G FOOD SERVICE
  - H REFUSE AREAS
  - O FIRE SPRINKLER TEST WATER

SITE DESIGN BMPs

- 4.3.1 MAINTAIN NATURAL DRAINAGE
- 4.3.2 CONSERVE NATURAL AREAS
- 4.3.3 MINIMIZE IMPERVIOUS AREA
- 4.3.4 MINIMIZE SOIL COMPACTION
- 4.3.5 IMPERVIOUS AREA DISPERSION
- 4.3.7 DROUGHT TOLERANT LANDSCAPING

I.D.		AREA(SF)	DRAINS TO I.M.P.
PARKING (N)		29,985	A
PARKING (S)		24,474	A
LANDSCAPE		65,073	A
LANDSCAPE		11,241	SELF-MITIGATING
HARDSCAPE(CONC)		26,351	A
ROOF		27,149	A
FIELD AREA		94,694	A
ROAD		22,258	B
OFF-SITE(RD)		13,137	B
PERMEABLE PAVING		1,800	SELF RET.
		314,362	

SELF - MITIGATING AREAS:

- VEGETATION IN THE NATURAL OR LANDSCAPED AREA IS NATIVE AND/OR NON-NATIVE/NON-INVASIVE DROUGHT TOLERANT SPECIES THAT DO NOT REQUIRE REGULAR APPLICATION OF FERTILIZERS AND PESTISIDES.

- SOILS ARE UNDISTURBED NATIVE TOPSOIL, OR DISTURBED SOILS THAT HAVE BEEN AMENDED PER SD-F

- THE INCIDENTAL IMPERVIOUS AREAS ARE LESS THAN 5 PERCENT OF THE SELF-MITIGATING AREA.

- IMPERVIOUS AREA WITHIN THE SELF-MITIGATED AREA SHOULD NOT BE HYDRAULICALLY CONNECTED TO OTHER IMPERVIOUS AREAS UNLESS IT IS A STORM WATER CONVEYANCE SYSTEM (SUCH AS A BROW DITCH).

- THE SELF-MITIGATING AREA IS HYDRAULICALLY SEPARATE FROM DMAs THAT CONTAIN PERMANENT STORM WATER POLLUTANT CONTROL BMPs.

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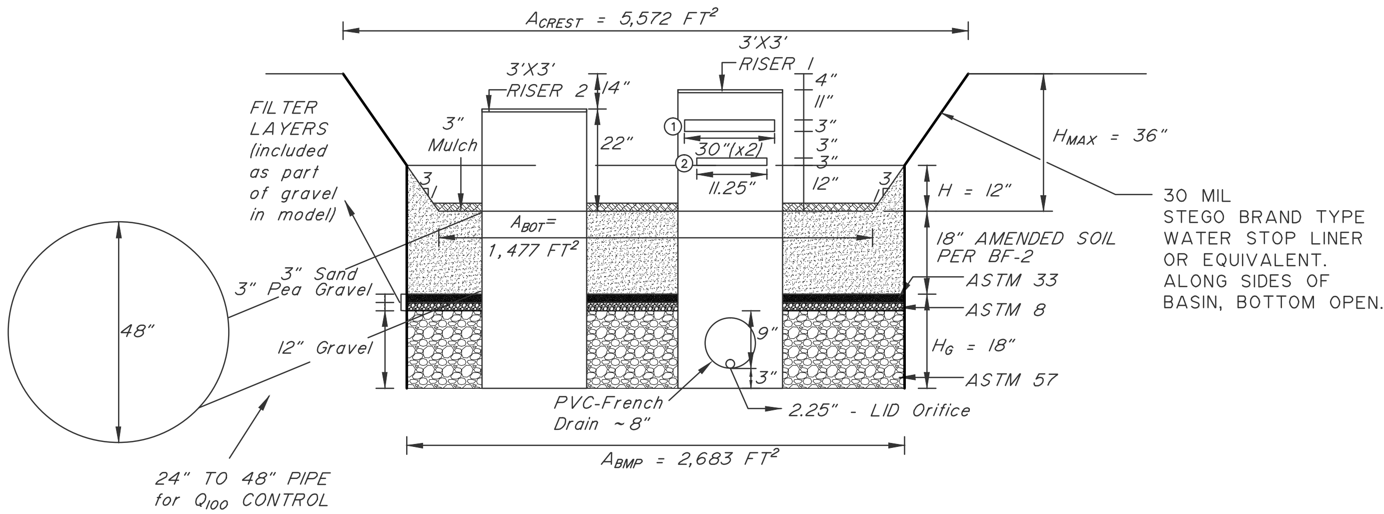
DMA EXHIBIT

PAGE 1 OF 2

LIBERTY CHARTER HIGH SCHOOL

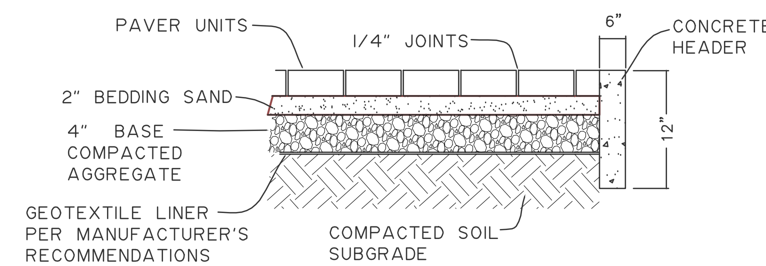
APRIL 30, 2017

I:\9323\DMA EXHIBIT



NOTES:
① 2 SLOTS 30"X3" EACH TO BE PLACED AT ELEVATION INDICATED. EACH ON OPPOSITE SIDE OF RISER.
② 1 SLOT 11.25"X3"

BMP A DETAIL
(NOT TO SCALE)



BRICK PAVERS
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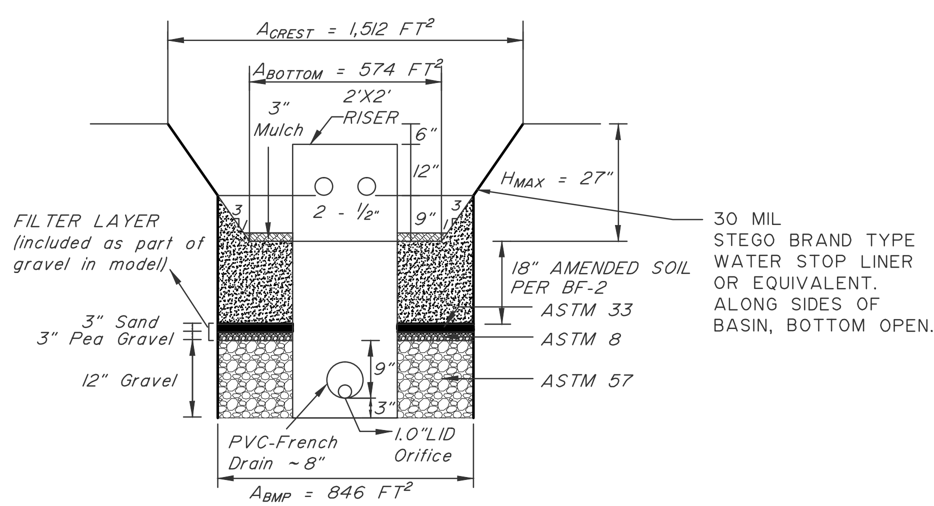

BMP B DETAIL
(NOT TO SCALE)

KARN

DMA EXHIBIT
PAGE 2 OF 2
LIBERTY CHARTER HIGH SCHOOL
APRIL 30, 2017

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Worksheet I-8 : Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition		Worksheet I-8	
Part 1 - Full Infiltration Feasibility Screening Criteria Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: See CTE letter "Conversion of Percolation Testing Results to Infiltration Rates", CTE Job No. 10-12202G, dated November 2, 2016. All derived infiltration rates were below 0.5 in/hr with no Factor of Safety applied. Further application of a Factor of Safety greater than 1 will further decrease the infiltration rates. 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.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet 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 shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: 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.		
Provide basis: 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		

*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 City Engineer to substantiate findings.

<table>
<tr><th colspan="4">Worksheet I-8 Page 3 of 4</th></tr>
<tr><td colspan="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?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: CTE understands that "appreciable rate" is not currently quantified. Therefore, based on feedback from multiple local jurisdictions, for the purposes of this determination form CTE considers "appreciable rate" to be an infiltration rate greater than 0.01 in/hr. All four infiltration rates were above an appreciable infiltration rate. Further, after application of a Factor of Safety of 2, in accordance with the Model BMP Design Manual, San Diego Region, Appendix D (February, 2016), all four infiltration rates would still be above an appreciable infiltration rate.

However, the storm water design engineer has the option to modify this safety factor by completing Tables D.5-1 and D.5-2 in the above referenced BMP Design Manual and with approval from the jurisdictional regulating body. Further adjustment of the safety factor may result in non-appreciable infiltration rates.

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.</td></tr>
<tr><td>6</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: CTE understands that two potential bio-filtration areas are proposed in the northeast corner of the subject site. A French Drain should be installed at the invert elevation of the basin in order to minimize potential infiltration mounding and/or lateral migration. Liners should be installed on the sides of the basins.

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.</td></tr>
</table>

Worksheet 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 shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: During previous investigation groundwater was not encountered within the maximum explored depth of 15 feet below existing ground surface (bgs) at the site or 10 feet bgs nearest the proposed infiltration areas. The site is located greater than approximately 0.5 miles from known surface waters. The site is not located in an industrial area and is planned for residential/school use. CTE is not aware of adjacent or nearby groundwater wells. Therefore, the risk of groundwater contamination is not considered to increase due to infiltration at the 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.			
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: Downstream water rights should not be violated, due to the proposed infiltration basin being located in an non-industrial usage area, no direct pathways to waters of the state, or known adjacent groundwater wells. 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.		Partial

*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 City Engineer to substantiate findings

SECTION B2. ESTIMATED TOTAL WATER USE (ETWU)

The project's Estimated Total Water Use is calculated using the following formula:

ETWU = (ETo)(0.62)(Total of Column J from the Hydrozone Information Table)

Where:

ETWU = Estimated total water use per year (gallons)

ETo = Reference Evapotranspiration (inches)

Show value: ETo = 51.1 in./yr.

Show calculation:

ETWU = (51.1)(.62)(44,620)

Estimated Total Water Use = 1,413,650 gallons per year.

Digitally signed by Carol Cornelius Fuentez
DN: cn=Carol Cornelius Fuentez, o=Carol Cornelius, R.L.A., ou, email=ccorneliusrla@gmail.com, c=US
Date: 2017.01.31 17:04:22 -08'00'

Signature

1-30-16

Date

SECTION B. WATER CALCULATIONS

SECTION B1. MAXIMUM APPLIED WATER ALLOWANCE (MAWA)

The project's Maximum Applied Water Allowance shall be calculated using this equation:

MAWA = (ETo)(0.62)[(0.7 x LA) + (0.3 x SLA)]

Where:

MAWA = Maximum Applied Water Allowance (gallons per year)
ETo = Reference Evapotranspiration Appendix A (inches per year)
0.7 = ET Adjustment Factor
LA = Landscaped Area including Special Landscape Area (square feet)
0.62 = Conversion factor (to gallons per square foot)
SLA = Portion of the landscaped area identified as Special Landscape Area (square feet)
0.3 = Additional ET adjustment Factor for Special Landscape Area (1.0 – 0.7 = 0.3)

Show values:

ETo = 51.1 in./yr.
LA = 333668 sq. ft. (Total from Column F of Hydrozone Information Table)
SLA = 0 sq. ft.

Show calculation:

(51.1)(.62)[(0.7 x 333,668)+(0.3x0)] =

(31.68)(.62)(233,567) = 4,587,629

Maximum Applied Water Allowance = 4,587,629 gallons per year

SECTION A. HYDROZONE INFORMATION TABLE

Please complete the hydrozone table(s) for each irrigation point of connection. Use as many tables as necessary to provide information on the total landscaped area. Controller #, Hydrozone #, and Valve Circuit # should correspond to the landscape and irrigation system plans.

Irrigation Point of Connection (P.O.C.) # 1

A	B	C	D	E	F	G	H	I	J
Controller #	**Hydro zone #**	**Valve Circuit #**	**Irrigation Method (Code)**	**Plant Factor (average) (PF)**	**Hydro zone Area (HA) (sf)**	**% of Total Landscaped Area**	**PF x HA**	**IE**	**PF x HA / IE**
C	1	ALL	D	.2	178480	100	35696	.8	44620
				SLA				1.0	
				TOTAL		100%			44,620

SLA = Special Landscaped Area

Hydrozone Category is based on the feature or plant within the hydrozone with the highest plant factor.

Hydrozone Category	PF – Plant Factor (average)
High Water Use	0.8
Moderate Water Use	0.5
Low Water Use	0.2
Special Landscaped Area	1.0

Artificial turf is considered Low Water Use.

Irrigation Method Code	IE – Irrigation Efficiency *
S = Spray	0.55
R = Rotor	0.70
D = Drip	0.80

* *Turf and Landscape Irrigation Best Management Practices,* April 2005, Water Management Committee of the Irrigation Association

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

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)

TECHNICAL MEMORANDUM:

SWMM Modeling for Hydromodification Compliance of:

Liberty High School

Prepared For:

James M. Roberts PE, LLC.

February 2, 2017. Revised: May 4, 2017.

Prepared by:

Luis Parra, PhD, CPSWQ, ToR, D.WRE.
R.C.E. 66377

REC Consultants
2442 Second Avenue
San Diego, CA 92101
Telephone: (619) 232-9200

R·E·C

TECHNICAL MEMORANDUM

TO: James M. Roberts PE, LLC – President

FROM: Luis Parra, PhD, PE, CPSWQ, ToR, D.WRE.
David Edwards, PE.

DATE: February 2, 2017. Revised: May 4, 2017.

RE: Summary of SWMM Modeling for Hydromodification Compliance for Liberty High School, El Cajon, CA.

INTRODUCTION

This memorandum summarizes the approach used to model the proposed high school development project site in the City of El Cajon using the Environmental Protection Agency (EPA) Storm Water Management Model 5.0 (SWMM). SWMM models were prepared for the pre and post-developed conditions at the site in order to determine if the proposed HMP detention facilities have sufficient volume to meet Order R9-2013-001 requirements of the California Regional Water Quality Control Board San Diego Region (SDRWQCB), as explained in the Final Hydromodification Management Plan (HMP), dated March 2011, prepared for the County of San Diego by Brown and Caldwell.

SWMM MODEL DEVELOPMENT

The Liberty High School project comprises of a proposed high school campus and associated parking areas. Two (2) SWMM models were prepared for this study: the first for the pre-development and the second for the post-developed conditions. The project site drains to one (1) Point of Compliance (POC-1) located to the east of the project site at the adjacent Chase Avenue. The SWMM model was used since we have found it to be more comparable to San Diego area watersheds than the alternative San Diego Hydrology Model (SDHM) and also because it is a non-proprietary model approved by the HMP document. For both SWMM models, flow duration curves were prepared to determine if the proposed HMP facilities are sufficient to meet the current HMP requirements.

The inputs required to develop SWMM models include rainfall, watershed characteristics, and BMP configurations. The Kearny Mesa Rain Gage from the Project Clean Water website was used for this study, since it is the most representative of the project site precipitation due to elevation and proximity to the project site according to a composite index explained in Attachment 8.

Per the California Irrigation Management Information System "Reference Evaporation Zones" (CIMIS ETo Zone Map), the project site is located within the Zone 9 Evapotranspiration Area. Thus evapotranspiration values for the site were modeled using Zone 9 average monthly values from Table G.1-1 from the County of San Diego 2016 BMP Design Manual. The site was modeled with Type B and D hydrologic soils as this is the existing soil determined from the NRCS Web Soil Survey and site specific soil investigation. Soils have been assumed to be uncompacted in the existing condition to represent the current natural condition of the site and fully compacted in the post developed conditions. Other SWMM inputs for the subareas are discussed in the appendices to this document, where the selection of the parameters is explained in detail.

HMP MODELING

UNDEVELOPED CONDITIONS

The existing site is a naturally vegetated site that drains in an easterly direction to a receiving storm drain located in Chase Avenue.

TABLE 1 – SUMMARY OF EXISTING CONDITIONS

DMA	Tributary Area, A (acres)	Impervious %, I_P (1)
DMA-all-SoilB	3.344	0.0%
DMA-all-SoilD	3.652	0.0%
DMA-off-B	0.063	100%
DMA-off-D	0.239	100%
DMA-off-perv	0.041	0.0%
TOTAL	**7.339**	--

Notes: (1) – Per the 2013 RWQCB permit, existing impervious surfaces within the project are not to be accounted for in existing conditions analysis. However, offsite street areas not belonging to the property and not under control of the project which drain to proposed BMPs are modeled in the same way in pre and post-development conditions.

DEVELOPED CONDITIONS

Storm water runoff from the proposed project site is routed to one (1) POC located at the discharge location to the east of the project site at Chase Avenue. Runoff from the developed project site is drained to two (2) onsite receiving BMPs. Once flows are routed via the proposed HMP BMPs, developed onsite flows are then conveyed to the storm drain within Chase Avenue.

It is assumed all storm water quality requirements for the project will be met by the onsite BMPs. However, detailed water quality requirements are not discussed within this technical memo. For further information in regards to storm water quality requirements for the project, please refer to the site specific Storm Water Quality Management Plan (SWQMP).

TABLE 2 – SUMMARY OF DEVELOPED CONDITIONS

DMA	Tributary Area, A (acres)	Impervious %, I_P
DMA-1-SoilB	3.228	56.2%
DMA-1-SoilD	2.918	22.8%
BR-1	0.0616	0.00%
DMA-2-SoilD	0.892	71.1%
DMA-2-SoilB	0.179	100.0%
BR-2	0.0194	0.00%
DMA-pavers	0.041	0.00%
TOTAL	**7.339**	--

Two (2) LID biofiltration basins are located within the project site and are responsible for handling hydromodification requirements for the project site. In developed conditions, the basins will have a surface depth and a riser spillway structure (see dimensions in Table 3). Flows will then discharge from the basin via a low flow orifice outlet within the gravel layer. The riser structure will act as a spillway such that peak flows can be safely discharged to the receiving storm drain system.

TABLE 3 – SUMMARY OF DETENTION BMPs

BMP	Tributary Area (Ac)(7)	DIMENSIONS					
		BMP Area(1) (ft^2)	Gravel Depth(2) (in)	Lower Orif. D (in)(3)	Depth Riser lowest Invert (in)(4)	Weir length = riser perim(5)	Total Surface Depth(6) (in)
BMP 1	6.146	2,683	18	2.25	12	12	30
BMP 2	1.071	846	18	1.00	9	8	27

Notes: (1): Area of amended soil equal to area of gravel
(2): Total gravel depth, 15" placed above invert of French Drain (includes 6" filter media layer) and 3" dead storage below French Drain.
(3): Diameter of orifice in gravel layer with invert 3" above bottom of layer; tied with hydromod min threshold ($0.1 \cdot Q_2$).
(4): Depth of ponding beneath invert of lowest slot in riser structure (includes 3" layer of mulch).
(5): Overflow length or the internal perimeter of the riser which is 12 ft or 8 ft respectively (3' x 3' or 2' x 2' internal dimensions).
(6): Total surface depth of BMP from top crest elevation to surface invert (surface at mulch-amended soil interphase).
(7): Tributary area to basin not including area of BMP.

TABLE 4 – SUMMARY OF OUTLET DETAILS:

BMP	Lower Orifice/Slot			Middle Slot Dimensions			Overspill Dimensions	
	Width/D (inch)	Height (inch)	Elevation(1) invert (ft)	Width (inch)	Height (inch)	Elevation(1) invert (ft)	Length(2) (ft)	Elevation(1) invert (ft)
BASIN 1	11.25	3	0.00	60(3)	3	0.50	12	0.833
BASIN 2	2 x 0.5"	N/A	0.00	N/A	N/A	N/A	8	1.00

Notes: (1): Invert elevation of lowest surface outlet assumed to be 0.00 ft elevation in SWMM for basin's modeling.
(2): Overflow length is the internal perimeter of the riser structure.
(3): 2-30" slots to be placed on two opposite sides of outlet structure.

In developed conditions, the majority of the project site (inclusive of the school structures and parking lots) will be drained by a receiving onsite storm drain system, conveying flows to a proposed bio-filtration basin located adjacent to the eastern property boundary. Runoff will drain via a proposed outlet structure within the biofiltration basin and discharge to the receiving storm drain system.

A second BMP detention facility is located at the eastern most corner of the project site, adjacent to Chase Avenue. Runoff generated by the improved and existing southern portion of Chase Avenue is intercepted by a proposed curb inlet, draining flows to the aforementioned biofiltration basin. Detained flows will then drain from the basin to the receiving storm drain within Chase Avenue. The riser structures will act as a spillway such that peak flows can be safely discharged to the receiving storm drain system.

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

Beneath the basins' invert lies the proposed LID biofiltration portion of the drainage facilities. This portion of the basin is comprised of a 3-inch layer of mulch, an 18-inch layer of amended soil (a highly sandy, organic rich composite with an infiltration capacity of at least 5 inches/hr) and an 18-inch layer of gravel (which includes a 6-inch filter media layer and 3-inches of dead storage beneath the French Drain outlet) for additional detention and to accommodate the French drain system. These systems are to be located beneath the biofiltration layers to intercept treated storm water and convey these flows to a small diameter lower outlet orifice. Once flows have been routed by the outlet structure, flows are then drained to the receiving storm drain system prior to discharging to the POC at the storm drain located within Chase Avenue. The basins will be unlined to allow for infiltration into the underlying soil. The Geotechnical Consultant provided letters to justify the possibility of a little infiltration if a French Drain system is included at a low elevation in the gravel to avoid risk of failure sue to the location of the BMP-1 near a slope. Letters are included in Attachment 8. Infiltration was assumed very low (soil D compacted, 0.01875 in/hr). Incidentally, this value is equal to the average value of the 3 lowest measurements (0.025, 0.025, 0.076) divided by a SF = 2.25, which is a realistic approach. A more detailed infiltration value can be included in final engineering, but as the infiltration assumed is very small such infiltration most likely be a higher value and if anything will reduce the surface requirements of the BMPs.

The biofiltration basins were modeled using the biofiltration LID module within SWMM. The biofiltration module can model the underground gravel storage layer, underdrain with an orifice plate, amended soil layer, and a surface storage pond up to the elevation of the invert of the spillway. It should be noted that detailed outlet structure location and elevations will be shown on the construction plans based on the recommendations of this study.

Water Quality BMP Sizing

It is assumed all storm water quality requirements for the project will be met by the biofiltration LIDs. However, detailed water quality requirements are not discussed within this technical memo. The partial retention bio-filtration basins have been designed in accordance with County of San Diego sizing criteria (which include maximum draw down requirements). For further information in regards to storm water quality requirements for the project (including sizing and drawdown) please refer to the site specific Storm Water Quality Management Plan (SWQMP).

BMP MODELING FOR HMP PURPOSES

Modeling of dual purpose Water Quality/HMP BMPs

Two (2) BMP basins are proposed for water quality treatment and hydromodification conformance for the project site. Tables 3 & 4 illustrate the dimensions required for HMP compliance according to the SWMM model that was undertaken for the project.

Additional Facilities for Flood Control

It should be mentioned that the riser of BMP-1 is connected to a 285 ft – 48" pipe whose purpose is to reduce the Synthetic 100-year peak flow to pre-development levels. For hydromodification purposes this riser is irrelevant as the maximum hourly level in the continuous simulation never reaches a depth in excess of 1.25 ft at any time (except for 1 hour on 12/10/65, which is less frequent than the maximum 10 year upper threshold, making this flow out of the range of analysis). Therefore no water is diverted to the underground pipe for hydromodification purposes. Consequently, there is no need to complicate the hydromodification model by including a by-pass to an underground structure that will never be needed at an hourly level according to the continuous simulation undertaken by this project.

FLOW DURATION CURVE COMPARISON

The Flow Duration Curve (FDC) for the site was compared at the POC-1 by exporting the hourly runoff time series results from SWMM to a spreadsheet. The FDC was compared between 10% of the existing condition Q_2 up to the existing condition Q_{10} for POC-1. The Q_2 and Q_{10} were determined with a partial duration statistical analysis of the runoff time series in an Excel spreadsheet using the Cunnane plotting position method (which is the preferred plotting methodology in the HMP Permit). As the SWMM Model includes a statistical analysis based on the Weibull Plotting Position Method, the Weibull Method was also used within the spreadsheet to ensure that the results were similar to those obtained by the SWMM Model.

The range between 10% of Q_2 and Q_{10} was divided into 100 equal time intervals; the number of hours that each flow rate was exceeded was counted from the hourly series. Additionally, the intermediate peaks with a return period "i" were obtained (Q_i with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate. FDC comparison at the POC is illustrated in Figure 1 in both normal and logarithmic scale. Attachment 5 provides a detailed drainage exhibit for the post-developed condition.

As can be seen in Figure 1, the FDC for the proposed condition with the HMP BMPs is within 110% of the curve for the existing condition in both peak flows and durations. The additional runoff volume generated from developing the site will be released to the existing point of discharge at a flow rate below the 10% Q_2 lower threshold for the POC. Additionally, the project will also not increase peak flow rates between the Q_2 and the Q_{10}, as shown in the graphic and also in the peak flow tables in Attachment 1.

Discussion of the Manning's coefficient (Pervious Areas) for Pre and Post-Development Conditions

Typically the Manning's coefficient is selected as n = 0.10 for pervious areas and n = 0.012 for impervious areas. However, due to the impact that n has in the continuous simulation a more accurate value of the Manning's coefficient has been chosen for pervious areas. Taken into consideration the recommended Manning's value included as supplemental information to the BMP Manual by San Diego County (Reference [6]) a value of n = 0.05 has been selected (see Table 1 of Reference [6] included in Attachment 7). An average n value between average grass plus pasture (0.04) and dense grass (0.06) has been selected per the reference cited, for light rain (<0.8 in/hr) as more than 99% of the rainfall has been measured with this intensity.

Pavers Storage Parameter

Porous paver area is very small (0.041 acres of a total of 7.34 acres, or less than 1%). However, we decided to explain the Dstore-perv parameter of SWMM: The pavers will have a 6" gravel layer, of which a minimum of 4 inches can have a horizontal ponding. Assuming a porosity of 0.4, it means that there will be at least 1.6 inches of storage under the porous pavers before any runoff is produced.

DRAWDOWN TIMES

Per calculations performed in the 100-yr peak flow report the drawdown times of the surface of Basin 1 and Basin 2 are 5.5 hrs and 13.1 hrs respectively (without including infiltration). Those values are considered adequate values for hydromodification purposes as the maximum allowable time is 96 hours. Additional drawdown time of the top 12 inches of amended soil has also being analyzed in Attachment 4.

SUMMARY

This study has demonstrated that the proposed HMP BMPs provided for the Liberty High School project site is sufficient to meet the current HMP criteria if the cross-section areas and volumes recommended within this technical memorandum, and the respective orifice and outlet structure are incorporated as specified within the proposed project site.

KEY ASSUMPTIONS

1. Type B & D Soil is representative of the existing condition site.

ATTACHMENTS

1. Q_2 to Q_{10} Comparison Tables
2. FDC Plots (log and natural “x” scale) and Flow Duration Table.
3. List of the “n” largest Peaks: Pre-Development and Post-Development Conditions
4. Elevations vs. Discharge & Stage- Storage Curves to be used in SWMM. Drawdown Calcs.
5. Pre & Post Development Maps, Project plan and section sketches
6. SWMM Input Data in Input Format (Existing and Proposed Models)
7. SWMM Screens and Explanation of Significant Variables
8. Soil Maps. Discussion of Selection of Rain Gauge. Geotechnical Letters.
9. Summary files from the SWMM Model

REFERENCES

[1] – *"Review and Analysis of San Diego County Hydromodification Management Plan (HMP): Assumptions, Criteria, Methods, & Modeling Tools – Prepared for the Cities of San Marcos, Oceanside & Vista",* May 2012, TRW Engineering.

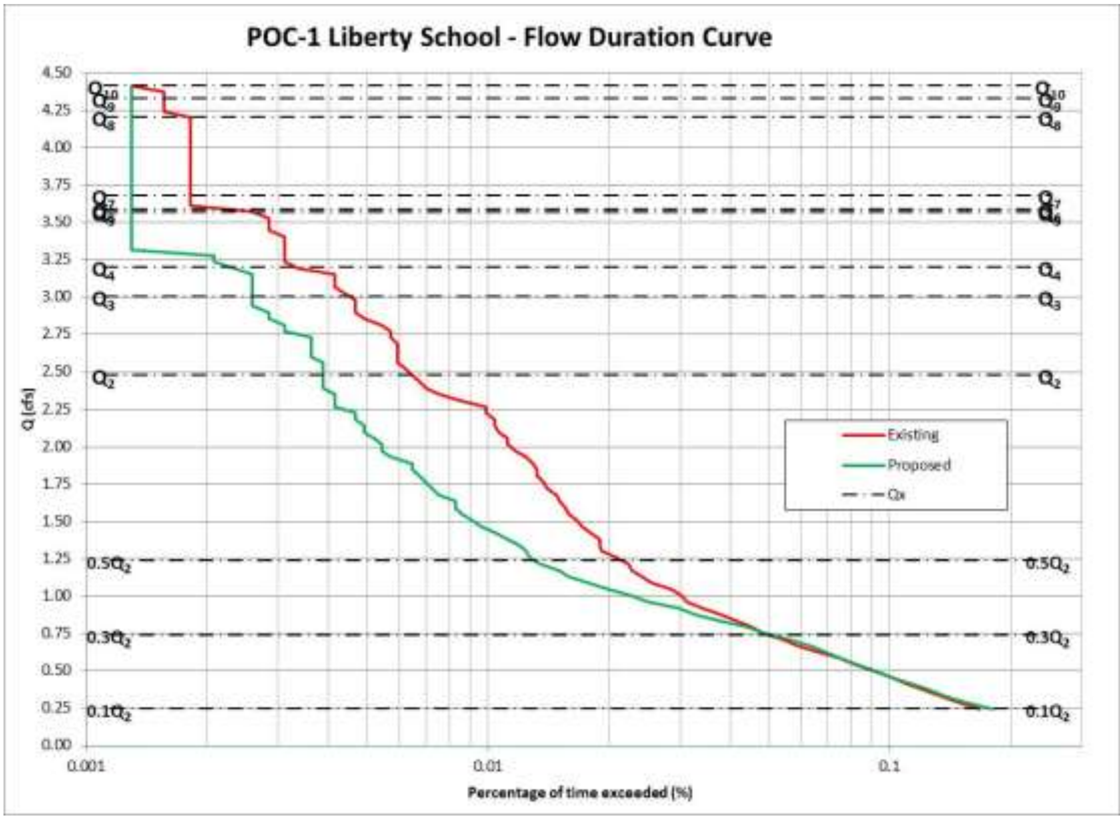
[2] – *"Final Hydromodification Management Plan (HMP) prepared for the County of San Diego",* March 2011, Brown and Caldwell.

[3] - Order R9-2007-001, California Regional Water Quality Control Board San Diego Region (SDRWQCB).

[4] – "*Handbook of Hydrology*", David R. Maidment, Editor in Chief. 1992, McGraw Hill.

[5] – "*County of San Diego BMP Design Manual*", February 2016.

[6] – *"Manning's n Values for Overland Flow". County of San Diego.* *http://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/Handout_2_N-Perv.pdf*



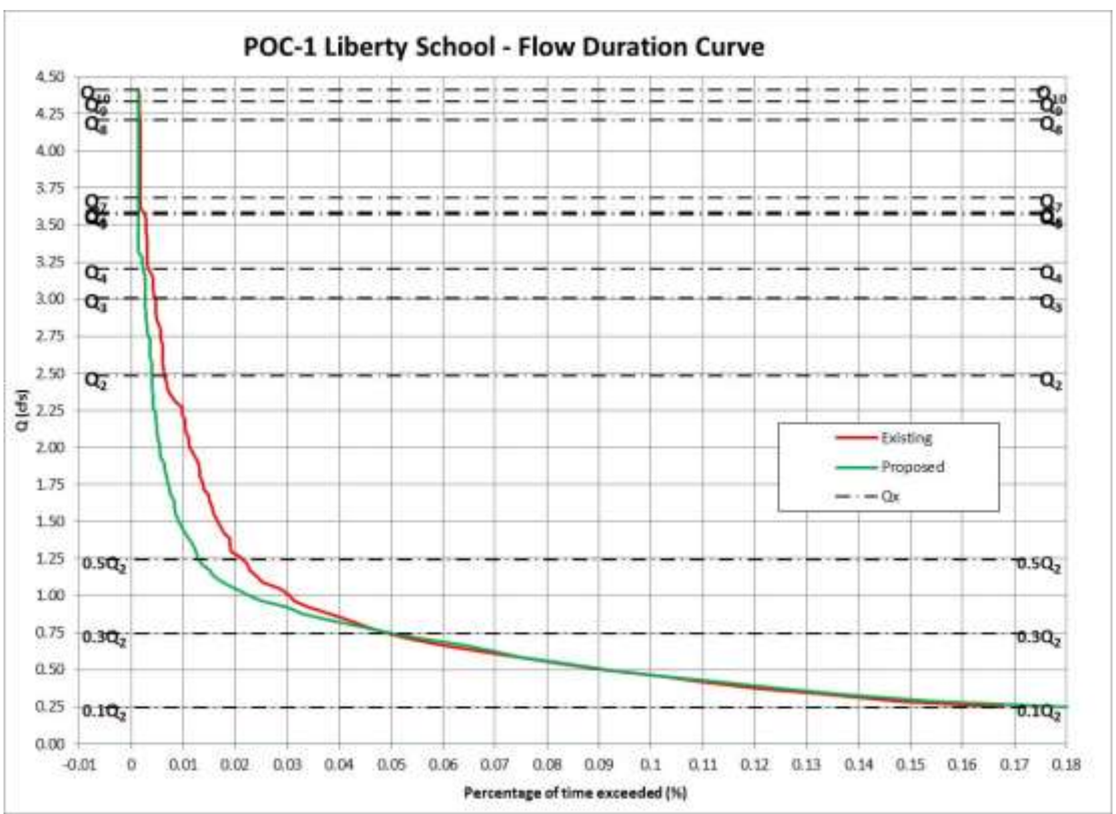


Figure 1a and 1b. Flow Duration Curve Comparison (logarithmic and normal "x" scale)

ATTACHMENT 1.

Q_2 to Q_{10} Comparison Table – POC 1

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
2-year	2.481	1.645	0.836
3-year	3.007	2.063	0.944
4-year	3.202	2.450	0.752
5-year	3.570	2.850	0.719
6-year	3.588	3.192	0.396
7-year	3.683	3.236	0.447
8-year	4.208	3.289	0.918
9-year	4.332	3.294	1.038
10-year	4.414	3.371	1.042

ATTACHMENT 2

FLOW DURATION CURVE ANALYSIS

1) Flow duration curve shall not exceed the existing conditions by more than 10%, neither in peak flow nor duration.

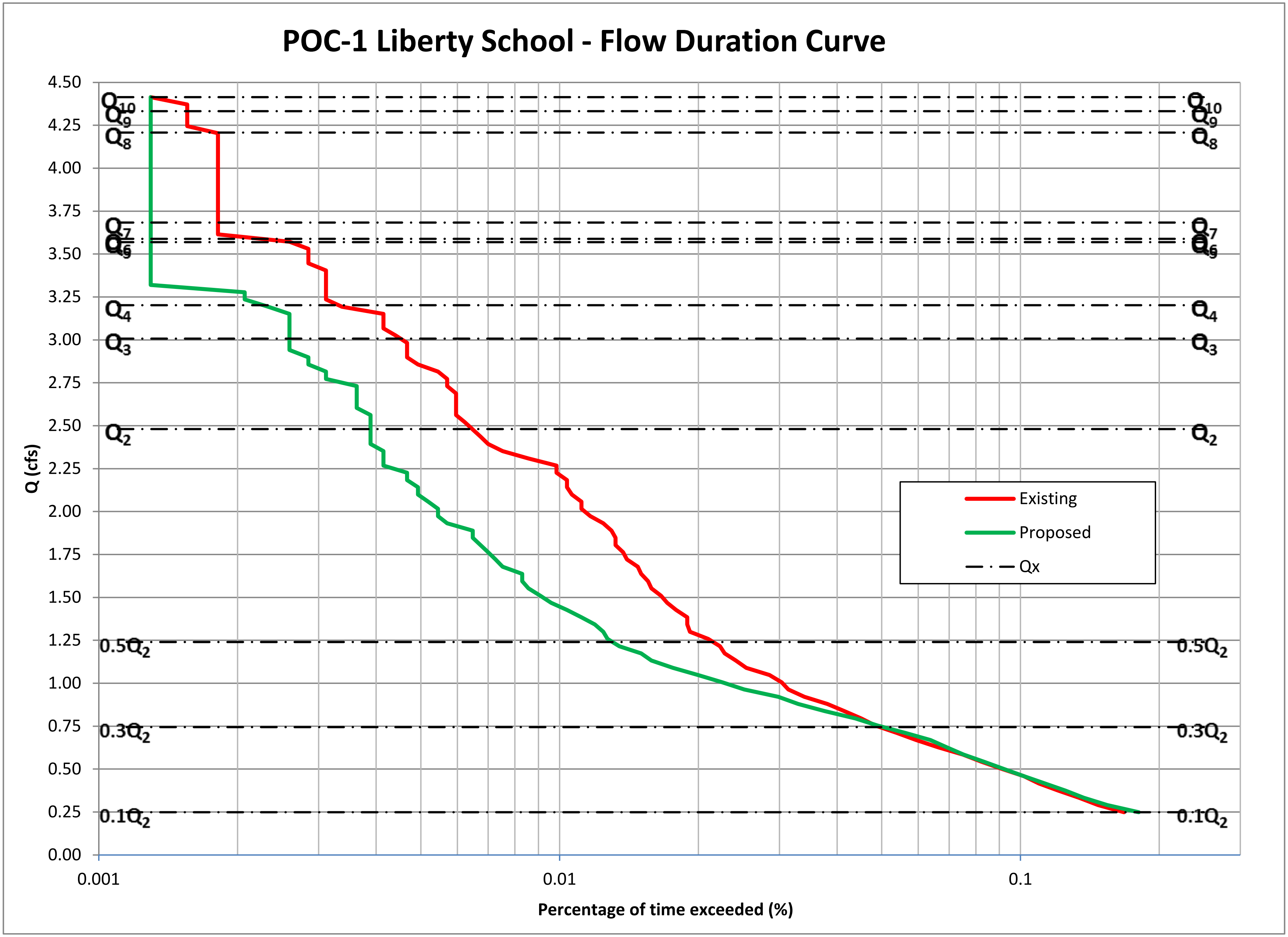
The figures on the following pages illustrate that the flow duration curve in post-development conditions after the proposed BMP is below the existing flow duration curve. The flow duration curve table following the curve shows that if the interval $0.10Q_2 – Q_{10}$ is divided in 100 sub-intervals,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

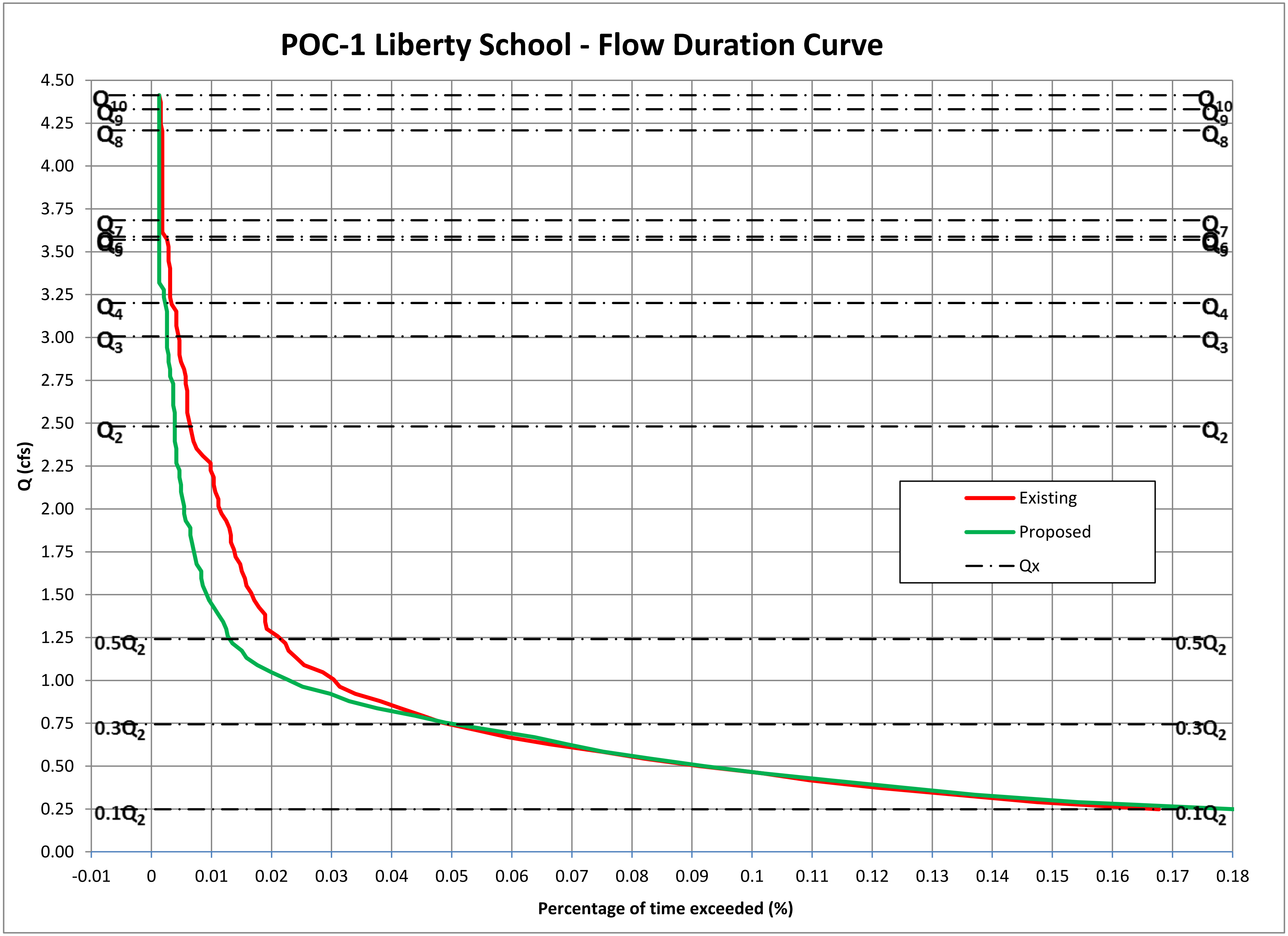
Consequently, the design passes the hydromodification test.

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

In terms of the “y” axis, the peak flow value is the variable of choice. As an additional analysis performed by REC, not only the range of analysis is clearly depicted (10% of Q_2 to Q_{10}) but also all intermediate flows are shown (Q_2, Q_3, Q_4, Q_5, Q_6, Q_7, Q_8 and Q_9) in order to demonstrate compliance at any range $Q_x – Q_{x+1}$. It must be pointed out that one of the limitations of both the SWMM and SDHM models is that the intermediate analysis is not performed (to obtain Q_i from i = 2 to 10). TRWE performed the analysis using the Cunnane Plotting position Method (the preferred method in the HMP permit) from the “n” largest independent peak flows obtained from the continuous time series.

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


POC-1 Liberty School - Flow Duration Curve
Q (cfs)
Percentage of time exceeded (%)
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.001
0.01
0.1
Q10
Q9
Q8
Q7
Q6
Q5
Q4
Q3
Q2
0.5Q2
0.3Q2
0.1Q2
Existing
Proposed
Qx


POC-1 Liberty School - Flow Duration Curve
Q (cfs)
Percentage of time exceeded (%)
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
-0.01
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
Q_{10}
Q_9
Q_8
Q_7
Q_6
Q_5
Q_4
Q_3
Q_2
$0.5Q_2$
$0.3Q_2$
$0.1Q_2$
Existing
Proposed
Qx

Flow Duration Curve Data for Liberty High School POC-1, El Cajon, SD County, CA

Q2 =	2.48	cfs	Fraction	10 %
Q10 =	4.41	cfs		
Step =	0.0421	cfs		
Count =	385703	hours		
	44.00	years		

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
1	0.248	647	1.68E-01	696	1.80E-01	108%	Pass
2	0.290	569	1.48E-01	595	1.54E-01	105%	Pass
3	0.332	517	1.34E-01	529	1.37E-01	102%	Pass
4	0.374	466	1.21E-01	483	1.25E-01	104%	Pass
5	0.416	423	1.10E-01	436	1.13E-01	103%	Pass
6	0.458	392	1.02E-01	392	1.02E-01	100%	Pass
7	0.501	352	9.13E-02	355	9.20E-02	101%	Pass
8	0.543	317	8.22E-02	321	8.32E-02	101%	Pass
9	0.585	289	7.49E-02	290	7.52E-02	100%	Pass
10	0.627	256	6.64E-02	267	6.92E-02	104%	Pass
11	0.669	229	5.94E-02	246	6.38E-02	107%	Pass
12	0.711	208	5.39E-02	217	5.63E-02	104%	Pass
13	0.753	187	4.85E-02	189	4.90E-02	101%	Pass
14	0.795	174	4.51E-02	169	4.38E-02	97%	Pass
15	0.837	160	4.15E-02	145	3.76E-02	91%	Pass
16	0.879	147	3.81E-02	127	3.29E-02	86%	Pass
17	0.921	131	3.40E-02	115	2.98E-02	88%	Pass
18	0.963	121	3.14E-02	97	2.51E-02	80%	Pass
19	1.005	117	3.03E-02	87	2.26E-02	74%	Pass
20	1.048	110	2.85E-02	77	2.00E-02	70%	Pass
21	1.090	98	2.54E-02	68	1.76E-02	69%	Pass
22	1.132	93	2.41E-02	61	1.58E-02	66%	Pass
23	1.174	88	2.28E-02	58	1.50E-02	66%	Pass
24	1.216	86	2.23E-02	52	1.35E-02	60%	Pass
25	1.258	81	2.10E-02	49	1.27E-02	60%	Pass
26	1.300	74	1.92E-02	48	1.24E-02	65%	Pass
27	1.342	73	1.89E-02	46	1.19E-02	63%	Pass
28	1.384	73	1.89E-02	43	1.11E-02	59%	Pass
29	1.426	69	1.79E-02	40	1.04E-02	58%	Pass
30	1.468	66	1.71E-02	37	9.59E-03	56%	Pass
31	1.510	64	1.66E-02	35	9.07E-03	55%	Pass
32	1.552	61	1.58E-02	33	8.56E-03	54%	Pass
33	1.595	60	1.56E-02	32	8.30E-03	53%	Pass
34	1.637	58	1.50E-02	32	8.30E-03	55%	Pass
35	1.679	57	1.48E-02	29	7.52E-03	51%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
36	1.721	54	1.40E-02	28	7.26E-03	52%	Pass
37	1.763	53	1.37E-02	27	7.00E-03	51%	Pass
38	1.805	51	1.32E-02	26	6.74E-03	51%	Pass
39	1.847	51	1.32E-02	25	6.48E-03	49%	Pass
40	1.889	50	1.30E-02	25	6.48E-03	50%	Pass
41	1.931	48	1.24E-02	22	5.70E-03	46%	Pass
42	1.973	45	1.17E-02	21	5.44E-03	47%	Pass
43	2.015	43	1.11E-02	21	5.44E-03	49%	Pass
44	2.057	43	1.11E-02	20	5.19E-03	47%	Pass
45	2.099	41	1.06E-02	19	4.93E-03	46%	Pass
46	2.142	40	1.04E-02	19	4.93E-03	48%	Pass
47	2.184	40	1.04E-02	18	4.67E-03	45%	Pass
48	2.226	38	9.85E-03	18	4.67E-03	47%	Pass
49	2.268	38	9.85E-03	16	4.15E-03	42%	Pass
50	2.310	33	8.56E-03	16	4.15E-03	48%	Pass
51	2.352	29	7.52E-03	16	4.15E-03	55%	Pass
52	2.394	27	7.00E-03	15	3.89E-03	56%	Pass
53	2.436	26	6.74E-03	15	3.89E-03	58%	Pass
54	2.478	25	6.48E-03	15	3.89E-03	60%	Pass
55	2.520	24	6.22E-03	15	3.89E-03	63%	Pass
56	2.562	23	5.96E-03	15	3.89E-03	65%	Pass
57	2.604	23	5.96E-03	14	3.63E-03	61%	Pass
58	2.646	23	5.96E-03	14	3.63E-03	61%	Pass
59	2.688	23	5.96E-03	14	3.63E-03	61%	Pass
60	2.731	22	5.70E-03	14	3.63E-03	64%	Pass
61	2.773	22	5.70E-03	12	3.11E-03	55%	Pass
62	2.815	21	5.44E-03	12	3.11E-03	57%	Pass
63	2.857	19	4.93E-03	11	2.85E-03	58%	Pass
64	2.899	18	4.67E-03	11	2.85E-03	61%	Pass
65	2.941	18	4.67E-03	10	2.59E-03	56%	Pass
66	2.983	18	4.67E-03	10	2.59E-03	56%	Pass
67	3.025	17	4.41E-03	10	2.59E-03	59%	Pass
68	3.067	16	4.15E-03	10	2.59E-03	63%	Pass
69	3.109	16	4.15E-03	10	2.59E-03	63%	Pass
70	3.151	16	4.15E-03	10	2.59E-03	63%	Pass
71	3.193	13	3.37E-03	9	2.33E-03	69%	Pass
72	3.235	12	3.11E-03	8	2.07E-03	67%	Pass
73	3.278	12	3.11E-03	8	2.07E-03	67%	Pass
74	3.320	12	3.11E-03	5	1.30E-03	42%	Pass
75	3.362	12	3.11E-03	5	1.30E-03	42%	Pass
76	3.404	12	3.11E-03	5	1.30E-03	42%	Pass
77	3.446	11	2.85E-03	5	1.30E-03	45%	Pass
78	3.488	11	2.85E-03	5	1.30E-03	45%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
79	3.530	11	2.85E-03	5	1.30E-03	45%	Pass
80	3.572	10	2.59E-03	5	1.30E-03	50%	Pass
81	3.614	7	1.81E-03	5	1.30E-03	71%	Pass
82	3.656	7	1.81E-03	5	1.30E-03	71%	Pass
83	3.698	7	1.81E-03	5	1.30E-03	71%	Pass
84	3.740	7	1.81E-03	5	1.30E-03	71%	Pass
85	3.782	7	1.81E-03	5	1.30E-03	71%	Pass
86	3.825	7	1.81E-03	5	1.30E-03	71%	Pass
87	3.867	7	1.81E-03	5	1.30E-03	71%	Pass
88	3.909	7	1.81E-03	5	1.30E-03	71%	Pass
89	3.951	7	1.81E-03	5	1.30E-03	71%	Pass
90	3.993	7	1.81E-03	5	1.30E-03	71%	Pass
91	4.035	7	1.81E-03	5	1.30E-03	71%	Pass
92	4.077	7	1.81E-03	5	1.30E-03	71%	Pass
93	4.119	7	1.81E-03	5	1.30E-03	71%	Pass
94	4.161	7	1.81E-03	5	1.30E-03	71%	Pass
95	4.203	7	1.81E-03	5	1.30E-03	71%	Pass
96	4.245	6	1.56E-03	5	1.30E-03	83%	Pass
97	4.287	6	1.56E-03	5	1.30E-03	83%	Pass
98	4.329	6	1.56E-03	5	1.30E-03	83%	Pass
99	4.372	6	1.56E-03	5	1.30E-03	83%	Pass
100	4.414	5	1.30E-03	5	1.30E-03	100%	Pass

Peak Flows calculated with Cunnane Plotting Position

Return Period (years)	Pre-dev. Q (cfs)	Post-Dev. Q (cfs)	Reduction (cfs)
10	4.414	3.371	1.042
9	4.332	3.294	1.038
8	4.208	3.289	0.918
7	3.683	3.236	0.447
6	3.588	3.192	0.396
5	3.570	2.850	0.719
4	3.202	2.450	0.752
3	3.007	2.063	0.944
2	2.481	1.645	0.836

ATTACHMENT 3

List of the “n” Largest Peaks: Pre & Post-Developed Conditions

Basic Probabilistic Equation:

R = 1/P R: Return period (years).

P: Probability of a flow to be equaled or exceeded any given year (dimensionless).

Cunnane Equation:

$$P = \frac{i-0.4}{n+0.2}$$

Weibull Equation:

$$P = \frac{i}{n+1}$$

i: Position of the peak whose probability is desired (sorted from large to small)

n: number of years analyzed.

Explanation of Variables for the Tables in this Attachment

Peak: Refers to the peak flow at the date given, taken from the continuous simulation hourly results of the n year analyzed.

Posit: If all peaks are sorted from large to small, the position of the peak in a sorting analysis is included under the variable Posit.

Date: Date of the occurrence of the peak at the outlet from the continuous simulation

Note: all peaks are not annual maxima; instead they are defined as event maxima, with a threshold to separate peaks of at least 12 hours. In other words, any peak P in a time series is defined as a value where dP/dt = 0, and the peak is the largest value in 25 hours (12 hours before, the hour of occurrence and 12 hours after the occurrence, so it is in essence a daily peak).

List of Peak events and Determination of P2 and P10 (Pre-Development)
Liberty High School POC 1 - El Cajon, CA

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**4.41**	**4.43**
9	**4.33**	**4.39**
8	**4.21**	**4.28**
7	**3.68**	**3.85**
6	**3.59**	**3.59**
5	**3.57**	**3.58**
4	**3.20**	**3.21**
3	**3.01**	**3.01**
2	**2.48**	**2.48**

Note:
Cunnane is the preferred method by the HMP permit.

Peaks (cfs)	Date	Posit	Period of Return (Years)	
			Weibull	**Cunnane**
1.774	3/17/1979	45	1.02	1.01
1.871	3/8/1968	44	1.05	1.04
1.899	1/31/1993	43	1.07	1.06
1.91	1/16/1978	42	1.10	1.09
1.962	11/14/1972	41	1.12	1.11
1.996	12/23/1995	40	1.15	1.14
2.007	1/8/1974	39	1.18	1.17
2.097	2/19/1980	38	1.21	1.20
2.099	2/21/2000	37	1.24	1.23
2.126	1/6/1979	36	1.28	1.27
2.184	1/7/2005	35	1.31	1.31
2.191	1/31/1979	34	1.35	1.35
2.273	10/10/1966	33	1.39	1.39
2.295	2/6/1992	32	1.44	1.43
2.297	2/11/1973	31	1.48	1.48
2.302	4/13/2003	30	1.53	1.53
2.318	2/6/1969	29	1.59	1.58
2.323	10/27/2004	28	1.64	1.64
2.337	3/17/1982	27	1.70	1.70
2.341	1/9/2005	26	1.77	1.77
2.375	2/8/1976	25	1.84	1.84
2.446	11/21/1967	24	1.92	1.92
2.481	3/2/1992	23	2.00	2.00
2.534	2/6/1976	22	2.09	2.09
2.705	2/11/2003	21	2.19	2.19
2.801	12/5/1966	20	2.30	2.31
2.829	3/1/1981	19	2.42	2.43
2.85	12/6/1966	18	2.56	2.57
2.858	12/18/1978	17	2.71	2.72
2.984	2/14/1995	16	2.88	2.90
3.029	3/20/1983	15	3.07	3.10
3.167	5/8/1977	14	3.29	3.32
3.171	1/10/1978	13	3.54	3.59
3.191	11/5/1987	12	3.83	3.90
3.229	1/4/1978	11	4.18	4.26
3.551	2/13/1973	10	4.60	4.71
3.586	3/1/1983	9	5.11	5.26
3.587	1/18/1993	8	5.75	5.95
3.604	2/24/2003	7	6.57	6.85
4.245	11/13/1998	6	7.67	8.07
4.409	1/14/1969	5	9.20	9.83
4.481	1/25/1995	4	11.50	12.56
4.823	2/28/1970	3	15.33	17.38
5.028	11/13/1972	2	23.00	28.25
8.336	12/4/1974	1	46.00	75.33

List of Peak events and Determination of P2 and P10 (Post-Development)
Liberty High School POC 1 - El Cajon, CA

T (Year)	Cunnane (cfs)	Weibull (cfs)	Peaks (cfs)	Date	Posit	Period of Return (Years)	
10	**3.37**	**3.71**				**Weibull**	**Cunnane**
9	**3.29**	**3.29**	1.016	2/6/1976	45	1.02	1.01
8	**3.29**	**3.29**	1.022	11/25/1985	44	1.05	1.04
7	**3.24**	**3.25**	1.023	12/9/1965	43	1.07	1.06
6	**3.19**	**3.20**	1.072	2/6/1992	42	1.10	1.09
5	**2.85**	**2.89**	1.079	3/5/2005	41	1.12	1.11
4	**2.45**	**2.49**	1.116	11/30/2007	40	1.15	1.14
3	**2.06**	**2.07**	1.117	3/11/1995	39	1.18	1.17
2	**1.65**	**1.65**	1.119	1/9/2005	38	1.21	1.20
			1.124	1/27/1983	37	1.24	1.23
			1.16	3/17/1982	36	1.28	1.27
			1.183	1/11/2005	35	1.31	1.31
			1.188	1/15/1993	34	1.35	1.35
			1.199	2/22/2005	33	1.39	1.39
			1.208	1/15/1978	32	1.44	1.43
			1.238	1/22/1967	31	1.48	1.48
			1.306	2/8/1976	30	1.53	1.53
			1.358	3/2/1983	29	1.59	1.58
			1.362	11/21/1967	28	1.64	1.64
			1.386	2/15/1986	27	1.70	1.70
			1.434	2/19/2007	26	1.77	1.77
			1.545	11/16/1965	25	1.84	1.84
			1.64	11/22/1965	24	1.92	1.92
			1.645	2/13/1978	23	2.00	2.00
			1.691	1/3/1977	22	2.09	2.09
			1.788	1/31/1979	21	2.19	2.19
			1.836	1/8/1974	20	2.30	2.31
			1.909	2/8/1993	19	2.42	2.43
			1.916	2/21/2005	18	2.56	2.57
			1.948	1/4/1995	17	2.71	2.72
			2.037	1/20/1982	16	2.88	2.90
			2.087	1/29/1980	15	3.07	3.10
			2.166	1/16/1978	14	3.29	3.32
			2.263	1/6/1979	13	3.54	3.59
			2.393	3/1/1983	12	3.83	3.90
			2.594	1/25/1995	11	4.18	4.26
			2.762	3/2/1992	10	4.60	4.71
			2.928	2/14/1995	9	5.11	5.26
			3.19	12/6/1966	8	5.75	5.95
			3.228	2/24/2003	7	6.57	6.85
			3.293	12/5/1966	6	7.67	8.07
			3.295	5/8/1977	5	9.20	9.83
			4.491	11/13/1972	4	11.50	12.56
			4.555	1/14/1969	3	15.33	17.38
			5.514	2/28/1970	2	23.00	28.25
			8.163	12/4/1974	1	46.00	75.33

Note:
Cunnane is the preferred method by the HMP permit.

ATTACHMENT 4

AREA VS ELEVATION

Stage-storage relationships for the gravel infiltration trench and the detention vault are provided on the following pages. It should be noted that due to void space reduction, the effective volume area for the gravel basin system is reduced by 60% (as the volume of voids within gravel is typically 40%).

DISCHARGE VS ELEVATION

The orifices have been selected to maximize its size while still restricting flows to conform with the required 10% of the Q_2 event flow as mandated in the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. While REC acknowledges that the orifice is small, to increase the size of the outlet would impact the basin's ability to restrict flows beneath the HMP thresholds, thus preventing the BMP from conformance with HMP requirements.

In order to further reduce the risk of blockage of the orifices, regular maintenance of the riser and orifice must be performed to ensure potential blockages are minimized. A detail of the orifice and riser structure is provided in Attachment 5 of this memorandum.

A stage-discharge relationship is provided on the following pages for the outlet structures.

DRAWDOWN TABLES AND EXPLANATION

Discharge vs. elevation tables allowed the calculation of drawdown table at the end of this attachment. Total surface drawdown is 5.5 hr for BMP-1 and 13.1 hr for BMP-2.

In regards to drawdown of 12 inches of amended soil, and knowing that porosity – field capacity = 0.2, the total volume that needs to drain by gravity in BMP-1 is V1 = 0.2·1·2683 = 536.6 cu-ft and in BMP-2 is V2 = 0.2·1·846 = 169.2 cu-ft. Knowing that the BMP-1 orifice discharges 0.1393 cfs and the BMP-2 orifice discharges 0.02884 cfs, the drying time of 12 inches of amended soil is 1.1 hr for BMP-1 and 1.6 hr for BMP-2.

Total drying time of surface + 12" of amended soil will be: 6.6 hr (BMP-1) and 14.7 hr (BMP-2), less than 24 hr.

DISCHARGE EQUATIONS

1) Weir:
   $Q_W = C_W \cdot L \cdot H^{3/2}$ (1)

2) Slot:

   As an orifice: $Q_s = B_s \cdot h_s \cdot c_g \cdot \sqrt{2g\left(H - \frac{h_s}{2}\right)}$ (2.a)

   As a weir: $Q_s = C_W \cdot B_s \cdot H^{3/2}$ (2.b)

   For H > h_s slot works as weir until orifice equation provides a smaller discharge. The elevation such that equation (2.a) = equation (2.b) is the elevation at which the behavior changes from weir to orifice.

3) Vertical Orifices

   As an orifice: $Q_o = 0.25 \cdot \pi D^2 \cdot c_g \cdot \sqrt{2g\left(H - \frac{D}{2}\right)}$ (3.a)

   As a weir: Critical depth and geometric family of circular sector must be solved to determined Q as a function of H:

$$\frac{Q_O^2}{g} = \frac{A_{cr}^3}{T_{cr}}; \quad H = y_{cr} + \frac{A_{cr}}{2 \cdot T_{cr}}; \; T_{cr} = 2\sqrt{y_{cr}(D - y_{cr})}\,; \quad A_{cr} = \frac{D^2}{8}[\alpha_{cr} - sin(\alpha_{cr})]\,;$$

   $y_{cr} = \frac{D}{2}[1 - sin(0.5 \cdot \alpha_{cr})]$ (3.b.1, 3.b.2, 3.b.3, 3.b.4 and 3.b.5)

   There is a value of H (approximately H = 110% D) from which orifices no longer work as weirs as critical depth is not possible at the entrance of the orifice. This value of H is obtained equaling the discharge using critical equations and equations (3.b).

A mathematical model is prepared with the previous equations depending on the type o discharge.

The following are the variables used above:

Q_W, Q_s, Q_O = Discharge of weir, slot or orifice (cfs)

C_W, c_g : Coefficients of discharge of weir (typically 3.1) and orifice (0.61 to 0.62)

L, B_s, D, h_s : Length of weir, width of slot, diameter of orifice and height of slot, respectively; (ft)

H: Level of water in the pond over the invert of slot, weir or orifice (ft)

A_{cr}, T_{cr}, y_{cr}, α_{cr}: Critical variables for circular sector: area (sq-ft), top width (ft), critical depth (ft), and angle to the center, respectively.

BMP-1

Elevation	h (ft)	Area (ft^2)	Vol (ft^3)
532.1	0	1477.1	0.0
532.35	0.25	1760.3	404.5
532.6	0.5	2054.0	881.0
532.85	0.75	2358.3	1432.3
533.1	1	2683.0	2061.0
533.35	1.25	2998.5	2769.8
533.6	1.5	3334.5	3561.2
533.85	1.75	3681.0	4437.9
534.1	2	4038.1	5402.6
534.35	2.25	4405.7	6457.8
534.6	2.5	4783.9	7606.3
534.85	2.75	5172.7	8850.7
535.1	3	5572.0	10193.5

BMP-2

Elevation	h (ft)	Area (ft^2)	Vol (ft^3)
524.05	0	573.8	0.0
524.3	0.25	660.0	154.1
524.55	0.5	750.8	330.4
524.8	0.75	846.0	529.9
525.05	1	945.8	753.8
525.3	1.25	1050.0	1003.1
525.55	1.5	1158.8	1279.1
525.8	1.75	1272.0	1582.9
526.05	2	1389.8	1915.5
526.3	2.25	1512.0	2278.1

Outlet structure for Discharge of Detention Basin 1

Discharge vs Elevation Table

Lower slot			Emergency Weir 1 (to outlet)		
Invert:	0.000	ft	Invert:	1.667	ft
B	0.938	ft	B:	12	ft
h	0.250	ft			
Upper slot			Emergency Weir 2 (to 48" pipe)		
Invert:	0.500	ft	Invert:	0.833	ft
B:	5.00	ft	B:	12	ft
h	0.250	ft			

h (ft)	**Qslot-low (cfs)**	**Qslot-upp (cfs)**	**Qemer1 (cfs)**	**Qemer2 (cfs)**	**$Q_{tot\text{-}surface}$ (cfs)**	**Qtot (cfs)**
0.000	0.000	0.000	0.000	0.000	0.000	0.139
0.100	0.092	0.000	0.000	0.000	0.092	0.231
0.200	0.260	0.000	0.000	0.000	0.260	0.399
0.300	0.478	0.000	0.000	0.000	0.478	0.617
0.400	0.602	0.000	0.000	0.000	0.602	0.741
0.500	0.703	0.000	0.000	0.000	0.703	0.842
0.600	0.791	0.489	0.000	0.000	1.280	1.419
0.700	0.870	1.385	0.000	0.000	2.255	2.395
0.800	0.943	2.546	0.000	0.000	3.488	3.628
0.900	1.010	3.208	0.000	0.640	4.859	4.998
1.000	1.073	3.747	0.000	2.531	7.351	7.490
1.100	1.133	4.217	0.000	5.123	10.472	10.612
1.200	1.190	4.640	0.000	8.259	14.089	14.228
1.300	1.244	5.027	0.000	**11.859**	18.130	18.269
1.400	1.296	5.386	0.000	**15.868**	22.550	22.690
1.500	1.345	5.724	0.000	**20.249**	27.318	27.457
1.600	1.393	6.042	0.000	**24.972**	32.407	32.546
1.667	1.425	6.246	0.000	**28.316**	35.987	36.126
1.700	1.440	6.344	0.223	**30.014**	38.021	38.160
1.800	1.485	6.633	1.804	**35.356**	45.277	45.417
1.900	1.529	6.909	4.184	**40.981**	53.603	53.742
2.000	1.571	7.175	7.148	**46.877**	62.772	62.911

Outlet structure for Discharge of Detention Basin 2

Discharge vs Elevation Table

Low orifice:	0.5 "		Emergency Weir	
Number:	2		Invert:	1.000 ft
Cg-low:	0.62		B:	8.00 ft
Middle orifice:	0 "			
number of orif:	0			
Cg-middle:	0.62			
invert elev:	4.00 ft			

h (ft)	H/D-low -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qemer (cfs)	$Q_{tot-surface}$ (cfs)	Qtot (cfs)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029
0.042	1.000	0.002	0.002	0.002	0.000	0.002	0.031
0.083	2.000	0.003	0.004	0.003	0.000	0.003	0.032
0.125	3.000	0.004	0.005	0.004	0.000	0.004	0.033
0.167	4.000	0.005	0.008	0.005	0.000	0.005	0.034
0.208	5.000	0.006	0.034	0.006	0.000	0.006	0.035
0.250	6.000	0.006	0.065	0.006	0.000	0.006	0.035
0.292	7.000	0.007	0.071	0.007	0.000	0.007	0.036
0.333	8.000	0.008	0.076	0.008	0.000	0.008	0.036
0.375	9.000	0.008	0.081	0.008	0.000	0.008	0.037
0.417	10.000	0.009	0.085	0.009	0.000	0.009	0.037
0.458	11.000	0.009	0.090	0.009	0.000	0.009	0.038
0.500	12.000	0.009	0.094	0.009	0.000	0.009	0.038
0.542	13.000	0.010	0.098	0.010	0.000	0.010	0.039
0.583	14.000	0.010	0.102	0.010	0.000	0.010	0.039
0.625	15.000	0.011	0.105	0.011	0.000	0.011	0.039
0.667	16.000	0.011	0.109	0.011	0.000	0.011	0.040
0.708	17.000	0.011	0.113	0.011	0.000	0.011	0.040
0.750	18.000	0.012	0.116	0.012	0.000	0.012	0.040
0.792	19.000	0.012	0.119	0.012	0.000	0.012	0.041
0.833	20.000	0.012	0.122	0.012	0.000	0.012	0.041
0.875	21.000	0.013	0.125	0.013	0.000	0.013	0.041
0.917	22.000	0.013	0.128	0.013	0.000	0.013	0.042
0.958	23.000	0.013	0.131	0.013	0.000	0.013	0.042
1.000	24.000	0.013	0.134	0.013	0.000	0.013	0.042
1.042	25.000	0.014	0.137	0.014	0.211	0.225	0.253
1.083	26.000	0.014	0.140	0.014	0.597	0.611	0.639
1.125	27.000	0.014	0.143	0.014	1.096	1.110	1.139
1.167	28.000	0.015	0.145	0.015	1.687	1.702	1.731
1.208	29.000	0.015	0.148	0.015	2.358	2.373	2.402
1.250	30.000	0.015	0.150	0.015	3.100	3.115	3.144
1.292	31.000	0.015	0.153	0.015	3.906	3.922	3.951
1.333	32.000	0.016	0.155	0.016	4.773	4.788	4.817
1.375	33.000	0.016	0.158	0.016	5.695	5.711	5.740
1.417	34.000	0.016	0.160	0.016	6.670	6.686	6.715
1.458	35.000	0.016	0.163	0.016	7.695	7.712	7.740
1.500	36.000	0.017	0.165	0.017	8.768	8.785	8.813

DRAWDOWN TIME OF SURFACE VOLUME (from Crest to Bottom Elevations)

BMP-1

Vol (ft^3)	h (ft)	Q (cfs)	Δt (hr)
10194	3.00	40.19	0.00
9644	2.90	32.25	0.01
9111	2.80	25.23	0.01
8594	2.70	19.37	0.00
8427	2.67	17.82	0.01
8092	2.60	15.27	0.01
7606	2.50	11.86	0.01
7136	2.40	8.98	0.02
6680	2.30	6.82	0.02
6239	2.20	5.97	0.02
5814	2.10	5.49	0.02
5403	2.00	4.96	0.02
5006	1.90	4.36	0.03
4624	1.80	3.63	0.03
4256	1.70	2.39	0.05
3901	1.60	1.42	0.08
3561	1.50	0.84	0.11
3235	1.40	0.74	0.13
2921	1.30	0.62	0.16
2621	1.20	0.40	0.25
2335	1.10	0.23	0.41
2061	1.00	0.14	4.11
0	0.00	0.14	
		T_{TOT} (hr)	**5.5**

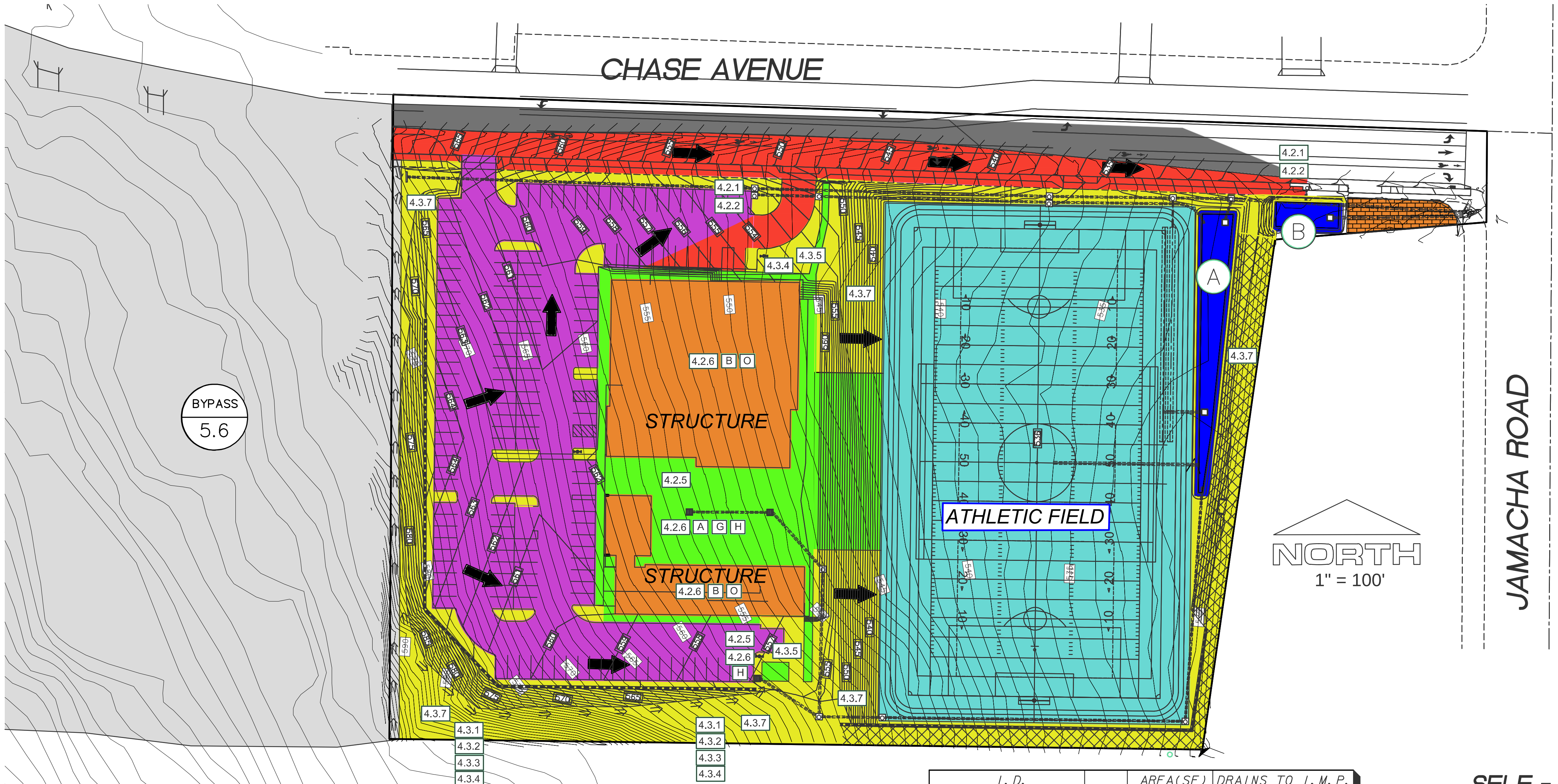
BMP-2

Vol (ft^3)	h (ft)	Q (cfs)	Δt (hr)
2278	2.25	8.81	0.00
2216	2.21	7.74	0.00
2154	2.17	6.72	0.00
2093	2.13	5.74	0.00
2033	2.08	4.82	0.00
1974	2.04	3.95	0.00
1916	2.00	3.14	0.01
1858	1.96	2.40	0.01
1801	1.92	1.73	0.01
1746	1.88	1.14	0.02
1690	1.83	0.64	0.03
1636	1.79	0.25	0.10
1583	1.75	0.04	0.35
1530	1.71	0.04	0.34
1478	1.67	0.04	0.34
1427	1.63	0.04	0.34
1377	1.58	0.04	0.34
1328	1.54	0.04	0.33
1279	1.50	0.04	0.33
1231	1.46	0.04	0.33
1184	1.42	0.04	0.33
1138	1.38	0.04	0.32
1092	1.33	0.04	0.32
1047	1.29	0.04	0.32
1003	1.25	0.04	0.32
960	1.21	0.04	0.32
917	1.17	0.04	0.31
875	1.13	0.04	0.31
834	1.08	0.04	0.31
794	1.04	0.04	0.31
754	1.00	0.04	0.31
715	0.96	0.03	0.31
676	0.92	0.03	0.31
639	0.88	0.03	0.31
602	0.83	0.03	0.32
565	0.79	0.03	0.33
530	0.75	0.03	5.10
0	0.00	0.03	
		T_{TOT} (hr)	**13.1**

ATTACHMENT 5

Pre & Post-Developed Maps, Project Plan and Detention

Section Sketches



EXISTING SITE CONDITIONS

UNDEVELOPED NATIVE LANDSCAPE

SOIL GROUP

WEST HALF OF SITE - VsD (TYPE B)
VISTA COARSE SANDY LOAM
EAST HALF OF SITE - PfC (TYPE D)
PLACENTIA SANDY LOAM

GROUND WATER

NO GROUND WATER OBSERVED AT 15' DEPTH.

CRITICAL COARSE SEDIMENT

NO "STEEP SLOPE LANDS" EXIST ON-SITE. RUN-ON FLOWS WILL BEEN BYPASSED.

A IMP A - BIOFILTRATION BASIN

BOTTOM AREA = 2,054 SF
BMP AREA = 2,683 SF

B IMP B - BIOFILTRATION BASIN

BOTTOM AREA = 660 SF
BMP AREA = 846 SF

SOURCE CONTROL BMPs

- 4.2.1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
- 4.2.2 STORM DRAIN STENCILING OR SIGNAGE
- 4.2.5 PROTECT TRASH STORAGE AREAS
- 4.2.6 A ON-SITE STORM DRAIN INLETS
  - B INTERIOR FLOOR DRAINS, ELEVATOR SHAFTS
  - G FOOD SERVICE
  - H REFUSE AREAS
  - O FIRE SPRINKLER TEST WATER

SITE DESIGN BMPs

- 4.3.1 MAINTAIN NATURAL DRAINAGE
- 4.3.2 CONSERVE NATURAL AREAS
- 4.3.3 MINIMIZE IMPERVIOUS AREA
- 4.3.4 MINIMIZE SOIL COMPACTION
- 4.3.5 IMPERVIOUS AREA DISPERSION
- 4.3.7 DROUGHT TOLERANT LANDSCAPING

I.D.		AREA(SF)	DRAINS TO I.M.P.
PARKING (N)		29,985	A
PARKING (S)		24,474	A
LANDSCAPE		65,073	A
LANDSCAPE		11,241	SELF-MITIGATING
HARDSCAPE(CONC)		26,351	A
ROOF		27,149	A
FIELD AREA		94,694	A
ROAD		22,258	B
OFF-SITE(RD)		13,137	B
PERMEABLE PAVING		1,800	SELF RET.
		314,362	

SELF - MITIGATING AREAS:

- VEGETATION IN THE NATURAL OR LANDSCAPED AREA IS NATIVE AND/OR NON-NATIVE/NON-INVASIVE DROUGHT TOLERANT SPECIES THAT DO NOT REQUIRE REGULAR APPLICATION OF FERTILIZERS AND PESTISIDES.

- SOILS ARE UNDISTURBED NATIVE TOPSOIL, OR DISTURBED SOILS THAT HAVE BEEN AMENDED PER SD-F

- THE INCIDENTAL IMPERVIOUS AREAS ARE LESS THAN 5 PERCENT OF THE SELF-MITIGATING AREA.

- IMPERVIOUS AREA WITHIN THE SELF-MITIGATED AREA SHOULD NOT BE HYDRAULICALLY CONNECTED TO OTHER IMPERVIOUS AREAS UNLESS IT IS A STORM WATER CONVEYANCE SYSTEM (SUCH AS A BROW DITCH).

- THE SELF-MITIGATING AREA IS HYDRAULICALLY SEPARATE FROM DMAs THAT CONTAIN PERMANENT STORM WATER POLLUTANT CONTROL BMPs.

KARN

DMA EXHIBIT

PAGE 1 OF 2

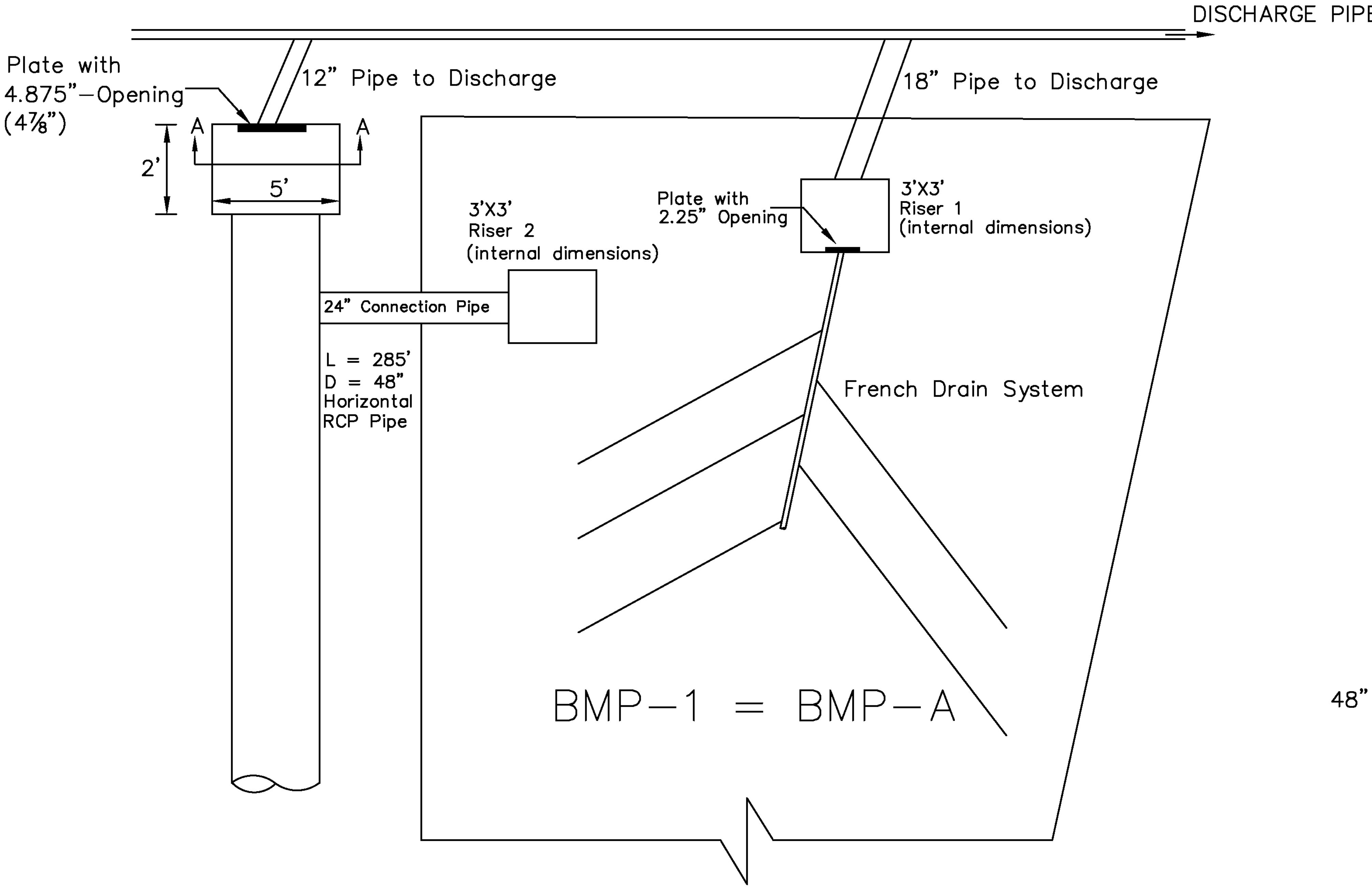
LIBERTY CHARTER HIGH SCHOOL

APRIL 30, 2017

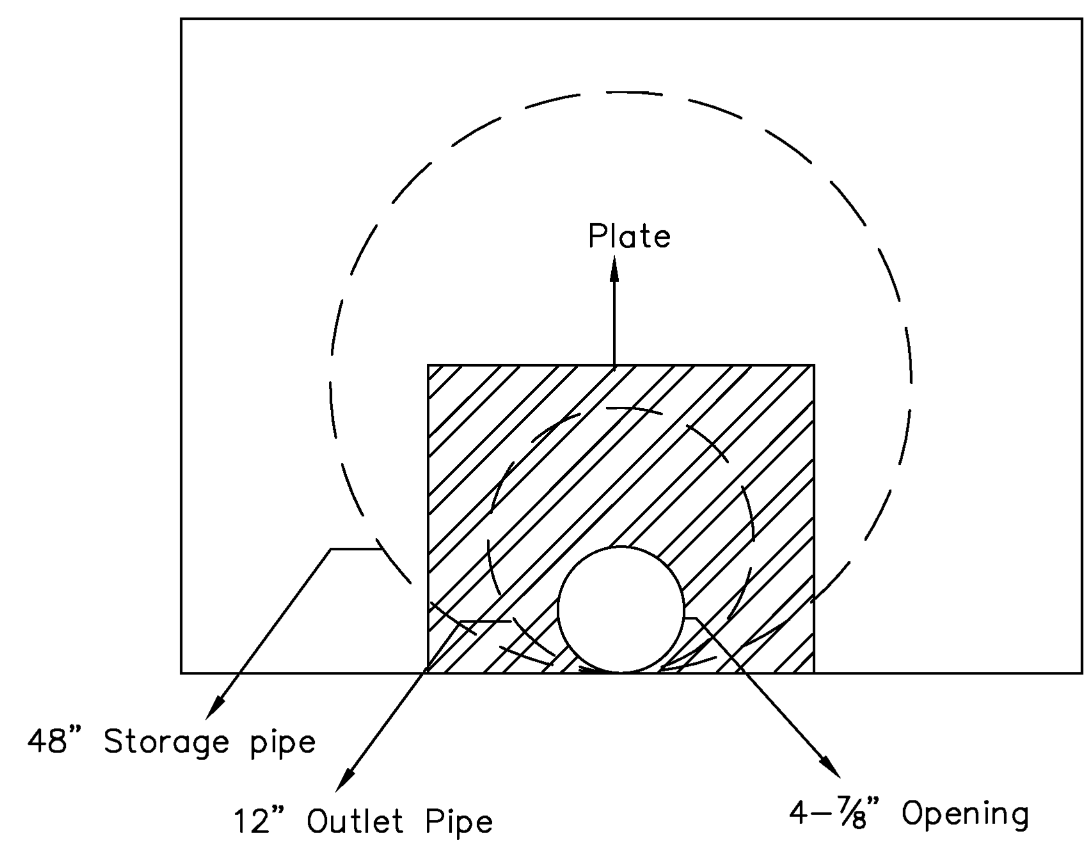
I:\9323\DMA EXHIBIT

BMP BASIN 1 PLAN VIEW

NOT TO SCALE

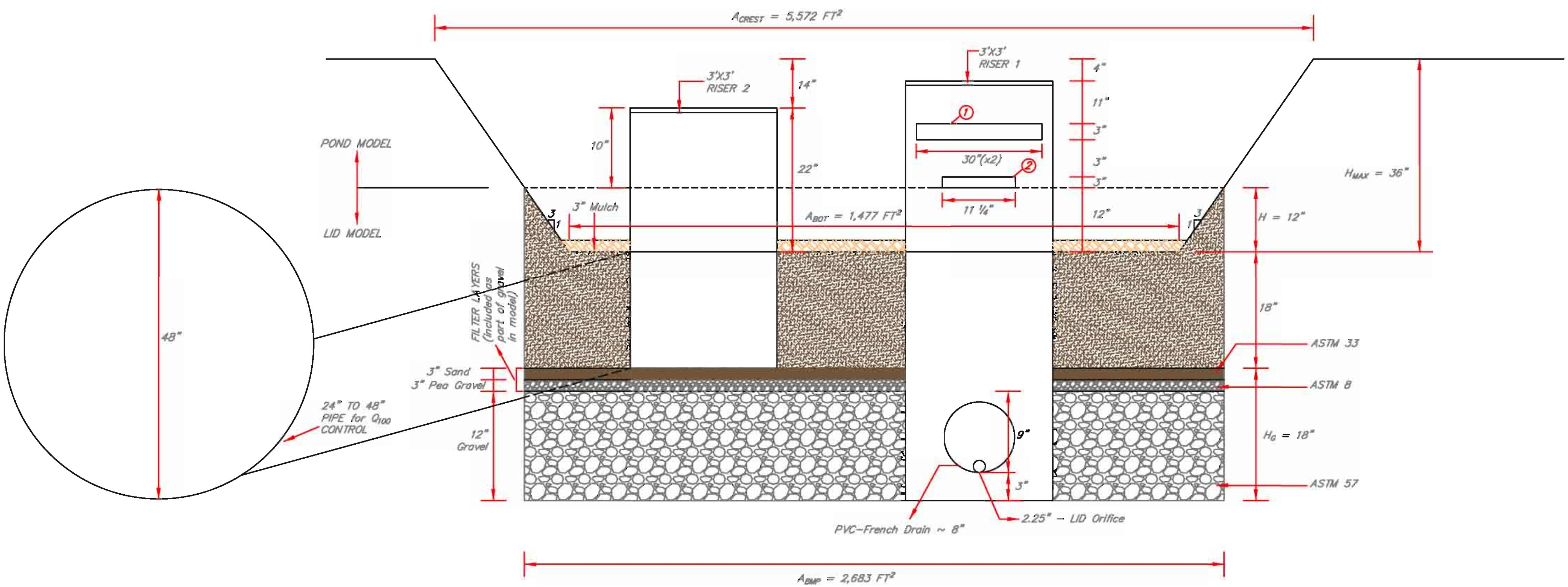


Section A–A



BMP BASIN 1 DETAIL

(NOT TO SCALE)

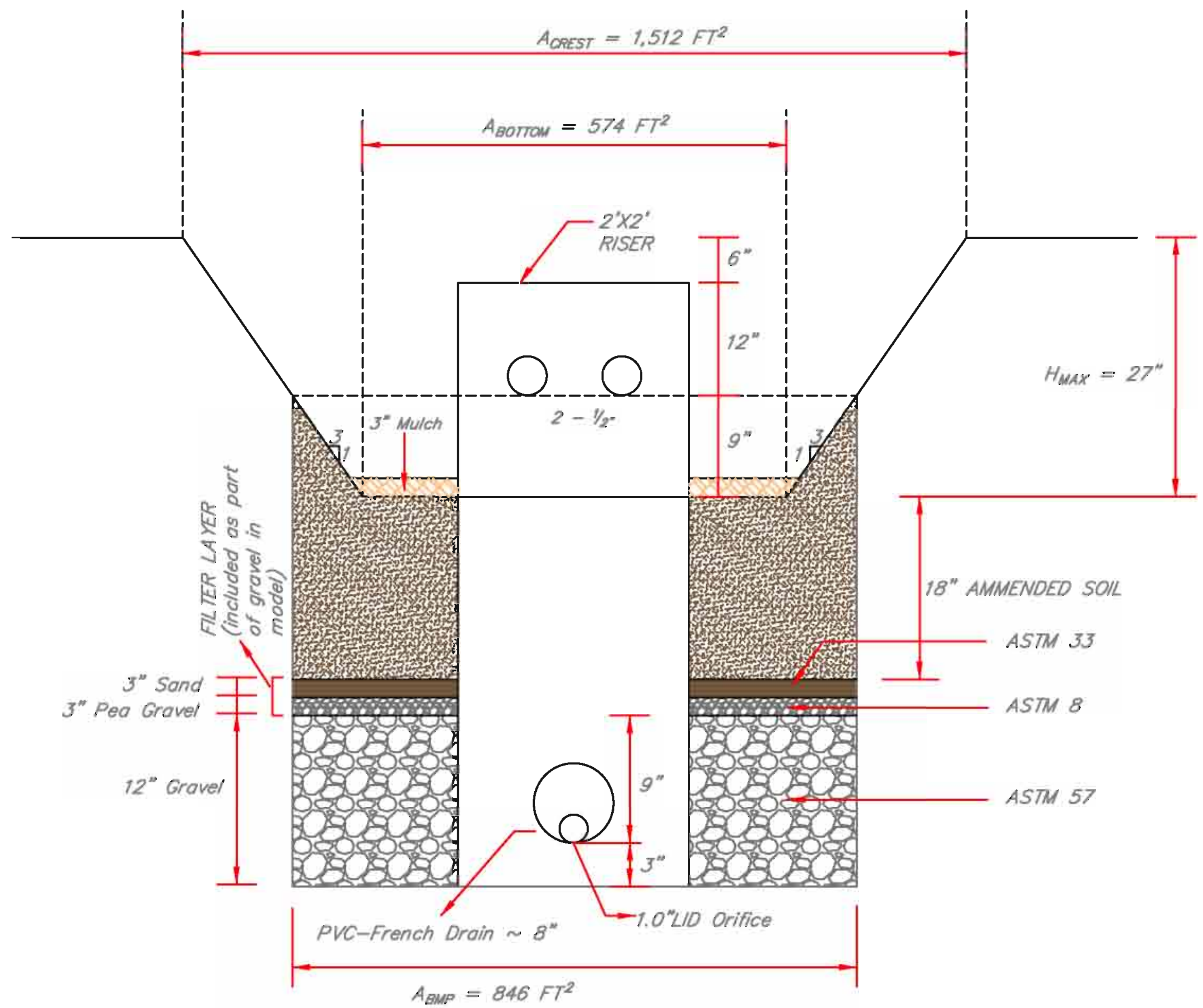


NOTES: 1 : 2 slots 30" x 3" each to be placed at elevation indicated, each on opposite side of riser.

2 : Only 1 slot (11 ¼"x2") needed at this elevation.

BMP BASIN 2 DETAIL

(NOT TO SCALE)



ATTACHMENT 6

SWMM Input Data in Input Format (Existing & Proposed Models)

PRE_DEV

```
[TITLE]

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           09/09/1964
START_TIME           00:00:00
REPORT_START_DATE    09/09/1964
REPORT_START_TIME    00:00:00
END_DATE             09/08/2008
END_TIME             23:00:00
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
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

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

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
KEARNY_MESA      INTENSITY 1:00   1.0    TIMESERIES KEARNY_MESA

[SUBCATCHMENTS]
;;                                                Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- -------
-
DMA-all-SoilB    KEARNY_MESA      POC-1            3.344    0        367      11.5     0
DMA-all-SoilD    KEARNY_MESA      POC-1            3.652    0        394      7.5      0
DMA--off-B       KEARNY_MESA      POC-1            0.063    100      40       6        0
DMA-off-D        KEARNY_MESA      POC-1            0.239    100      40       6        0
DMA-off-perv     KEARNY_MESA      POC-1            0.041    0        60       2        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-all-SoilB    0.012      0.05       0.02       0.1        25         OUTLET
DMA-all-SoilD    0.012      0.05       0.02       0.1        25         OUTLET
DMA--off-B       0.012      0.05       0.02       0.1        25         OUTLET
DMA-off-D        0.012      0.05       0.02       0.1        25         OUTLET
DMA-off-perv     0.012      0.05       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
DMA-all-SoilB    3          0.2        0.32
DMA-all-SoilD    9          0.025      0.3
DMA--off-B       3.0        0.15       0.32
DMA-off-D        3.0        0.15       0.32
DMA-off-perv     9          0.01875    0.3
```

```
[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC-1            0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
KEARNY_MESA      FILE "Kearny Mesa.txt"

[REPORT]
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
;;-------------- ------------------ ------------------
POC-1            2500.000           2700.000

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-all-SoilB    2436.343           6053.241
DMA-all-SoilB    2436.343           6053.241
DMA-all-SoilD    4484.954           5960.648
DMA--off-B       618.990            5372.596
DMA-off-D        679.669            4101.655
DMA-off-D        691.489            4125.296
DMA-off-perv     4600.000           4000.000

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
KEARNY_MESA      1515.305           6866.060
```

POST_DEV

```
[TITLE]

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           09/09/1964
START_TIME           00:00:00
REPORT_START_DATE    09/09/1964
REPORT_START_TIME    00:00:00
END_DATE             09/08/2008
END_TIME             23:00:00
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
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

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

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
KEARNY_MESA      INTENSITY 1:00   1.0    TIMESERIES KEARNY_MESA

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
DMA-1-SoilB      KEARNY_MESA      BR-1             3.228    56.2     175      1.5      0
DMA-1-SoilD      KEARNY_MESA      BR-1             2.918    22.8     362      1.5      0
DMA-2-SoilD      KEARNY_MESA      BR-2             0.892    71.1     89       4        0
BR-1             KEARNY_MESA      DIV-1            0.061593 0        10       0        0
BR-2             KEARNY_MESA      DIV-2            0.01942  0        10       0        0
DMA-2-soilB      KEARNY_MESA      BR-2             0.179    100      89       4        0
DMA-pavers       KEARNY_MESA      POC-1            0.041    0        60       2        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1-SoilB      0.012      0.05       0.05       0.1        25         OUTLET
DMA-1-SoilD      0.012      0.05       0.05       0.1        25         OUTLET
DMA-2-SoilD      0.012      0.05       0.05       0.1        25         OUTLET
BR-1             0.012      0.05       0.02       0.1        25         PERVIOUS   100
BR-2             0.012      0.05       0.05       0.1        25         PERVIOUS   100
DMA-2-soilB      0.012      0.05       0.05       0.1        25         OUTLET
DMA-pavers       0.012      0.05       0.05       1.6        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
DMA-1-SoilB      3          0.15       0.32
DMA-1-SoilD      9          0.01875    0.3
DMA-2-SoilD      9          0.01875    0.3
BR-1             9          0.01875    0.3
BR-2             9          0.01875    0.3
DMA-2-soilB      3          0.15       0.32
DMA-pavers       9          0.01875    0.3
```

POST_DEV

```
[LID_CONTROLS]
;;               Type/Layer Parameters
;;-------------- ---------- ----------
BR-1             BC
BR-1             SURFACE    9.21       0.05       0          0          5
BR-1             SOIL       18         0.4        0.2        0.1        5          5          1.5
BR-1             STORAGE    18         0.67       0.01875    0
BR-1             DRAIN      0.6283     0.5        3          6

BR-2             BC
BR-2             SURFACE    7.52       0.05       0.0        0.0        5
BR-2             SOIL       18         0.4        0.2        0.1        5          5          1.5
BR-2             STORAGE    18         0.67       0.01875    0
BR-2             DRAIN      0.3936     0.5        3          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv     Report File
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- -----------
BR-1             BR-1             1       2683       0          0          100        0
BR-2             BR-2             1       846        0          0          100        0

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC-1            0          FREE                        NO

[DIVIDERS]
;;               Invert     Diverted         Divider
;;Name           Elev.      Link             Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
DIV-1            0          BYPASS-1         CUTOFF     0.141      0          0          0          0
DIV-2            0          BYPASS-2         CUTOFF     0.0291     0          0          0          0

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                 Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                                Area     Frac.    Infiltration Parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- --------------------------
BASIN-1          0        2        0        TABULAR    BASIN-1                               5490     1        6        0.3075   0.3
BASIN-2          0        1.5      0        TABULAR    BASIN-2                               945      1

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
BYPASS-2         DIV-2            BASIN-2          10         0.01       0          0          0          0
U-DRAIN2         DIV-2            POC-1            10         0.01       0          0          0          0
BYPASS-1         DIV-1            BASIN-1          10         0.01       0          0          0          0
U-DRAIN1         DIV-1            POC-1            10         0.01       0          0          0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet          Qcoeff/                     Flap
;;Name           Node             Node             Height     Type            QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ---------- ----
OUTLET-1         BASIN-1          POC-1            0          TABULAR/DEPTH   OUT-1                       NO
OUTLET-2         BASIN-2          POC-1            0          TABULAR/DEPTH   OUT-2                       NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
BYPASS-2         DUMMY        0                0          0          0          1
U-DRAIN2         CIRCULAR     1                0          0          0          1
BYPASS-1         DUMMY        0                0          0          0          1
U-DRAIN1         DUMMY        0                0          0          0          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate
;;-------------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
OUT-1            Rating     0.000      0.000
OUT-1                       0.100      0.092
OUT-1                       0.200      0.260
OUT-1                       0.300      0.478
OUT-1                       0.400      0.602
OUT-1                       0.500      0.703
OUT-1                       0.600      1.280
```

```
OUT-1                           0.700      2.255
OUT-1                           0.800      3.488
OUT-1                           0.900      4.859
OUT-1                           1.000      7.351
OUT-1                           1.100      10.472
OUT-1                           1.200      14.089
OUT-1                           1.300      18.130
OUT-1                           1.400      22.550
OUT-1                           1.500      27.318
OUT-1                           1.600      32.407
OUT-1                           1.667      35.987
OUT-1                           1.700      38.021
OUT-1                           1.800      45.277
OUT-1                           1.900      53.603
OUT-1                           2.000      62.772

OUT-2            Rating         0.000      0.000
OUT-2                           0.042      0.002
OUT-2                           0.083      0.003
OUT-2                           0.125      0.004
OUT-2                           0.167      0.005
OUT-2                           0.208      0.006
OUT-2                           0.250      0.006
OUT-2                           0.292      0.007
OUT-2                           0.333      0.008
OUT-2                           0.375      0.008
OUT-2                           0.417      0.009
OUT-2                           0.458      0.009
OUT-2                           0.500      0.009
OUT-2                           0.542      0.010
OUT-2                           0.583      0.010
OUT-2                           0.625      0.011
OUT-2                           0.667      0.011
OUT-2                           0.708      0.011
OUT-2                           0.750      0.012
OUT-2                           0.792      0.012
OUT-2                           0.833      0.012
OUT-2                           0.875      0.013
OUT-2                           0.917      0.013
OUT-2                           0.958      0.013
OUT-2                           1.000      0.013
OUT-2                           1.042      0.225
OUT-2                           1.083      0.611
OUT-2                           1.125      1.110
OUT-2                           1.167      1.702
OUT-2                           1.208      2.373
OUT-2                           1.250      3.115
OUT-2                           1.292      3.922
OUT-2                           1.333      4.788
OUT-2                           1.375      5.711
OUT-2                           1.417      6.686
OUT-2                           1.458      7.712
OUT-2                           1.500      8.785

BASIN-1          Storage        0          2683
BASIN-1                         0.75       3681
BASIN-1                         2          5490

BASIN-2          Storage        0          846
BASIN-2                         0.5        1050
BASIN-2                         1.5        1512

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
KEARNY_MESA      FILE "Kearny Mesa.txt"

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
```

POST_DEV

```
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            4062.500           1375.000
DIV-1            2026.786           3946.429
DIV-2            5794.643           3910.714
BASIN-1          991.071            2464.286
BASIN-2          7042.824           2615.741

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1-SoilB      892.428            6063.702
DMA-1-SoilB      892.428            6063.702
DMA-1-SoilD      2286.659           6021.635
DMA-2-SoilD      5820.313           5859.375
BR-1             1705.357           5196.429
BR-2             5804.398           4918.981
DMA-2-soilB      7424.880           5715.144
DMA-pavers       3800.000           5000.000

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
KEARNY_MESA      4708.534           4182.692
```

ATTACHMENT 7

EPA SWMM FIGURES AND EXPLANATIONS

Per the attached, the reader can see the screens associated with the EPA-SWMM Model in both pre-development and post-development conditions. Each portion, i.e., sub-catchments, outfalls, storage units, weir as a discharge, and outfalls (point of compliance), are also shown.

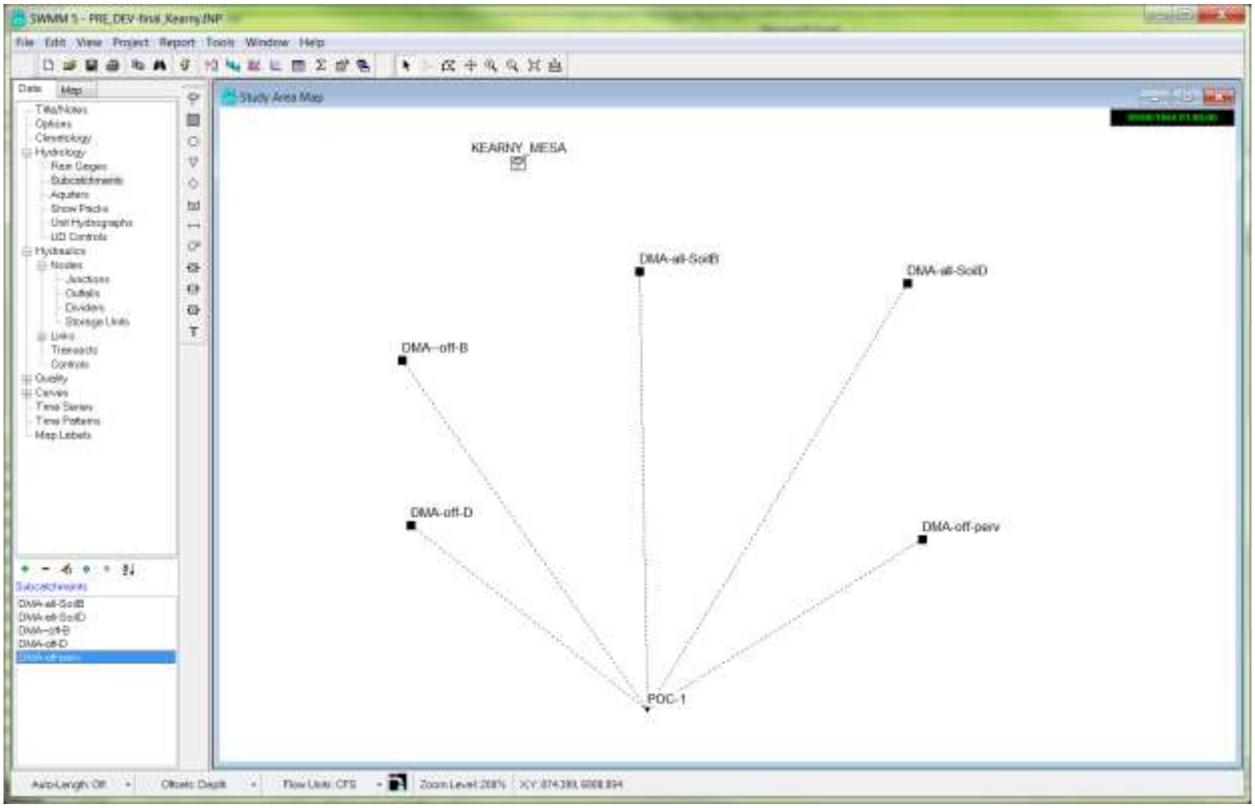
Variables for modeling are associated with typical recommended values by the EPA-SWMM model, typical values found in technical literature (such as Maidment's Handbook of Hydrology). Recommended values for the SWMM model have been attained from the interim Orange County criteria established for their SWMM calibration. Currently, no recommended values have been established by the San Diego County HMP Permit for the SWMM Model.

Soil characteristics of the existing soils were determined from the NRCS Web Soil Survey Exhibit and site specific geotechnical investigation (located in Attachment 8 of this report).

Some values incorporated within the SWMM model have been determined from the professional experience of REC using conservative assumptions that have a tendency to increase the size of the needed BMP and also generate a long-term runoff as a percentage of rainfall similar to those measured in gage stations in Southern California by the USGS.

A Technical document prepared by Tory R Walker Engineering for the Cities of San Marcos, Oceanside and Vista (Reference [1]) can also be consulted for additional information regarding typical values for SWMM parameters.

PRE-DEVELOPED CONDITION



Rain Gage KEARNY_MESA

Property	Value
Name	KEARNY_MESA
X-Coordinate	1515.305
Y-Coordinate	6866.060
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	KEARNY_MESA
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	2500.000
Y-Coordinate	2700.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfal	
Series Name	*

Select YES if outfall contains a tide gate to prevent backflow

Subcatchment DMA-all-SoilB

Property	Value
Name	DMA-all-SoilB
X-Coordinate	2436.343
Y-Coordinate	6053.241
Description	...
Tag	
Rain Gage	KEARNY_MESA
Outlet	POC-1
Area	3.344
Width	367
% Slope	11.5
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.02
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Subcatchment DMA-all-SoilD

Property	Value
Name	DMA-all-SoilD
X-Coordinate	4484.954
Y-Coordinate	5960.648
Description	...
Tag	
Rain Gage	KEARNY_MESA
Outlet	POC-1
Area	3.652
Width	394
% Slope	7.5
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.02
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	3
Conductivity	0.2
Initial Deficit	0.32

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.025
Initial Deficit	0.3

Subcatchment DMA--off-B

Property	Value
Name	DMA--off-B
X-Coordinate	618.990
Y-Coordinate	5372.596
Description	...
Tag	
Rain Gage	KEARNY_MESA
Outlet	POC-1
Area	0.063
Width	40
% Slope	6
% Imperv	100
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.02
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Subcatchment DMA-off-D

Property	Value
Name	DMA-off-D
X-Coordinate	685.579
Y-Coordinate	4113.476
Description	...
Tag	
Rain Gage	KEARNY_MESA
Outlet	POC-1
Area	0.239
Width	40
% Slope	6
% Imperv	100
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.02
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Infiltration Editor

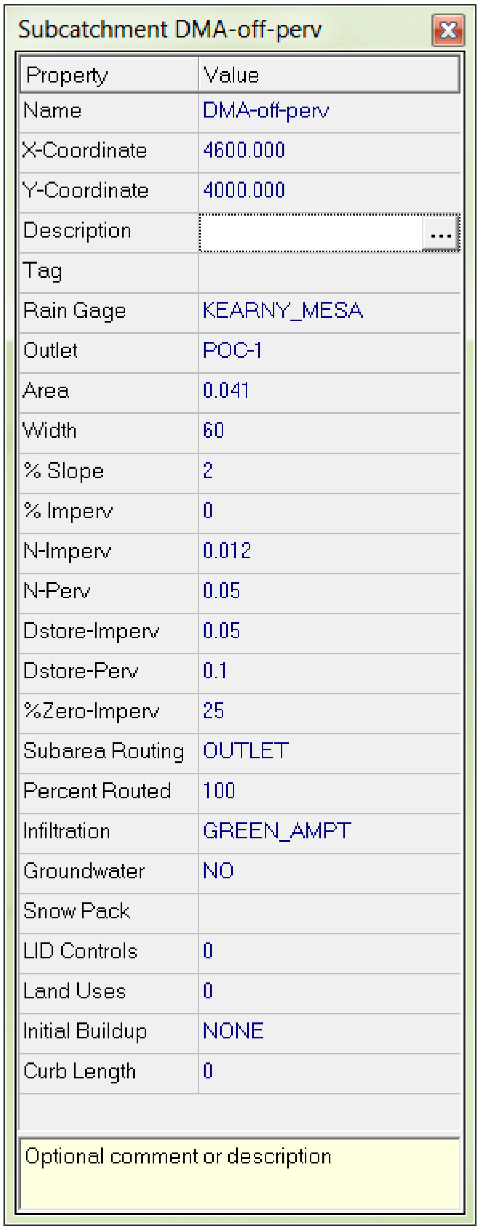
Infiltration Method: GREEN_AMPT

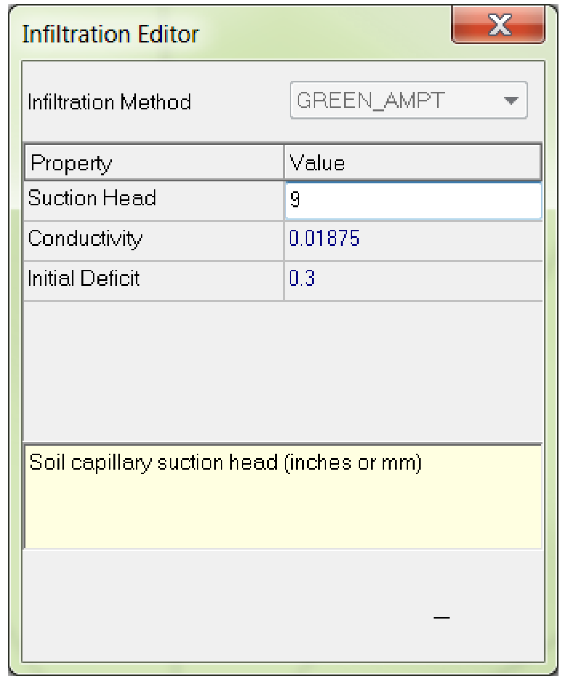
Property	Value
Suction Head	3.0
Conductivity	0.15
Initial Deficit	0.32

Infiltration Editor

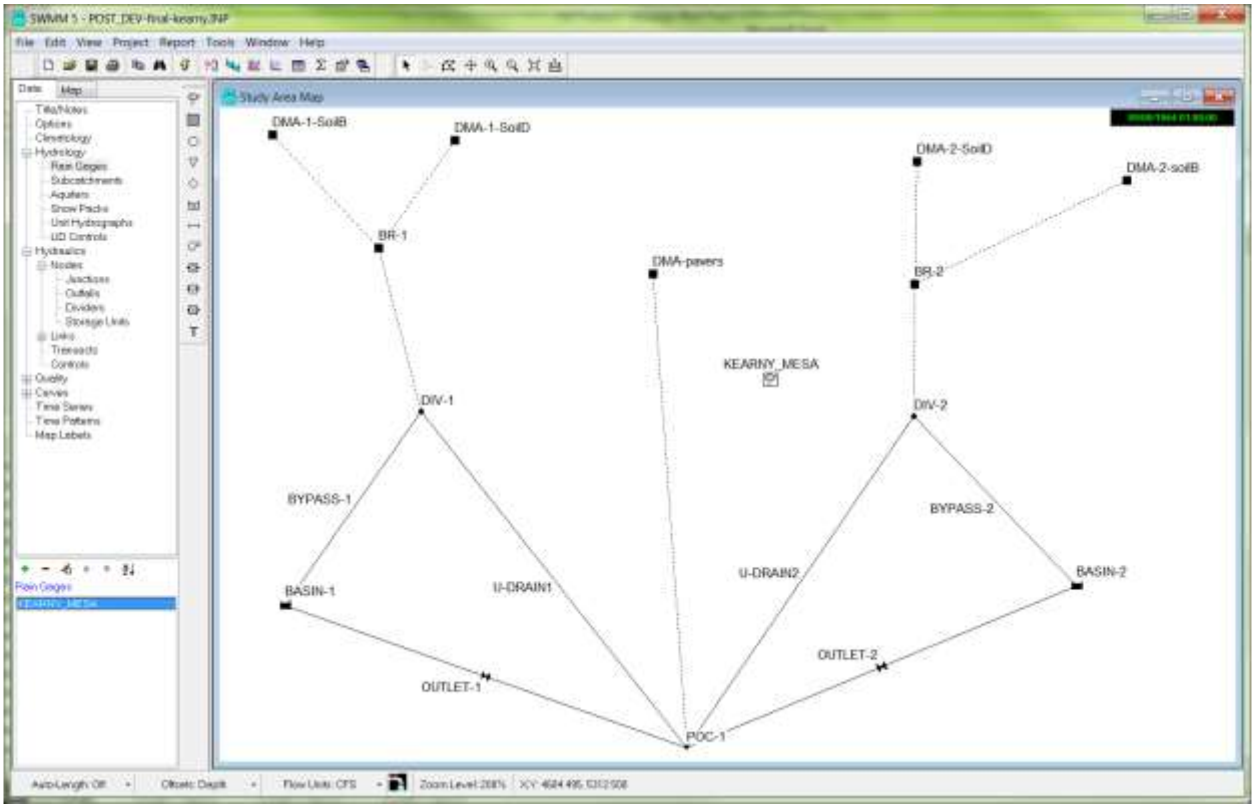
Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	3.0
Conductivity	0.15
Initial Deficit	0.32


Subcatchment DMA-off-perv
Property
Value
Name
DMA-off-perv
X-Coordinate
4600.000
Y-Coordinate
4000.000
Description
Tag
Rain Gage
KEARNY_MESA
Outlet
POC-1
Area
0.041
Width
60
% Slope
2
% Imperv
0
N-Imperv
0.012
N-Perv
0.05
Dstore-Imperv
0.05
Dstore-Perv
0.1
%Zero-Imperv
25
Subarea Routing
OUTLET
Percent Routed
100
Infiltration
GREEN_AMPT
Groundwater
NO
Snow Pack
LID Controls
0
Land Uses
0
Initial Buildup
NONE
Curb Length
0
Optional comment or description


Infiltration Editor
Infiltration Method
GREEN_AMPT
Property
Value
Suction Head
9
Conductivity
0.01875
Initial Deficit
0.3
Soil capillary suction head (inches or mm)

POST-DEVELOPED CONDITION



Rain Gage KEARNY_MESA

Property	Value
Name	KEARNY_MESA
X-Coordinate	2116.071
Y-Coordinate	8303.571
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	KEARNY_MESA
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	4062.500
Y-Coordinate	1375.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall

Subcatchment DMA-1-SoilB

Property	Value
Name	DMA-1-SoilB
X-Coordinate	892.428
Y-Coordinate	6063.702
Description	...
Tag	
Rain Gage	KEARNY_MESA
Outlet	BR-1
Area	3.228
Width	175
% Slope	1.5
% Imperv	56.2
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Subcatchment DMA-1-SoilD

Property	Value
Name	DMA-1-SoilD
X-Coordinate	2286.659
Y-Coordinate	6021.635
Description	...
Tag	
Rain Gage	KEARNY_MESA
Outlet	BR-1
Area	2.918
Width	362
% Slope	1.5
% Imperv	22.8
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	3
Conductivity	0.15
Initial Deficit	0.32

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.3

Subcatchment DMA-2-SoilD

Property	Value
Name	DMA-2-SoilD
X-Coordinate	5820.313
Y-Coordinate	5859.375
Description	
Tag	
Rain Gage	KEARNY_MESA
Outlet	BR-2
Area	0.892
Width	89
% Slope	4
% Imperv	71.1
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Subcatchment DMA-2-soilB

Property	Value
Name	DMA-2-soilB
X-Coordinate	7424.880
Y-Coordinate	5715.144
Description	
Tag	
Rain Gage	KEARNY_MESA
Outlet	BR-2
Area	0.179
Width	89
% Slope	4
% Imperv	100
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Optional comment or description

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.3

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	3
Conductivity	0.15
Initial Deficit	0.32

Subcatchment BR-1

Property	Value
Name	BR-1
X-Coordinate	1705.357
Y-Coordinate	5196.429
Description	
Tag	
Rain Gage	KEARNY_MESA
Outlet	DIV-1
Area	0.061593
Width	10
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.02
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	PERVIOUS
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Subcatchment BR-2

Property	Value
Name	BR-2
X-Coordinate	5804.398
Y-Coordinate	4918.981
Description	
Tag	
Rain Gage	KEARNY_MESA
Outlet	DIV-2
Area	0.01942
Width	10
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.05
Dstore-Imperv	0.05
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	PERVIOUS
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Infiltration Editor

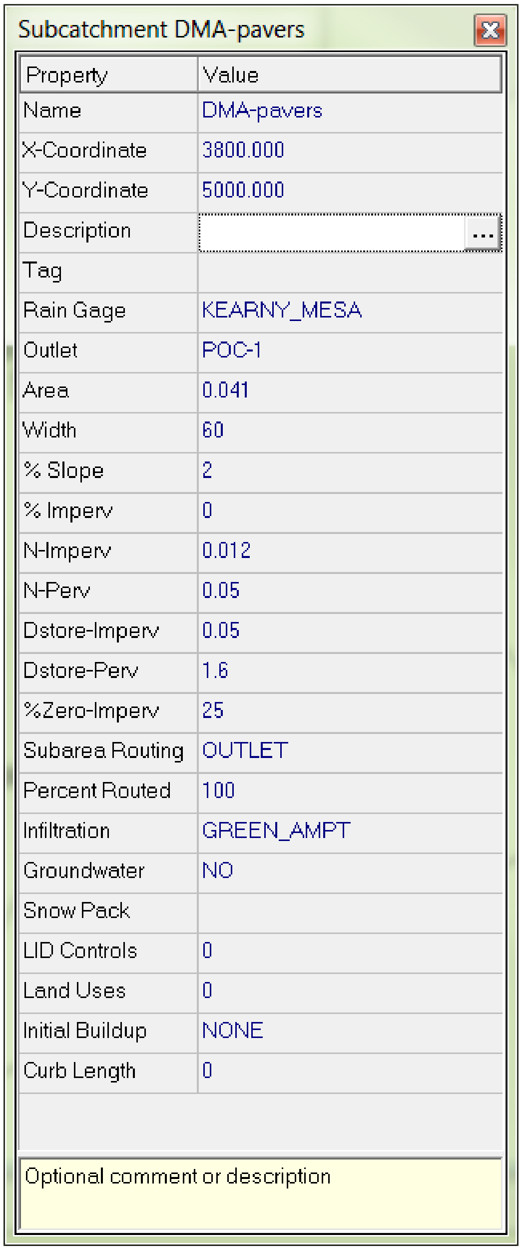
Infiltration Method: GREEN_AMPT

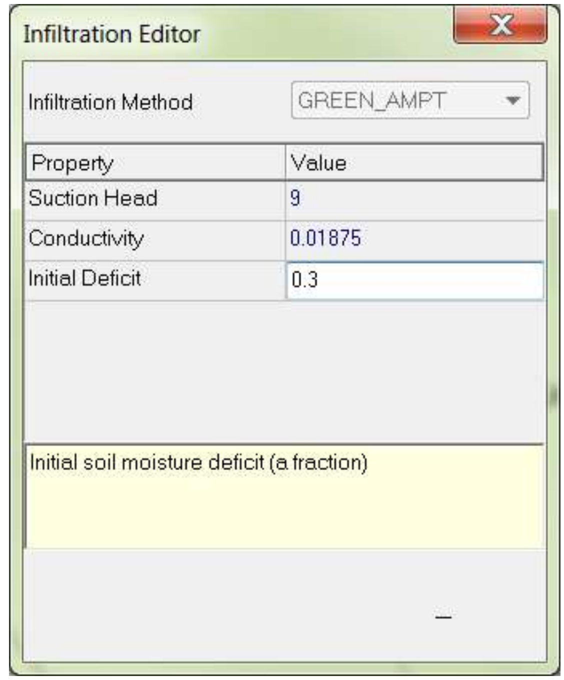
Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.3

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.3


Subcatchment DMA-pavers
Property
Value
Name
DMA-pavers
X-Coordinate
3800.000
Y-Coordinate
5000.000
Description
...
Tag
Rain Gage
KEARNY_MESA
Outlet
POC-1
Area
0.041
Width
60
% Slope
2
% Imperv
0
N-Imperv
0.012
N-Perv
0.05
Dstore-Imperv
0.05
Dstore-Perv
1.6
%Zero-Imperv
25
Subarea Routing
OUTLET
Percent Routed
100
Infiltration
GREEN_AMPT
Groundwater
NO
Snow Pack
LID Controls
0
Land Uses
0
Initial Buildup
NONE
Curb Length
0
Optional comment or description


Infiltration Editor
Infiltration Method
GREEN_AMPT
Property
Value
Suction Head
9
Conductivity
0.01875
Initial Deficit
0.3
Initial soil moisture deficit (a fraction)

EXPLANATION OF SELECTED VARIABLES

<u>Sub-Catchment Areas:</u>

Please refer to the attached diagrams that indicate the DMA and Bio-Retention BMP (BMP) sub areas modeled within the project site at both the pre and post developed conditions draining to the POC.

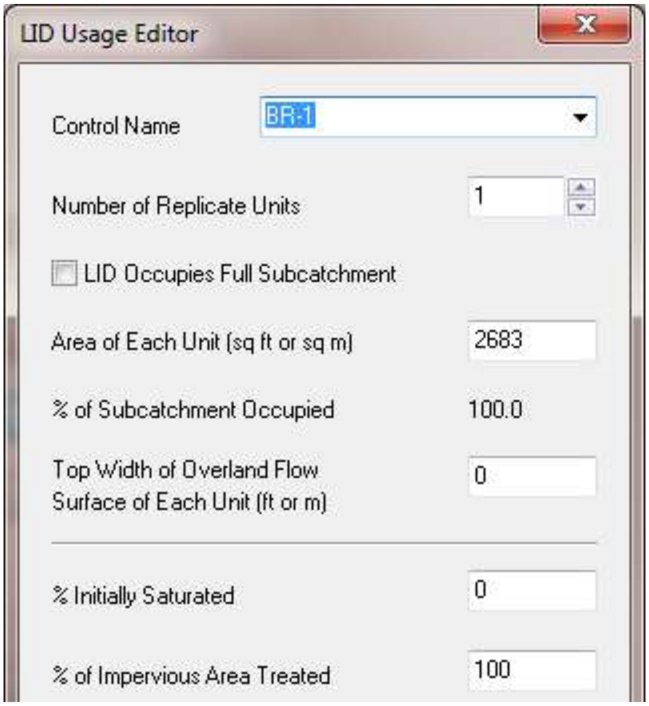
Parameters for the pre- and post-developed models include soil types B & D as determined from the site specific Natural Resources Conservation Service (NRCS) and geologic review (attached at the end of this appendix). Suction head, conductivity and initial deficit corresponds to average values expected for these soils types, according to sources consulted, professional experience, and approximate values obtained by the interim Orange County modeling approach.

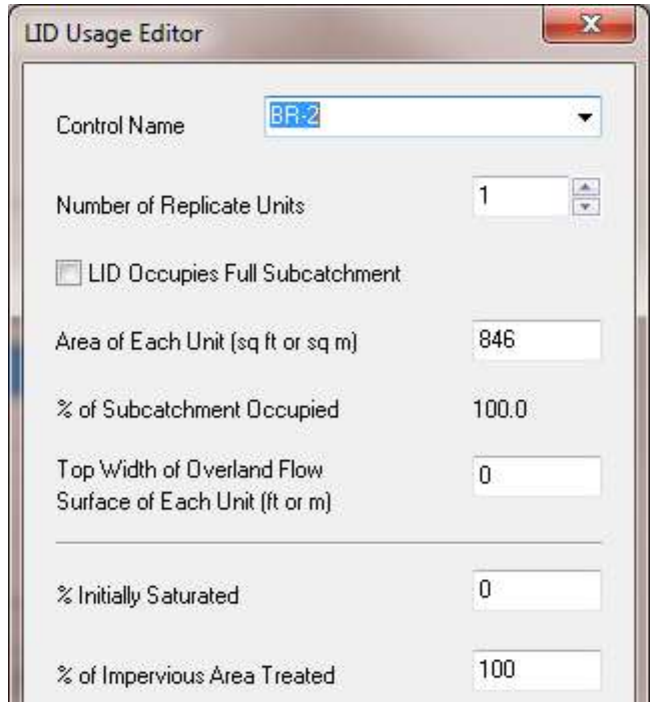
REC selected infiltration values, such that the percentage of total precipitation that becomes runoff is realistic for the soil types and slightly smaller than measured values for Southern California watersheds.

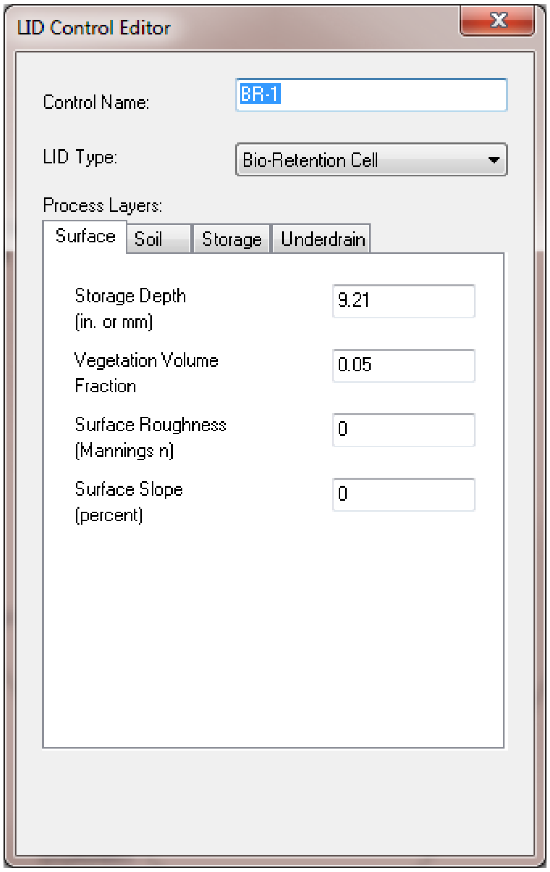
Selection of a Kinematic Approach: As the continuous model is based on hourly rainfall, and the time of concentration for the pre-development and post-development conditions is significantly smaller than 60 minutes, precise routing of the flows through the impervious surfaces, the underdrain pipe system,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

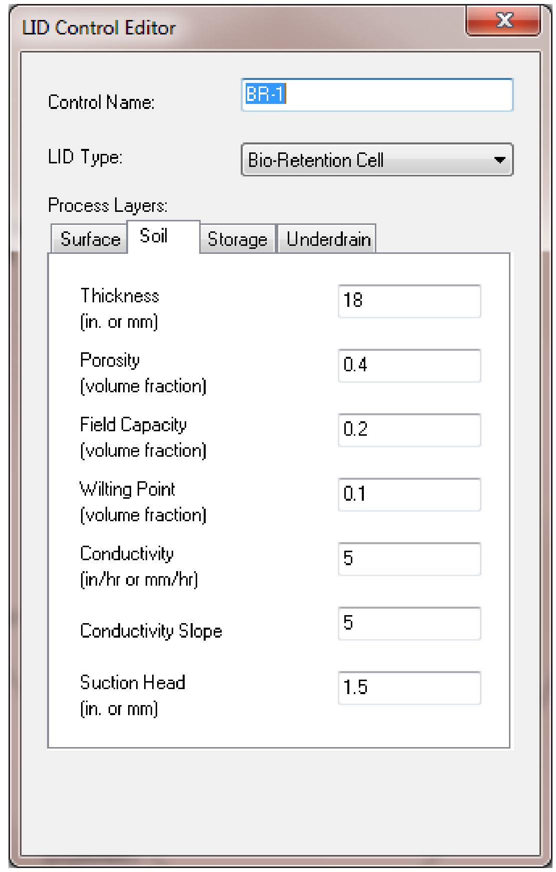
<u>Sub-Catchment BMP:</u>

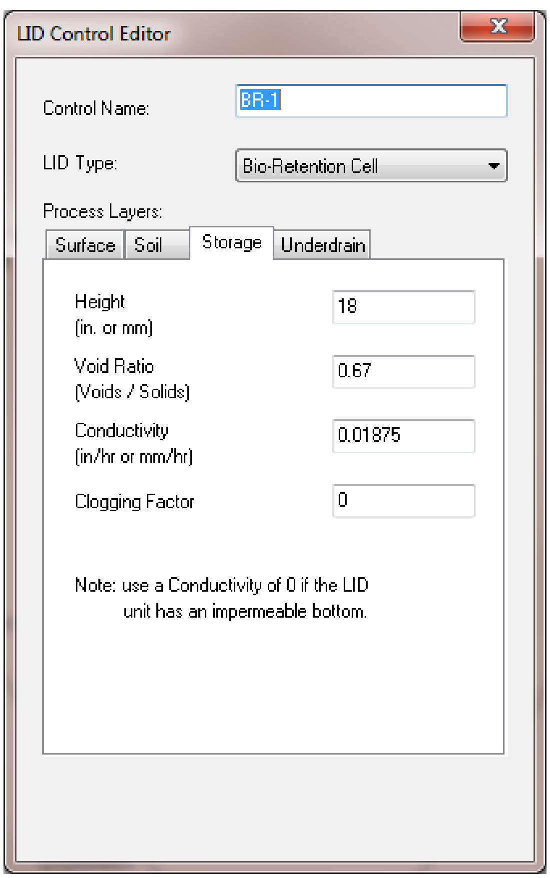
The area of bio-filtration must be equal to the area of the development tributary to the bioretention facility (area that drains into the biofiltration, equal external area plus bio-filtration itself). Five (5) decimal places were given regarding the areas of the bio-filtration to insure that the area used by the program for the LID subroutine corresponds exactly with this tributary.

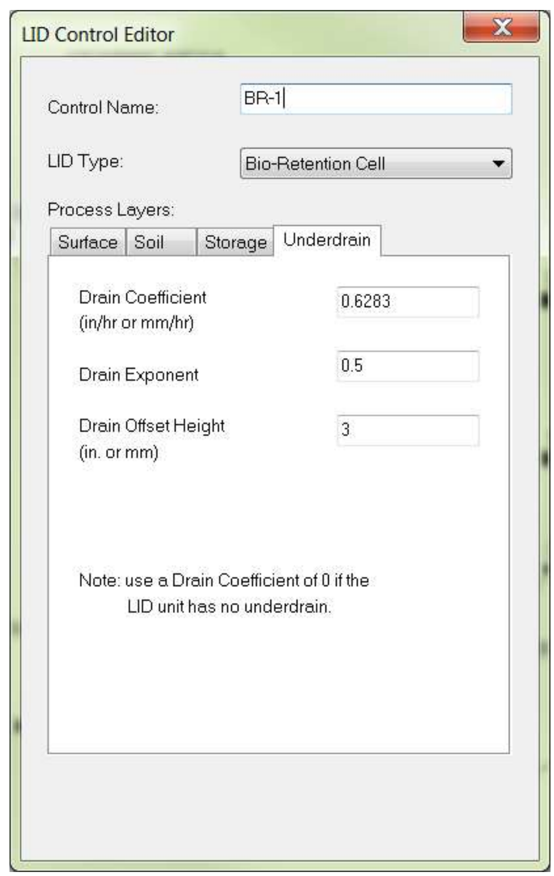

LID Usage Editor
Control Name
BR-1
Number of Replicate Units
1
LID Occupies Full Subcatchment
Area of Each Unit (sq ft or sq m)
2683
% of Subcatchment Occupied
100.0
Top Width of Overland Flow Surface of Each Unit (ft or m)
0
% Initially Saturated
0
% of Impervious Area Treated
100

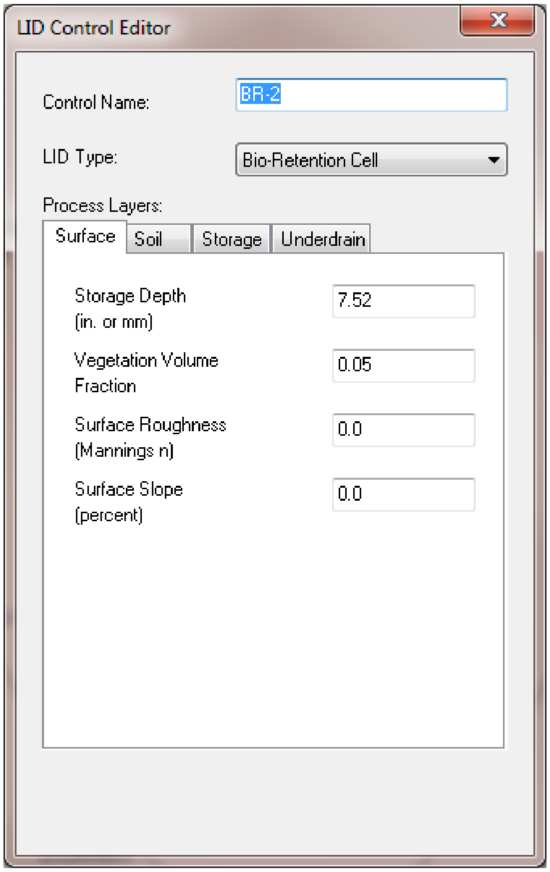

LID Usage Editor
Control Name
BR-2
Number of Replicate Units
1
LID Occupies Full Subcatchment
Area of Each Unit (sq ft or sq m)
846
% of Subcatchment Occupied
100.0
Top Width of Overland Flow Surface of Each Unit (ft or m)
0
% Initially Saturated
0
% of Impervious Area Treated
100

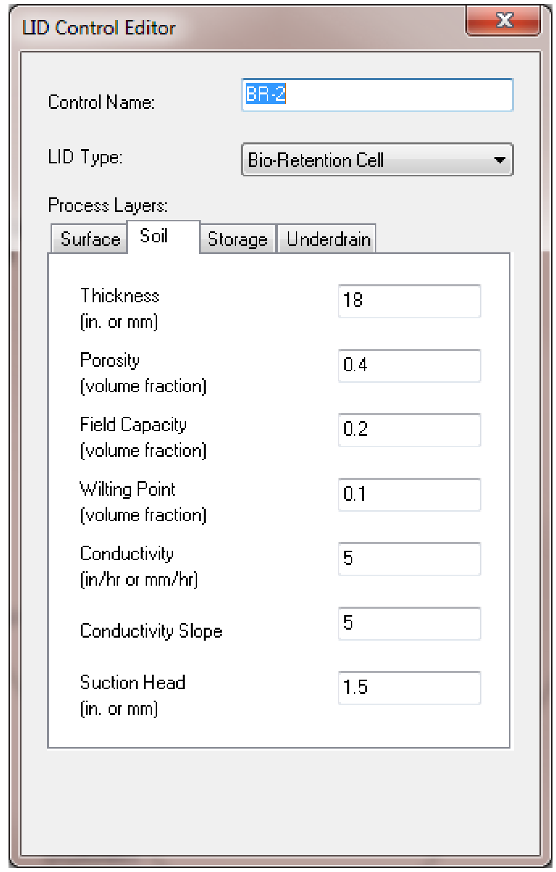

LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
9.21
Vegetation Volume
Fraction
0.05
Surface Roughness
(Mannings n)
0
Surface Slope
(percent)
0

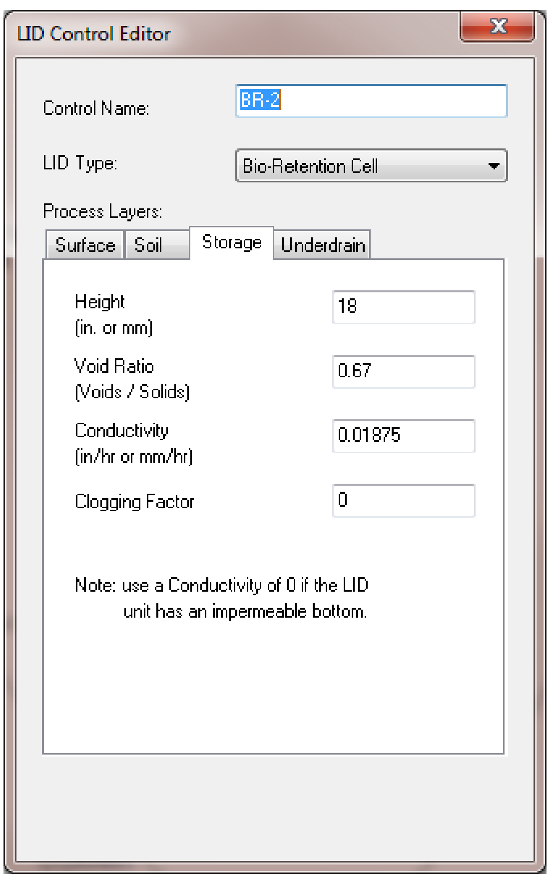

LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
18
Porosity
(volume fraction)
0.4
Field Capacity
(volume fraction)
0.2
Wilting Point
(volume fraction)
0.1
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5

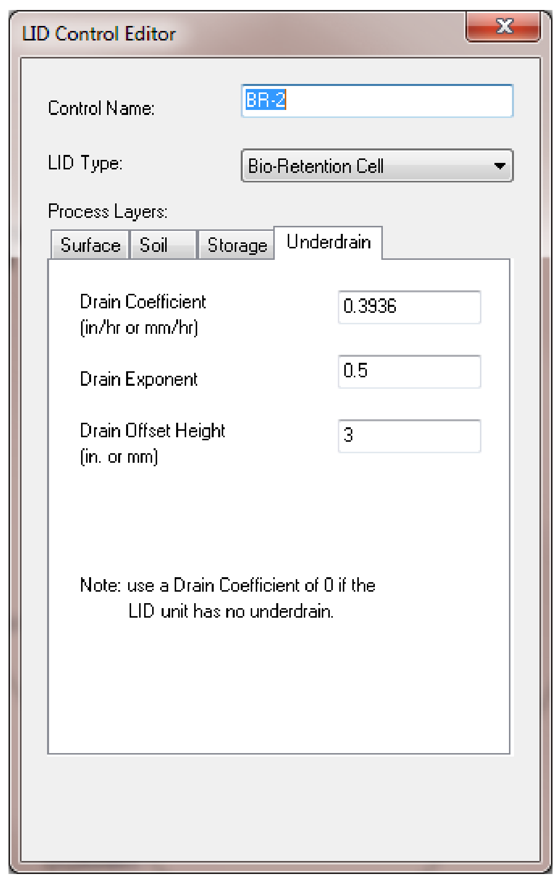

LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
18
Void Ratio
(Voids / Solids)
0.67
Conductivity
(in/hr or mm/hr)
0.01875
Clogging Factor
0
Note: use a Conductivity of 0 if the LID
unit has an impermeable bottom.


LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
(in/hr or mm/hr)
0.6283
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
3
Note: use a Drain Coefficient of 0 if the
LID unit has no underdrain.


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth (in. or mm)
7.52
Vegetation Volume Fraction
0.05
Surface Roughness (Mannings n)
0.0
Surface Slope (percent)
0.0


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness (in. or mm)
18
Porosity (volume fraction)
0.4
Field Capacity (volume fraction)
0.2
Wilting Point (volume fraction)
0.1
Conductivity (in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head (in. or mm)
1.5


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height (in. or mm)
18
Void Ratio (Voids / Solids)
0.67
Conductivity (in/hr or mm/hr)
0.01875
Clogging Factor
0
Note: use a Conductivity of 0 if the LID unit has an impermeable bottom.


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient (in/hr or mm/hr)
0.3936
Drain Exponent
0.5
Drain Offset Height (in. or mm)
3
Note: use a Drain Coefficient of 0 if the LID unit has no underdrain.

LID Control Editor: Explanation of Significant Variables

Storage Depth:

The storage depth variable within the SWMM model is representative of the storage volume provided beneath the first surface riser outlet and the engineered soil and mulch components of the bioretention facility.

In those cases where the surface storage has a variable area that is also different to the area of the gravel and amended soil, the SWMM model needs to be calibrated as the LID module will use the storage depth multiplied by the BMP area as the amount of volume stored at the surface.

Let A_{BMP} be the area of the BMP (area of amended soil and area of gravel). The proper value of the storage depth S_D to be included in the LID module can be calculated by using geometric properties of the surface volume. Let A_0 be the surface area at the bottom of the surface pond, and let A_i be the surface area at the elevation of the invert of the first row of orifices (or at the invert of the riser if not surface orifices are included). Finally, let h_i be the difference in elevation between A_0 and A_i. By volumetric definition:

$$A_{BMP} \cdot S_D = \frac{(A_0 + A_i)}{2} h_i \qquad (1)$$

Equation (1) allows the determination of S_D to be included as Storage Depth in the LID module.

Porosity: A porosity value of 0.4 has been selected for the model. The amended soil is to be highly sandy in content in order to have a saturated hydraulic conductivity of approximately 5 in/hr.

REC considers such a value to be slightly high; however, in order to comply with the HMP Permit, the value recommended by the Copermittees for the porosity of amended soil is 0.4, per Appendix A of the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. Such porosity is equal to the porosity of the gravel per the same document.

Void Ratio: The ratio of the void volume divided by the soil volume is directly related to porosity as n/(1-n). As the underdrain layer is composed of gravel, a porosity value of 0.4 has been selected (also per Appendix A of the Final HMP document), which results in a void ratio of 0.4/(1-0.4) = 0.67 for the gravel detention layer.

Conductivity: BMPs 1 & 2 will have a conductivity of 0.01875 in/hr as it will be unlined to allowed for infiltration.

Clogging factor: A clogging factor was not used (0 indicates that there is no clogging assumed within the model). The reason for this is related to the fairness of a comparison with the SDHM model and the HMP sizing tables: a clogging factor was not considered, and instead, a conservative value of infiltration was recommended.

Drain (Flow) coefficient: The flow coefficient C in the SWMM Model is the coefficient needed to transform the orifice equation into a general power law equation of the form:

$$q = C(H - H_D)^n \qquad (2)$$

where q is the peak flow in in/hr, n is the exponent (typically 0.5 for orifice equation), H_D is the elevation of the centroid of the orifice in inches (assumed equal to the invert of the orifice for small orifices and in our design equal to 0) and H is the depth of the water in inches.

The general orifice equation can be expressed as:

$$Q = \frac{\pi}{4} c_g \frac{D^2}{144} \sqrt{2g \frac{(H - H_D)}{12}} \qquad (3)$$

where Q is the peak flow in cfs, D is the diameter in inches, c_g is the typical discharge coefficient for orifices (0.61-0.63 for thin walls and around 0.75-0.8 for thick walls), g is the acceleration of gravity in ft/s^2, and H and H_D are defined above and are also used in inches in Equation (3).

It is clear that:

$$q\ \left(\frac{in}{hr}\right) X\ \frac{A_{BMP}}{12\ X\ 3600} = Q\ (cfs) \qquad (4)$$

Detention Basin 1

Storage Unit BASIN-1

Property	Value
Name	BASIN-1
X-Coordinate	991.071
Y-Coordinate	2464.286
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	2
Initial Depth	0
Ponded Area	5490
Evap. Factor	1
Infiltration	YES
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	BASIN-1

User-assigned name of storage unit

Outlet OUTLET-1

Property	Value
Name	OUTLET-1
Inlet Node	BASIN-1
Outlet Node	POC-1
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/DEPTH
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OUT-1

User-assigned name of outlet

Storage Curve Editor

Curve Name

BASIN-1

Description

	Depth (ft)	Area (ft2)
1	0	2683
2	0.75	3681
3	2	5490
4		
5		
6		
7		
8		
9		
10		
11		

View... Load... Save... OK Cancel Help

Rating Curve Editor

Curve Name

OUT-1

Description

	Head (ft)	Outflow (CFS)
1	0.000	0.000
2	0.100	0.092
3	0.200	0.260
4	0.300	0.478
5	0.400	0.602
6	0.500	0.703
7	0.600	1.280
8	0.700	2.255
9	0.800	3.488
10	0.900	4.859
11	1.000	7.351

View... Load... Save... OK Cancel Help

Detention Basin B

Storage Unit BASIN-2

Property	Value
Name	BASIN-2
X-Coordinate	7042.824
Y-Coordinate	2615.741
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	1.5
Initial Depth	0
Ponded Area	945
Evap. Factor	1
Infiltration	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	BASIN-2

Click to specify infiltration through the bottom of the storage unit

Outlet OUTLET-2

Property	Value
Name	OUTLET-2
Inlet Node	BASIN-2
Outlet Node	POC-1
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/DEPTH
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OUT-2

User-assigned name of outlet

Storage Curve Editor

Curve Name: BASIN-2

Description:

	Depth (ft)	Area (ft2)
1	0	846
2	0.5	1050
3	1.5	1512
4		
5		
6		
7		
8		
9		
10		
11		

View... Load... Save... OK Cancel Help

Rating Curve Editor

Curve Name: OUT-2

Description:

	Head (ft)	Outflow (CFS)
1	0.000	0.000
2	0.042	0.002
3	0.083	0.003
4	0.125	0.004
5	0.167	0.005
6	0.208	0.006
7	0.250	0.006
8	0.292	0.007
9	0.333	0.008
10	0.375	0.008
11	0.417	0.009

View... Load... Save... OK Cancel Help

Overland Flow Manning's Coefficient per County of San Diego (Reference [6])

Manning’s *n* Values for Overland Flow[1]

The BMP Design Manuals within the County of San Diego allow for a land surface description other than short prairie grass to be used for hydromodification BMP design only if documentation provided is consistent with Table A.6 of the SWMM 5 User’s Manual.

In January 2016, the EPA released the SWMM Reference Manual Volume I – Hydrology (SWMM Hydrology Reference Manual). The SWMM Hydrology Reference Manual complements the SWMM 5 User’s Manual by providing an in-depth description of the program’s hydrologic components. Table 3-5 of the SWMM Hydrology Reference Manual expounds upon Table A.6 of the SWMM 5 User’s Manual by providing Manning’s *n* values for additional overland flow surfaces. Therefore, in order to provide SWMM users with a wider range of land surfaces suitable for local application and to provide Copermittees with confidence in the design parameters, we recommend using the values published by Yen and Chow in Table 3-5 of the EPA SWMM Reference Manual Volume I – Hydrology. The values are provided in the table below:

Overland Surface	**Manning value (*n*)**
Smooth asphalt pavement	0.010
Smooth impervious surface	0.011
Tar and sand pavement	0.012
Concrete pavement	0.014
Rough impervious surface	0.015
Smooth bare packed soil	0.017
Moderate bare packed soil	0.025
Rough bare packed soil	0.032
Gravel soil	0.025
Mowed poor grass	0.030
Average grass, closely clipped sod	0.040
Pasture	0.040
Timberland	0.060
Dense grass	0.060
Shrubs and bushes	0.080
Land Use	
Business	0.014
Semibusiness	0.022
Industrial	0.020
Dense residential	0.025
Suburban residential	0.030
Parks and lawns	0.040

[1]Content summarized from *Improving Accuracy in Continuous Simulation Modeling: Guidance for Selecting Pervious Overland Flow Manning’s n Values in the San Diego Region* (TRWE, 2016).

ATTACHMENT 8

Soils Maps

Discussion of Selection of Rain Gauge

Hydrologic Soil Group—San Diego County Area, California
(Liberty School)

Map Scale: 1:1,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 8, Sep 17, 2014

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

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

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	D	3.7	53.1%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes	B	3.3	46.9%
Totals for Area of Interest			**7.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Selection of Rain Gauge

This project will compare 3 stations: Santee, Kearny Mesa, Flynn. Flynn is closest but has more difference in elevation. Kearny Mesa is farthest but has less difference in elevation.

Distance project to: Santee: D_1 = 11.9 miles. Flynn: D_2 = 11.2 miles. Kearny Mesa: D_3 = 20.0 miles.

Weight factor (distance): Santee: WL_1 = 0.376. Flynn: WL_2 = 0.400. Kearny Mesa: WL_3 = 0.224

($WL_i = D_i^{-1}/(D_1^{-1} + D_2^{-1} + \ldots + D_N^{-1})$)

Change in elevation of project with: Santee: Z_1 = 240 ft. Flynn: Z_2 = 340 ft. Kearny Mesa: Z_3 = 115 ft.

Weight factor (elevation): Santee: WZ_1 = 0.264. Flynn: WZ_2 = 0.186. Kearny Mesa: WZ_3 = 0.550

($WZ_i = Z_i^{-1}/(Z_1^{-1} + Z_2^{-1} + \ldots + Z_N^{-1})$)

Total weight (TW): 0.4 x distance + 0.6 x elevation (elevation is considered more important than distance in terms of effect on precipitation)

Santee: TW_1 = 0.306. Flynn: TW_2 = 0.272. Kearny Mesa: TW_3 = 0.420.

($TW_i = 0.4 \cdot WL_i + 0.6 \cdot WZ_i$)

Note: Even if the weight is the same ($TW_i = 0.5 \cdot WL_i + 0.5 \cdot WZ_i$), then total weight = average between weight factor distance and weight factor elevation. Santee: 0.320. Flynn: 0.293. Kearny Mesa: 0.387.

Kearny Mesa is the best station for this project because it has the highest dimensionless TW factor.

ATTACHMENT 8

Geotechnical Letters

Infiltration Values per CTE Initial Measurements

November 2, 2016 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Conversion of Percolation Testing Results to Infiltration Rates
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: At End of Document

Mr. Hamann:

Construction Testing & Engineering, Inc. (CTE) previously conducted percolation testing in the proposed athletic field area for the proposed development (CTE, 2015). The purpose of this letter is to provide estimated infiltration rates for the tested areas per the requirements of the referenced San Diego Region Model BMP Design Manual. As recommended in the manual, CTE converted the previously provided percolation rates to infiltration rates using the Porchet method. Infiltration rates are provided in the following Table 1.

TABLE 1: PERCOLATION TEST RESULTS

Test Number	Percolation Rate (minutes/inch)	Approximate Test Depth from Existing 536’ Elevation (feet)	Soil Description	Converted Infiltration Rate* (inches/hour)
P-1	480	6	Granite	0.025
P-2	480	6.5	Granite	0.025
P-3	44	3	Residual Soil	0.280
P-4	169	3	Residual Soil	0.076

*Percolation rates converted to infiltration rates using the Porchet method.

As indicated herein, we understand that the percolation testing results and converted infiltration rates provided are to be appropriately used by the project civil engineer of record to design and detail onsite storm water facilities or improvements, as necessary, for project development and/or construction.

Additionally, and per our referenced letter (CTE, 2015) CTE understands that a fill slope will be constructed along the eastern border of the athletic field, which is also the eastern border of the proposed development and the likely lowest elevation of the proposed development. CTE recommends that a French drain, discharging into an appropriately designed offsite conveyance, or equivalent, be installed at the slope keyway in order to minimize subsurface seepage from migrating offsite.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

Dan T. Math, RCE # 61013
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
DANIEL T. MATH
No.61013
EXP.12/31/16
CIVIL
STATE OF CALIFORNIA

Colm J. Kenny, RCE #84406
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
COLM J. KENNY
No.84406
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

REFERENCES:

Model BMP Design Manual
San Diego Region
For Permanent Site Design, Storm Water Treatment and Hydromodification Management
February, 2016

Percolation Testing Results
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, Dated January 2, 2015

Preliminary Geotechnical Investigation
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, Dated October 15, 2014

January 30, 2017 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Completed City of San Diego Worksheet I-8
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: At End of Document

Mr. Hamann:

As requested, Construction Testing & Engineering, Inc. (CTE) provides the attached completed City of San Diego Form I-8 for determining infiltration feasibility at the subject site. Based on the answers provided in the attached Worksheet I-8, CTE makes a determination that "no infiltration" is an appropriate designation. However, if infiltration is employed, CTE provides the following recommendations for infiltration basins to be designed by others:

1) For infiltration basins near the existing eastern slope, CTE recommends that the proposed basin area be lined along the sidewalls and invert elevations to reduce the potential for mounding and lateral and vertical migration of infiltrating waters.
2) For infiltration basins not near the aforementioned slope but near Chase Avenue, Jamacha Boulevard, and adjacent businesses, CTE recommends that the proposed basin area be lined along the sidewalls to potentially reduce lateral migration of infiltrating waters.
3) An overflow device should be connected to a piping system that is directed to the nearest acceptable discharge location.
4) The sidewalls of the proposed infiltration basins should have slopes no greater than 1:1 (H:V) if the liner is extended beyond the top of the basin, and 1.5:1 if any portion of the sidewall is not lined.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

Jay F. Lynch, CEG # 1890
Principal Engineering Geologist

PROFESSIONAL GEOLOGIST
JAY F. LYNCH
No.1890
CERTIFIED
ENGINEERING
GEOLOGIST
Exp. 5/31/17
STATE OF CALIFORNIA

Colm J. Kenny, RCE #84406
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
COLM J. KENNY
No.84406
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

Attachments

Attachment A Worksheet I-8

REFERENCES:

Conversion of Percolation Testing Results to Infiltration Rates
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, dated November 2, 2016

Model BMP Design Manual
San Diego Region
For Permanent Site Design, Storm Water Treatment and Hydromodification Management
February, 2016

Percolation Testing Results
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, Dated January 2, 2015

Preliminary Geotechnical Investigation
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

<u>ATTACHMENT A</u>

WORKSHEET I-8: CATERGORIZATION OF INFILTRATION FEASIBILITY CONDITION

Worksheet I-8 : Categorization of Infiltration Feasibility Condition

<table>
<tr><th colspan="3">Categorization of Infiltration Feasibility Condition</th><th colspan="2">Worksheet I-8</th></tr>
<tr><td colspan="5">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?</td></tr>
<tr><td>Criteria</td><td colspan="2">Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>1</td><td colspan="2">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.</td><td></td><td>X</td></tr>
<tr><td colspan="5">Provide basis: See CTE letter "Conversion of Percolation Testing Results to Infiltration Rates", CTE Job No. 10-12202G, dated November 2, 2016. All derived infiltration rates were below 0.5 in/hr with no Factor of Safety applied. Further application of a Factor of Safety greater than 1 will further decrease the infiltration rates.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td colspan="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.</td><td></td><td></td></tr>
<tr><td colspan="5">Provide basis:

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

<table>
<tr><th colspan="4">Worksheet I-8 Page 2 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all answers to rows 1 - 4 are “Yes” a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

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

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

<table>
<tr><th colspan="4">Worksheet I-8 Page 3 of 4</th></tr>
<tr><td colspan="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?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: CTE understands that "appreciable rate" is not currently quantified. Therefore, based on feedback from multiple local jurisdictions, for the purposes of this determination form CTE considers "appreciable rate" to be an infiltration rate greater than 0.01 in/hr. All four infiltration rates were above an appreciable infiltration rate. Further, after application of a Factor of Safety of 2, in accordance with the Model BMP Design Manual, San Diego Region, Appendix D (February, 2016), all four infiltration rates would still be above an appreciable infiltration rate.

However, the storm water design engineer has the option to modify this safety factor by completing Tables D.5-1 and D.5-2 in the above referenced BMP Design Manual and with approval from the jurisdictional regulating body. Further adjustment of the safety factor may result in non-appreciable infiltration rates.

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.</td></tr>
<tr><td>6</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: CTE understands that two potential bio-filtration areas are proposed in the northeast corner of the subject site. A French Drain should be installed at the invert elevation of the basin in order to minimize potential infiltration mounding and/or lateral migration. Liners should be installed on the sides of the basins.

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.</td></tr>
</table>

<table>
<tr><th colspan="4">Worksheet I-8 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: During previous investigation groundwater was not encountered within the maximum explored depth of 15 feet below existing ground surface (bgs) at the site or 10 feet bgs nearest the proposed infiltration areas. The site is located greater than approximately 0.5 miles from known surface waters. The site is not located in an industrial area and is planned for residential/school use. CTE is not aware of adjacent or nearby groundwater wells. Therefore, the risk of groundwater contamination is not considered to increase due to infiltration at the 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.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Downstream water rights should not be violated, due to the proposed infiltration basin being located in an non-industrial usage area, no direct pathways to waters of the state, or known adjacent groundwater wells.

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.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.
If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td>Partial</td></tr>
</table>

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

March 30, 2017 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Revised Recommendations for Eastern Slope Biofiltration Basin
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: At End of Document

Mr. Hamann:

As requested, Construction Testing & Engineering, Inc. (CTE) provides these revised recommendations for the proposed eastern biofiltration basin at the subject site. CTE has also reviewed the referenced preliminary grading plan. CTE understands that, for the eastern biofiltration basin labeled with an invert elevation of 532.6 feet, the client proposes to leave the bottom of the basin unlined to allow partial infiltration, and to install a French drain at the easterly side of the basin at the invert elevation in order to prevent or minimize potential infiltrate mounding and/or lateral migration. Based on review of the referenced grading plan it appears that the adjacent slope to the east of the basin is to consist of a 2:1 (H:V) fill slope which then transitions to the less steep existing slope.

CTE believes it is acceptable to leave the bottom of the described basin unlined, provided that the proposed and described French drain is installed, and that the drain outlets to an appropriate location. Additionally, periodic inspection and maintenance (as necessary, but at a minimum annually) of the adjacent slope should be considered a best practice.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

Jay F. Lynch, CEG # 1890
Principal Engineering Geologist

Colm J. Kenny, RCE #84406
Project Engineer

REFERENCES:

Preliminary Grading Plan Sheet C-1
Liberty Charter High School
Prepared by Karn Engineering and Surveying, dated February 10, 2017

Completed City of San Diego Worksheet I-8
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, dated January 30, 2017

Conversion of Percolation Testing Results to Infiltration Rates
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, dated November 2, 2016

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San Diego Region
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February, 2016

Percolation Testing Results
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, Dated January 2, 2015

ATTACHMENT 9

Summary Files from the SWMM Model

PRE_DEV

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)
--------------------------------------------------------------


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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ SEP-09-1964 00:00:00
Ending Date .............. SEP-08-2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       298.911       488.750
Evaporation Loss .........         7.553        12.350
Infiltration Loss ........       248.668       406.598
Surface Runoff ...........        45.008        73.592
Final Surface Storage ....         0.000         0.000
Continuity Error (%) .....        -0.775


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......        45.008        14.666
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........        45.008        14.666
Internal Outflow .........         0.000         0.000
Storage Losses ...........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Subcatchment Runoff Summary
***************************

---------------------------------------------------------------------------------------------------------
                            Total      Total      Total      Total      Total        Total     Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff       Runoff   Runoff   Coeff
Subcatchment                   in         in         in         in         in     10^6 gal      CFS
---------------------------------------------------------------------------------------------------------
DMA-all-SoilB              488.75       0.00       1.04     478.54       9.98         0.91     3.36   0.020
DMA-all-SoilD              488.75       0.00      18.16     374.98     101.81        10.10     4.50   0.208
DMA--off-B                 488.75       0.00      63.40       0.00     433.19         0.74     0.09   0.886
DMA-off-D                  488.75       0.00      66.70       0.00     428.42         2.78     0.34   0.877
DMA-off-perv               488.75       0.00      21.84     349.73     127.86         0.14     0.05   0.262


Analysis begun on:  Thu May 04 13:23:59 2017
Analysis ended on:  Thu May 04 13:24:12 2017
Total elapsed time: 00:00:13
```

POST_DEV

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)
--------------------------------------------------------------


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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ SEP-09-1964 00:00:00
Ending Date .............. SEP-08-2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00
Routing Time Step ........ 60.00 sec


WARNING 04: minimum elevation drop used for Conduit BYPASS-2

WARNING 04: minimum elevation drop used for Conduit U-DRAIN2

WARNING 04: minimum elevation drop used for Conduit BYPASS-1

WARNING 04: minimum elevation drop used for Conduit U-DRAIN1

**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       298.912       488.750
Evaporation Loss .........        34.375        56.207
Infiltration Loss ........       137.820       225.349
Surface Runoff ...........       129.711       212.090
Final Surface Storage ....         0.000         0.000
Continuity Error (%) .....        -1.002


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       129.711        42.268
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       125.694        40.959
Internal Outflow .........         0.000         0.000
Storage Losses ...........         3.968         1.293
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.038


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


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

POST_DEV

```
*************************
Minimum Time Step          :    60.00 sec
Average Time Step          :    60.00 sec
Maximum Time Step          :    60.00 sec
Percent in Steady State    :     0.00
Average Iterations per Step :     1.00
```

```
***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-1-SoilB	488.75	0.00	53.07	206.87	231.39	20.28	4.04	0.473
DMA-1-SoilD	488.75	0.00	35.27	274.31	182.75	14.48	3.78	0.374
DMA-2-SoilD	488.75	0.00	69.05	101.26	323.73	7.84	1.22	0.662
BR-1	488.75	20784.99	735.86	940.62	19739.46	33.01	7.62	0.928
BR-2	488.75	18650.14	745.81	979.09	17528.34	9.24	1.45	0.916
DMA-2-soilB	488.75	0.00	86.20	0.00	410.15	1.99	0.25	0.839
DMA-pavers	488.75	0.00	35.46	447.79	7.77	0.01	0.03	0.016

```
**********************
LID Performance Summary
**********************
```

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Init. Storage in	Final Storage in	Pcnt. Error
BR-1	BR-1	21273.74	735.88	940.65	6094.31	13645.81	0.00	0.00	-0.67
BR-2	BR-2	19138.89	745.78	979.05	5184.14	12343.50	0.00	0.00	-0.59

```
******************
Node Depth Summary
******************
```

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	hr:min
POC-1	OUTFALL	0.00	0.18	0.18	11816	19:47
DIV-1	DIVIDER	0.00	0.00	0.00	0	00:00
DIV-2	DIVIDER	0.00	0.17	0.17	109	15:53
BASIN-1	STORAGE	0.00	1.00	1.00	3738	09:16
BASIN-2	STORAGE	0.01	1.15	1.15	3738	08:59

```
*******************
Node Inflow Summary
*******************
```

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal
POC-1	OUTFALL	0.03	8.91	3738	09:16	0.009	40.956
DIV-1	DIVIDER	7.62	7.62	3738	09:15	33.013	33.013
DIV-2	DIVIDER	1.45	1.45	3738	09:15	9.243	9.243
BASIN-1	STORAGE	0.00	7.48	3738	09:15	0.000	10.231
BASIN-2	STORAGE	0.00	1.42	3738	09:15	0.000	2.703

```
*********************
Node Surcharge Summary
*********************
```

Surcharging occurs when water rises above the top of the highest conduit.

```
---------------------------------------------------------------------
                                          Max. Height   Min. Depth
```

POST_DEV

Node	Type	Hours Surcharged	Above Crown Feet	Below Rim Feet
DIV-1	DIVIDER	385703.02	0.000	0.000
BASIN-1	STORAGE	385703.02	0.999	1.001
BASIN-2	STORAGE	385703.02	1.147	0.353

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
BASIN-1	0.002	0	12	3.350	41	3738 09:15	7.32
BASIN-2	0.008	0	1	1.251	71	3738 08:57	1.43

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
POC-1	3.89	0.10	8.91	40.956
System	3.89	0.10	8.91	40.956

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
BYPASS-2	DUMMY	1.42	3738 09:15			
U-DRAIN2	CONDUIT	0.03	11816 19:47	0.34	0.07	0.17
BYPASS-1	DUMMY	7.48	3738 09:15			
U-DRAIN1	DUMMY	0.14	109 16:17			
OUTLET-1	DUMMY	7.32	3738 09:16			
OUTLET-2	DUMMY	1.43	3738 08:59			

****
Conduit Surcharge Summary
****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
BYPASS-2	0.01	0.01	0.01	385703.02	0.01
BYPASS-1	0.01	0.01	0.01	385703.02	0.01
U-DRAIN1	0.01	0.01	0.01	385703.02	0.01

Analysis begun on: Thu May 04 13:14:12 2017
Analysis ended on: Thu May 04 13:14:50 2017
Total elapsed time: 00:00:38

SLOPE ANALYSIS

SCALE 1"=40'

LEGEND

	PROPERTY	PERCENTAGE
SLOPES < 15%	6.884 ACRES	89.3%
SLOPES BETWEEN 15% AND 25%	0.451 ACRES	5.8%
SLOPES BETWEEN 25% AND 50%	0.220 ACRES	2.9%
SLOPES > 50%	0.148 ACRES	1.9%
	7.663 ACRES	100%

AVERAGE SLOPE = 10.7%

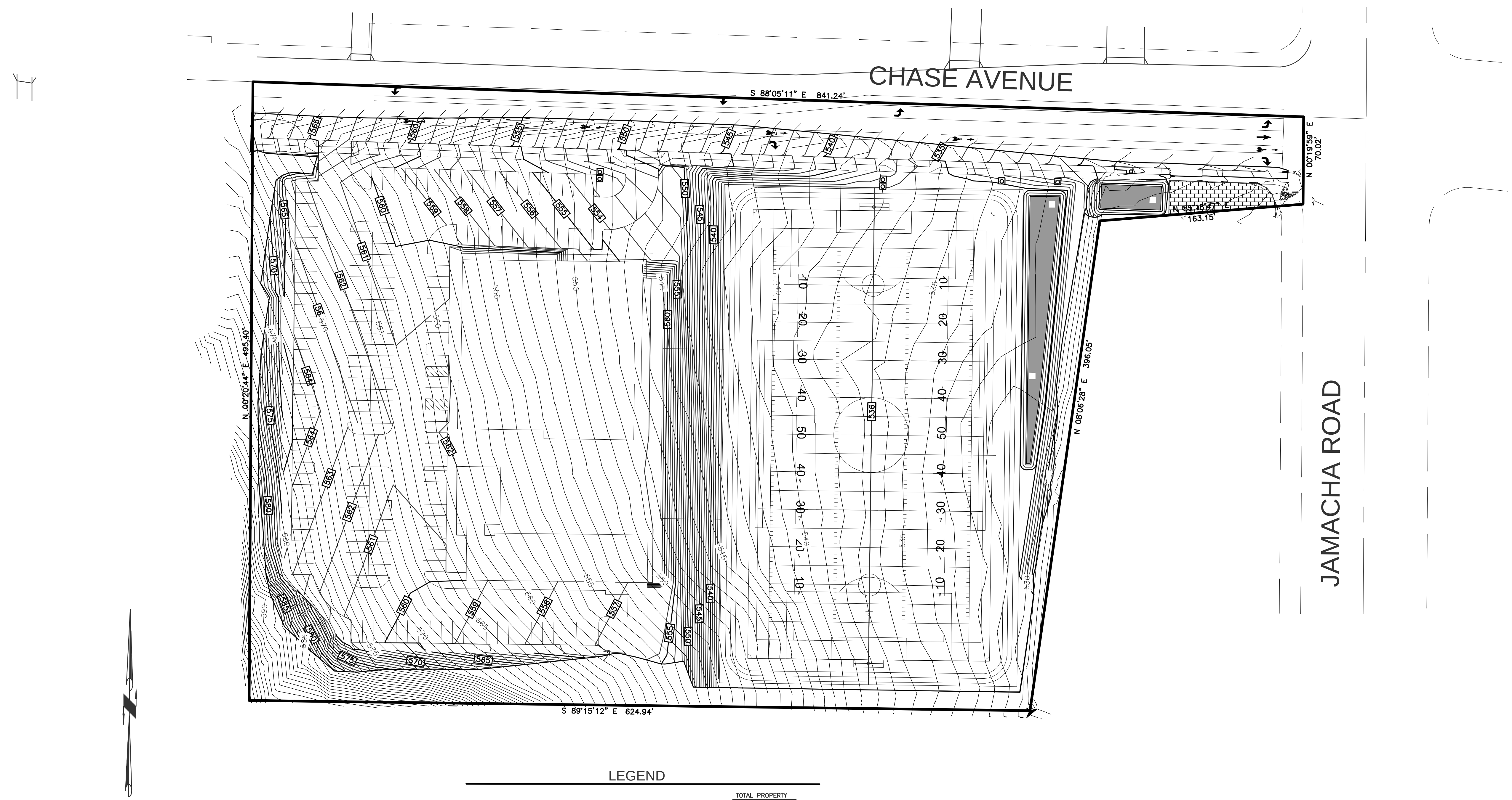
LIBERTY CHARTER HIGH SCHOOL

APN 498-330-39
7.66 ACRES

KARN

9323 SLOPE ANALYSIS.dwg 3/14/16

STEEP SLOPE ENCROACHMENT/OPEN SPACE MAP



SCALE 1" =40'

LEGEND

		TOTAL PROPERTY
NON STEEP SLOPE LANDS		7.663 ACRES
PROPOSED STEEP SLOPE EASEMENT		N/A
STEEP SLOPE LANDS		0.00 ACRES
		7.663 ACRES
% OF LOT IN STEEP SLOPE LANDS		0.00%
ALLOWABLE ENCROACHMENT INTO STEEP SLOPE LANDS		N/A
ENCROACHMENT INTO STEEP SLOPE LANDS		N/A
% ENCROACHMENT INTO STEEP SLOPE LANDS (DRIVEWAYS & ROADS NOT INCLUDED)		N/A
AVERAGE SLOPE		10.7%

NO STEEP SLOPE LANDS EXIST ON PROPERTY

LIBERTY CHARTER HIGH SCHOOL
APN 498-330-39
7.66 ACRES

KARN ENGINEERING & SURVEYING 129 W. FIG STREET, FALLBROOK, CA (760) 728-1134

9323 STEEP SLOPE ENCROACHMENT EXHIBIT.dwg 3/2/16

ATTACHMENT 3

Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

Indicate which Items are Included behind this cover sheet:

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

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

Attachment 3a must identify:

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

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

TABLE 7-1. Schedule for Developing Maintenance Plan and Agreement

Item	Description	Time Frame
1	Determine structural BMP ownership, party responsible for permanent maintenance, and maintenance funding mechanism Where maintenance responsibility is proposed to be transferred to a County department, the proposal must be reviewed and approved by that department.	Prior to first submittal of final engineering application – discuss with the County.
2	Identify expected maintenance actions	First submittal of a project application – identify in SWQMP
3	Develop detailed Maintenance Plan	As required by the County, prior to approval of construction, grading, building, site development, or other applicable permits for Maintenance Agreements. As required by the County, prior to approval of Record Plans for Maintenance Notifications.
4	For private maintenance, prepare draft Maintenance Agreement (legal agreement to be recorded against the property by the County Assessor)	As required by the County, prior to approval of construction, grading, building, site development, or other applicable permits for Maintenance Agreements. As required by the County, prior to approval of Record Plans for Maintenance Notifications.
5	For private maintenance, execute and record Maintenance Agreement	As required by the County, prior to approval of construction, grading, building, site development, or other applicable permits for Maintenance Agreements. As required by the County, prior to approval of Record Plans for Maintenance Notifications.
6	Update/finalize Maintenance Plan to reflect constructed structural BMPs with as-built plans and baseline photos. Maintenance Acceptance Memoranda are to be completed before maintenance responsibility is transferred to the County.	As required by the County upon completion of construction of structural BMPs

7.3 Maintenance Responsibility

Who is responsible for the maintenance of the permanent structural BMPs into perpetuity?

The property owner is responsible to ensure inspection and maintenance of permanent structural BMPs on their property unless responsibility has been formally transferred to another entity. Another entity may be the County, a community facilities district, homeowners association, property

MAINTENANCE CHECKLIST FOR BIORETENTION FACILITIES

- **Weeding** - As with any garden, bioretention/biofiltration requires weeding of unwanted plant materials. Mulching helps to reduce weed growth and retain moisture in the soil. Weeding should be accomplished routinely and at least monthly.
- **Watering** - If plants wilt during the heat of the day, but recover in the evening, watering is not necessary. The plants are simply conserving moisture. If they do not recover, watering is indicated. Another good rule of thumb is to stick a pencil or screwdriver about four inches into the soil. If the soil is moist at that depth, watering is not needed. If the soil is dry, and the shrubs or trees were planted within the last three years, watering is necessary.
- **Fertilization** - In traditional, intensively cropped landscapes, soil fertility (and especially the level of available nitrogen) is considered the limiting factor to plant growth. By design, however, bioretention facilities are located in areas where nutrients (especially nitrogen) are significantly elevated above natural levels. Therefore, it is unlikely that soil fertility will be the limiting factor in plant growth, and thus fertilization would be unnecessary. Excess fertilization, (besides compromising the facility's pollutant reduction effectiveness) leads to weak plant growth, promotes disease and pest outbreaks, and inhibits soil life. If soil fertility is in doubt, a simple soil test can resolve the question. If fertilization should become necessary, an organic fertilizer will provide nutrients as needed without disrupting soil life.
- **Mulching** - The mulch materials placed in the facility will decompose and blend with the soil medium over time. Typically, mulch material should be re-applied once every six months. The depth of the mulch layer should be no more than 3". Mulch applied any deeper than three inches reduces proper oxygen and carbon dioxide cycling between the soil and the atmosphere, and keeps plant roots from making good contact with the soil. The mulch layer provides an important role in the bioretention physical properties for removing heavy metals from the system.
- **Dividing and Replanting** - The properly designed facility should thrive and allow planting materials to expand and propagate, eventually becoming overcrowded. If this occurs, perennial plants should be divided in spring or fall. Plants that do not perform well, or die, should also be replaced.
- **Trimming and Harvesting** - Current practice is to leave ornamental grasses and perennial seed heads standing to provide winter interest, wildlife forage, and homes for beneficial insects. Plants should not be cut back until spring when new growth commences, and even then it is only done for neatness, it does not impact growth. Plants may be pinched, pruned, sheared or dead-headed during the growing sea-son to encourage more flowering, a bushier plant, or a fresh set of leaves. Diseased or damaged plant parts should be pruned as they occur, and if a plant is pest-infested, then perform cleanup in fall to deny the pest a winter home. Trees and shrubs may be pruned for shape or to maximize fruit production.
- **Standing Water Problems** - Bioretention facilities are designed to have water standing for up to four hours. If this period is routinely exceeded, the facility may not be functioning properly. Should standing or pooling water become a maintenance burden, minor corrective action can usually correct it. Pooling water is usually caused by clogging or blockage of either the surface layer or fines obstructing the filter fabric used between the gravel bed/underdrain and the surrounding planting soil. The surface blockage problem may be corrected by removing the mulch layer and raking the surface. For blocked filter fabric, use lengths of small reinforcing bar (2'-3' #4 rebar) to puncture the fabric with holes every one foot on center. If the soils themselves

are causing the problem, punch holes in the soil or optionally, install a "sand window" at least one foot wide running vertically to the underdrain system elevation. In a worst case scenario, the entire facility may need to be re-installed. In any case, contact the Department of Environmental Resources for an evaluation of the facility and recommendations on how to correct the situation.

- **Trash and Debris** - Runoff flowing into bioretention facilities may carry trash and debris with it, particularly in commercial settings. Trash and debris should be removed regularly both to ensure that inlets do not become blocked and to keep the area from becoming unsightly.
- **Pet Waste** - Pet waste should not be left to decay in bioretention facilities because of the danger of disease-causing organisms.

Bioretention/Biofiltration Maintenance Schedule

Description	Method	Frequency	Time of the year
Soil			
Inspect and Repair Erosion	Visual	Monthly	Monthly
Organic Layer			
Re-mulch any void areas	By hand	Whenever needed	Whenever needed
Add fresh mulch layer	By hand	Annually	Spring
Plants			
Removal and replacement of all dead and diseased vegetation considered beyond treatment	See planting specs.	Twice a year	Spring and fall
Inspect for disease/pest problems	Visual	Once a month (average)	Inspect more frequently in warmer months
Determine if treatment is warranted; use least toxic treatment approach.	By hand	N A	Varies, depends on disease or insect infestation
Watering of plant material shall take place for fourteen consecutive days after planting has been completed unless there is sufficient natural rainfall.	By hand	Immediately after completion of project	N/A
Remove stakes and wires after 6 months	By hand	After trees have taken root	Remove stakes and wires when possible, but at least by six months time
Remove Tags	By hand	At end of warrantee period	

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	Liberty Charter High School
Record ID (e.g., grading/improvement plan number)	PDS2015-MUP-15-027
Project Address	1530 Jamacha Road, El Cajon, CA 92020
Assessor's Parcel Number(s) (APN(s))	498-330-39-00
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Sweetwater HU (909), Middle Sweetwater HA (909.2), Hillsdale HSA (909.22)
Maintenance Notification / Agreement No.	
Responsible Party for Construction Phase	
Developer's Name	Hamann Companies
Address	1000 Pioneer Way El Cajon, CA 92020
Email Address	gregg@hamannco.com
Phone Number	619-440-7424
Engineer of Work	Karn Engineering and Surveying
Engineer's Phone Number	760-728-1134
Responsible Party for Ongoing Maintenance	
Owner's Name(s)*	Hamann Property Management
Address	1000 Pioneer Way El Cajon, CA 92020
Email Address	gregg@hamannco.com
Phone Number	619-440-7424
*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	G.P.	IMP A	1	TBD	
Biofiltration Basin	G.P.	IMP B	2	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:

____

Professional Engineer's Signed Name:

____

Date: ____________________________________

[SEAL]

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

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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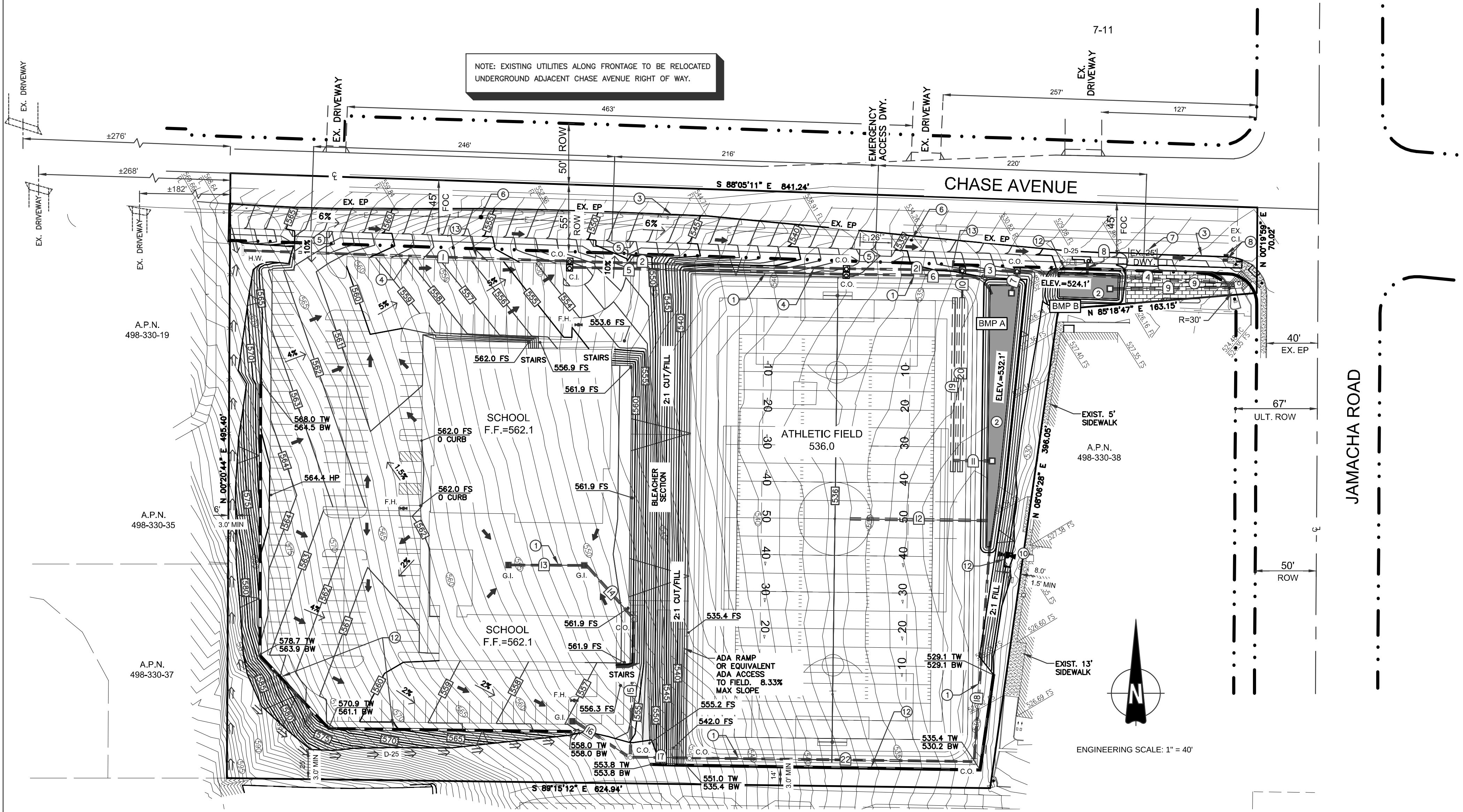


LEGEND

- EXISTING CONTOUR
- PROP. CONTOUR
- FLOW DIRECTION
- PROP. C.M.U. WALL
- PROPERTY BOUNDARY
- EXISTING STREET CENTERLINE
- RIGHT OF WAY
- CUT/FILL (2:1)
- PERVIOUS PAVERS

NOTES:

1. HDPE STORM DRAIN.
2. BIOFILTRATION BASIN. SEE SWQMP AND DRAINAGE STUDY.
3. SAWCUT LINE.
4. HDPE STORM DRAIN. BYPASS PIPE.
5. 30' TYPE G-14 CONCRETE DRIVEWAY.
6. EXISTING POWER POLE. EXISTING UTILITIES TO BE RELOCATED UNDERGROUND ALONG PROPOSED PROJECT FRONTAGE.
7. EXISTING DRIVEWAY TO REMAIN
8. EXISTING CURB INLET/STORM DRAIN TO BE RELOCATED TO PROPOSED CURB.
9. PERVIOUS PAVERS.
10. EXISTING FIRE HYDRANT. PROTECT IN PLACE.
11. 48 INCH HDPE STORAGE PIPES BENEATH FIELD. 285 FEET TOTAL LENGTH (142.5 FEET EACH OR EQUIVALENT) SEE DETAIL THIS SHEET.
12. PROPOSED RETAINING WALL.
13. BYPASS PIPE FOR HYDRAULICALLY SEPARATE OFF-SITE RUN-ON.

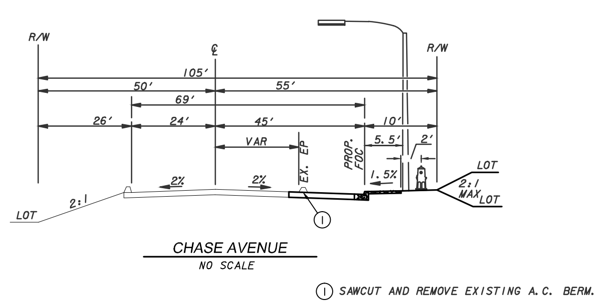
STRUCTURAL STORM WATER BMPs

BMP A

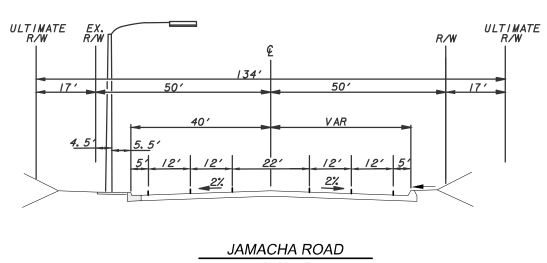
BIOFILTRATION BASIN. SEE DETAILS THIS SHEET.
- AREA BOTTOM = 1,477 SF
- DEPTH = 36 INCHES
- 2 OUTLET RISERS
- CONNECTS TO 2-48 INCH HDPE STORAGE PIPES (FLOW CONTROL)

BMP B

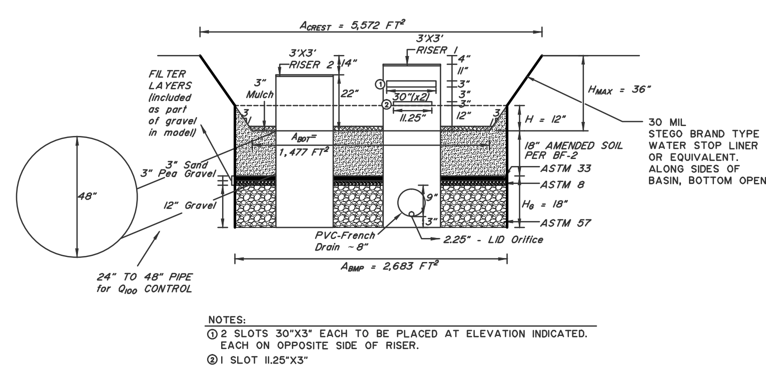
BIOFILTRATION BASIN. SEE DETAILS THIS SHEET.
- AREA BOTTOM = 574 SF
- DEPTH = 27 INCHES
- 1 OUTLET RISER



CHASE AVENUE
NO SCALE

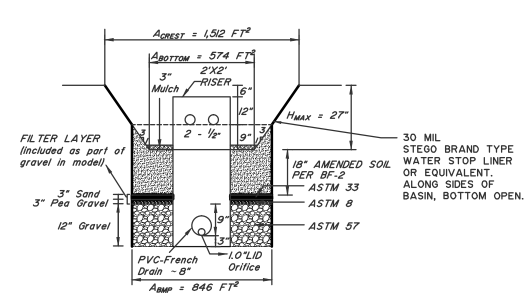


JAMACHA ROAD
NO SCALE

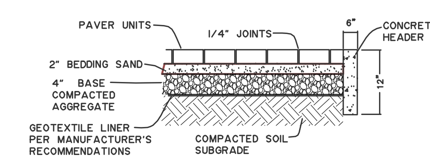


NOTES:
1. 2 SLOTS 30"X3" EACH TO BE PLACED AT ELEVATION INDICATED. EACH ON OPPOSITE SIDE OF RISER.
2. 1 SLOT 11.25"X3"

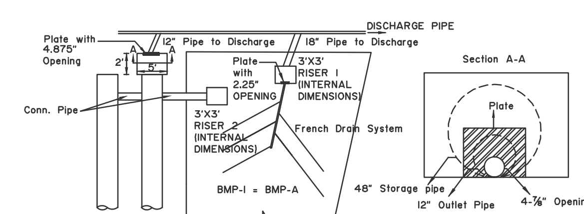
BMP A DETAIL
(NOT TO SCALE)



BMP B DETAIL
(NOT TO SCALE)



BRICK PAVERS
(NOT TO SCALE)



BMP A PLAN VIEW
NOT TO SCALE

STORM DRAIN TABLE

LINE	BEARING	DISTANCE	REMARKS
1	N 88°06'05" W	265.28'	30" HDPE
2	N 88°26'55" W	222.13'	30" HDPE
3	N 89°15'35" W	40.73'	30" HDPE
4	N 86°42'11" W	176.09'	30" HDPE
5	N 88°32'19" W	222.22'	24" HDPE
6	S 89°16'04" E	126.51'	24" HDPE
7	N 17°45'54" E	14.86'	18" HDPE
8	N 01°54'49" E	14.00'	24" HDPE
9	S 89°11'00" W	100.10'	18" HDPE
10	N 00°44'25" E	21.76'	12" HDPE
11	S 89°17'36" E	30.10'	24" HDPE
12	S 89°16'04" E	112.42'	18" HDPE
13	S 89°42'06" E	58.35'	18" HDPE
14	N 41°30'13" W	58.37'	18" HDPE
15	N 01°26'42" E	111.42'	18" HDPE
16	S 56°41'15" E	54.42'	24" HDPE
17	S 89°17'12" E	44.58'	30" HDPE
18	S 04°10'09" W	178.75'	30" HDPE
19	N 00°42'24" E	142.50'	48" HDPE
20	S 00°42'24" W	142.50'	48" HDPE
21	S 89°15'35" E	91.02'	30" HDPE
22	N 89°16'25" W	229.00'	30" HDPE

EARTHWORK QUANTITIES

CUT = 24,500 CY ±
FILL = 24,500 CY ±

HAMANN COMPANIES

THIS PLAN IS PROVIDED TO ALLOW FOR FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT. THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN A VALID GRADING PERMIT BEFORE COMMENCING SUCH ACTIVITY.

NOT FOR CONSTRUCTION

KARN
ENGINEERING AND SURVEYING, INC.
129 W. FIG STREET
FALLBROOK, CA 92028
760-728-1134 760-728-3209 Fax

REGISTERED PROFESSIONAL ENGINEER
SCOTT R. HARRY
NO. 63792
EXP 9-30-18
CIVIL
STATE OF CALIFORNIA

Date Issued	Remarks
06/15/15	CLIENT REVIEW
06/30/15	CLIENT REVIEW
09/11/15	MUP SUBMITTAL
04/06/16	MUP RE-SUBMITTAL
02/10/17	MUP RE-SUBMITTAL

CONCEPTUAL DRAWINGS
THE ARCHITECT ASSUMES NO RESPONSIBILITY FOR CONTRACT BIDS MADE FROM THESE CONCEPTUAL - ONLY DRAWINGS. THESE DRAWINGS HAVE BEEN ISSUED AS CONCEPT REVIEW ONLY AND PRIOR TO OWNER ACCEPTENCE, AGENCY REVIEWS, AND HAVE BEEN PRINTED PRIOR TO OBTAINING BUILDING PERMIT AND COORDINATED AND REFINED ENGINEERING AND ARE SUBJECT TO REVISION. FINAL CONTRACT DOCUMENTS SHALL BE ISSUED AT A LATER DATE.

Proposed Project:
LIBERTY CHARTER HIGH SCHOOL
- MAJOR USE PERMIT -

Project No. 15-135

Sheet Title:
PRELIMINARY GRADING PLAN

Sheet No.
C-1

ATTACHMENT 6

Copy of Project's Drainage Report

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ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

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CTE INC.
Construction Testing & Engineering, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

January 2, 2015 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Percolation Testing Results
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: Preliminary Geotechnical Investigation
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, Dated October 15, 2014

Design Manual for Onsite Wastewater Treatment Systems
County of San Diego Department of Environmental Health
Dated March 22, 2010 (updated November 25, 2013).

Mr. Hamann:

As requested, Construction Testing & Engineering, Inc. (CTE) conducted percolation testing in the proposed athletic field area for the proposed development. Approximate percolation test hole locations are presented in Figure 1. Percolation test results and approximate test depths are provided in the following Table 1.

Percolation testing was performed on December 18th and 19th, 2014. The percolation testing was performed in general accordance with the County of San Diego "Design Manual for Onsite Wastewater Treatment Systems", dated March 22, 2010 (updated November 25, 2013), as previously discussed with the project civil engineer of record. Also as discussed with the project civil engineer or record, we understand that the percolation testing results are to be appropriately used to design and detail onsite storm water facilities or improvements, as necessary.

Percolation test depths shown in Table 1 were approximately measured from the 536 foot elevation contour line, as shown on Figure 1, which was ascertained from the civil plan prepared and provided by the project civil engineer of record.

TABLE 1: PERCOLATION TEST RESULTS

Test Number	Percolation Rate (minutes/inch)	Approximate Test Depth from Existing 536' Elevation (feet)	Soil Description
P-1	480	6	Granite
P-2	480	6.5	Granite
P-3	44	3	Residual Soil
P-4	169	3	Residual Soil

As indicated herein, we understand that the percolation testing results provided are to be appropriately used by the project civil engineer of record to design and detail onsite storm water facilities or improvements, as necessary, for project development and/or construction.

CTE understands that a fill slope will be constructed along the eastern border of the athletic field, which is also the eastern border of the proposed development and the likely lowest elevation of the proposed development. CTE recommends that a French drain, discharging into an appropriately designed offsite conveyance, or equivalent, be installed at the slope keyway in order to minimize subsurface seepage from migrating offsite.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

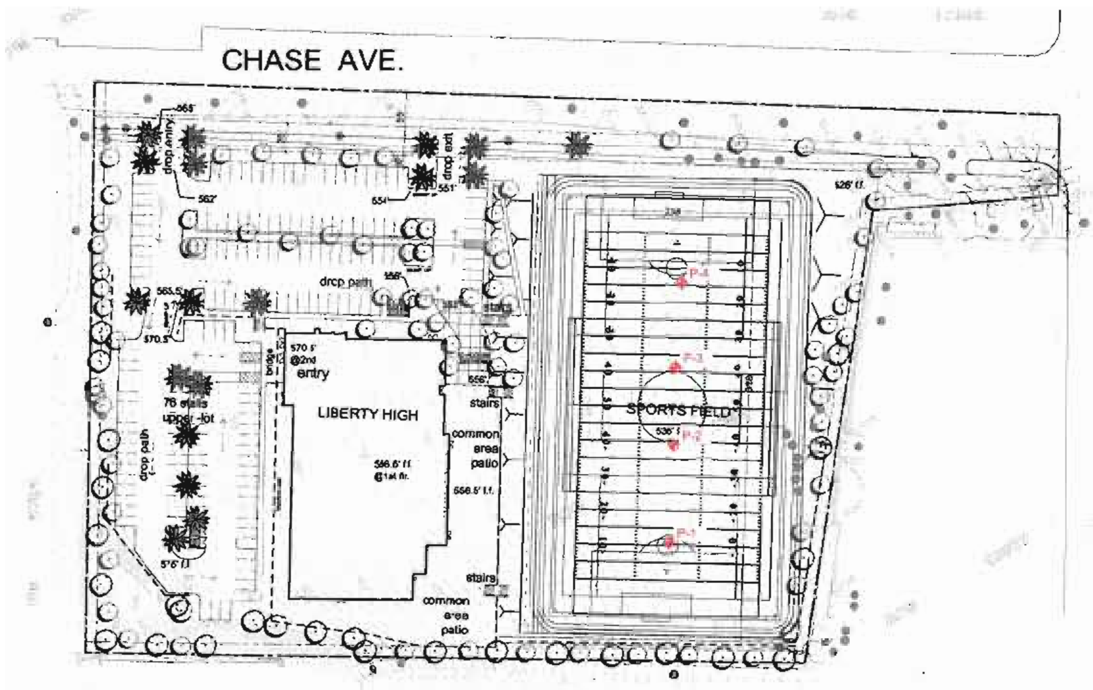
CONSTRUCTION TESTING & ENGINEERING, INC.

Dan T. Math, RCE # 61013
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
DANIEL T. MATH
No.61013
EXP.12/31/16
CIVIL
STATE OF CALIFORNIA

Colm J. Kenny
Project Engineer

Figure 1 Percolation Test Location Map



OPTION 1

LEGEND

P-1 APPROXIMATE PERCOLATION TEST LOCATION

0 40' 80' 160'

1 inch = 80' ft.

CTE INC. Construction Testing & Engineering, Inc.

PERCOLATION TEST LOCATION MAP
PROPOSED LIBERTY HIGH
SEC OF JAMACHA ROAD & E. CHASE AVENUE
SAN DIEGO, CALIFORNIA

10-12202G	
1" = 80'	
1/15	1

\\Esc_server\projects\10-12202G\Fig 1 - Perc Results.dwg

November 2, 2016 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Conversion of Percolation Testing Results to Infiltration Rates
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: At End of Document

Mr. Hamann:

Construction Testing & Engineering, Inc. (CTE) previously conducted percolation testing in the proposed athletic field area for the proposed development (CTE, 2015). The purpose of this letter is to provide estimated infiltration rates for the tested areas per the requirements of the referenced San Diego Region Model BMP Design Manual. As recommended in the manual, CTE converted the previously provided percolation rates to infiltration rates using the Porchet method. Infiltration rates are provided in the following Table 1.

TABLE 1: PERCOLATION TEST RESULTS

Test Number	Percolation Rate (minutes/inch)	Approximate Test Depth from Existing 536' Elevation (feet)	Soil Description	Converted Infiltration Rate* (inches/hour)
P-1	480	6	Granite	0.025
P-2	480	6.5	Granite	0.025
P-3	44	3	Residual Soil	0.280
P-4	169	3	Residual Soil	0.076

*Percolation rates converted to infiltration rates using the Porchet method.

As indicated herein, we understand that the percolation testing results and converted infiltration rates provided are to be appropriately used by the project civil engineer of record to design and detail onsite storm water facilities or improvements, as necessary, for project development and/or construction.

Additionally, and per our referenced letter (CTE, 2015) CTE understands that a fill slope will be constructed along the eastern border of the athletic field, which is also the eastern border of the proposed development and the likely lowest elevation of the proposed development. CTE recommends that a French drain, discharging into an appropriately designed offsite conveyance, or equivalent, be installed at the slope keyway in order to minimize subsurface seepage from migrating offsite.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

Dan T. Math, RCE # 61013
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
DANIEL T. MATH
No.61013
EXP.12/31/16
CIVIL
STATE OF CALIFORNIA

Colm J. Kenny, RCE #84406
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
COLM J. KENNY
No.84406
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

REFERENCES:

Model BMP Design Manual
San Diego Region
For Permanent Site Design, Storm Water Treatment and Hydromodification Management
February, 2016

Percolation Testing Results
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, Dated January 2, 2015

Preliminary Geotechnical Investigation
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Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
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Design Manual for Onsite Wastewater Treatment Systems
County of San Diego Department of Environmental Health
Dated March 22, 2010 (updated November 25, 2013)

January 30, 2017 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Completed City of San Diego Worksheet I-8
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: At End of Document

Mr. Hamann:

As requested, Construction Testing & Engineering, Inc. (CTE) provides the attached completed City of San Diego Form I-8 for determining infiltration feasibility at the subject site. Based on the answers provided in the attached Worksheet I-8, CTE makes a determination that "no infiltration" is an appropriate designation. However, if infiltration is employed, CTE provides the following recommendations for infiltration basins to be designed by others:

1) For infiltration basins near the existing eastern slope, CTE recommends that the proposed basin area be lined along the sidewalls and invert elevations to reduce the potential for mounding and lateral and vertical migration of infiltrating waters.
2) For infiltration basins not near the aforementioned slope but near Chase Avenue, Jamacha Boulevard, and adjacent businesses, CTE recommends that the proposed basin area be lined along the sidewalls to potentially reduce lateral migration of infiltrating waters.
3) An overflow device should be connected to a piping system that is directed to the nearest acceptable discharge location.
4) The sidewalls of the proposed infiltration basins should have slopes no greater than 1:1 (H:V) if the liner is extended beyond the top of the basin, and 1.5:1 if any portion of the sidewall is not lined.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

Jay F. Lynch, CEG # 1890
Principal Engineering Geologist

PROFESSIONAL GEOLOGIST
JAY F. LYNCH
No. 1890
CERTIFIED ENGINEERING GEOLOGIST
Exp. 5/31/17
STATE OF CALIFORNIA

Colm J. Kenny, RCE #84406
Project Engineer

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COLM J. KENNY
No. 84406
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

Attachments

Attachment A Worksheet I-8

REFERENCES:

Conversion of Percolation Testing Results to Infiltration Rates
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, dated November 2, 2016

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February, 2016

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CTE INC. Construction Testing & Engineering, Inc.

Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

March 30, 2017 CTE Project No. 10-12202G

Hamann Construction
Attention: Mr. Gregg Hamann
1000 Pioneer Way
San Diego, California 92122
Telephone: (619) 440-7424 Via Email: Gregg@hamannco.com

Subject: Revised Recommendations for Eastern Slope Biofiltration Basin
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California

References: At End of Document

Mr. Hamann:

As requested, Construction Testing & Engineering, Inc. (CTE) provides these revised recommendations for the proposed eastern biofiltration basin at the subject site. CTE has also reviewed the referenced preliminary grading plan. CTE understands that, for the eastern biofiltration basin labeled with an invert elevation of 532.6 feet, the client proposes to leave the bottom of the basin unlined to allow partial infiltration, and to install a French drain at the easterly side of the basin at the invert elevation in order to prevent or minimize potential infiltrate mounding and/or lateral migration. Based on review of the referenced grading plan it appears that the adjacent slope to the east of the basin is to consist of a 2:1 (H:V) fill slope which then transitions to the less steep existing slope.

CTE believes it is acceptable to leave the bottom of the described basin unlined, provided that the proposed and described French drain is installed, and that the drain outlets to an appropriate location. Additionally, periodic inspection and maintenance (as necessary, but at a minimum annually) of the adjacent slope should be considered a best practice.

CTE appreciates the opportunity to be of service on this project. Should you have any questions or need further information please do not hesitate to contact this office.

Respectfully submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

PROFESSIONAL GEOLOGIST
JAY F. LYNCH
No. 1890
CERTIFIED ENGINEERING GEOLOGIST
Exp. 5/31/17
STATE OF CALIFORNIA

Jay F. Lynch, CEG # 1890
Principal Engineering Geologist

REGISTERED PROFESSIONAL ENGINEER
COLM J. KENNY
No. 84406
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

Colm J. Kenny, RCE #84406
Project Engineer

REFERENCES:

Preliminary Grading Plan Sheet C-1
Liberty Charter High School
Prepared by Karn Engineering and Surveying, dated February 10, 2017

Completed City of San Diego Worksheet I-8
Proposed Liberty High School
Southwest Corner of Jamacha Road and Chase Avenue
El Cajon, California
CTE Job #10-12202G, dated January 30, 2017

Conversion of Percolation Testing Results to Infiltration Rates
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